Strategies for environmental sustainability of municipal energy companies

Pathways of sustainable development between business and society

Gabriela Schaad

Bokförlaget BAS
School of Business, Economics and Law
University of Gothenburg
Box 610
405 30 Gothenburg
Sweden
E-mail: BAS@handels.gu.se

ISBN 978-91-628-8556-4

Cover Picture: Jörgen Öberg
Cover Design: Mats Kamperin

Printed in Sweden by
Ineko, Kållered, 2012

MILJÖMÄRKT
Licensnr. 341559
TRYCKSAK

Acknowledgements

Approaching the end of the long and winding road of doctoral research I would like to thank all those who supported and inspired me during this process. To start with, I am deeply grateful for the sound and steady guidance I received from my supervisor Professor Ted Lindblom. Thank you for giving me the freedom to develop my ideas and for your help to steer this thesis safely into the harbor. I am equally thankful to my assistant supervisor Ph.D. Anders Sandoff, especially for his inspiration and confidence in me ever since I was a bachelor student. I would never have dreamt of doing a Ph.D., if it weren't for you Anders!

My further thanks go to Professor Filip Johnsson and Tech lic. Bo Rydén, project leaders of 'Pathways to Sustainable Energy Systems' and 'Nordic Energy Perspectives', in which I was involved. I am sincerely grateful for the research funding provided during the first three years of my Ph.D. I am also indebted to all participating researchers for sharing their experience and providing me with a basic understanding of energy issues.

Inspiration is a rare commodity! I want to express my gratitude to all who spread plenty of enthusiasm about research at various Ph.D. seminars, especially Professors Irene Henriques, James P. Walsh, Volker Hoffmann and Ph.D. Timo Busch, as well as fellow Ph.D. students at the 11th ETH PhD-Academy.

I further want to thank Professors Alexander Styhre and Tommy Andersson for their constructive comments at my final internal seminar, as well as Ph.D. Petter Rönnborg for providing valuable advice on an earlier draft. Sincere thanks go to those who read parts of my work along the way and helped this thesis improve.

To all researchers at Industrial and Financial Management & Logistics: thank you for having me here! I am also sincerely grateful for the funding received from the Department of Business Administration at the School of Business, Economics and Law.

In the same spirit, I would like to thank the case companies for making this study possible, and my interviewees for open-heartedly sharing their knowledge and experience with me. You made this research meaningful and exciting!

Many more made this journey enjoyable. Marissa and Oxana, thank you for your faithful companionship over the years, sharing happy and confused moments. To my former colleagues Kristina and Merja, your moral support and encouragement meant a lot to me!

My appreciation goes to many others at the school with whom I worked, spent time, or who supported me in any other way: Jun Du, Katarina Forsberg, Marina Grahovar, Wivianne Hall, Hans Jeppsson, Elisabeth Karlsson, Elin Larsson, Erik Lundberg, Kajsa Lundh, Sabrina Luthfa, Rita Mårtenson, Taylan Mavruk, Zoi Nikopoulou, Conny Overland, Niuosha Samani, Edith Sorkina, Per Thilander, Stavroula Wallström, and last but not least Jon Williamsson. To current and former members of the Ph.D. student organization: thank you for the good experience, I learned a lot from you!

I also would like to express my gratitude to family and friends close by and in Switzerland; thank you for being there! Anna-Britta, Torbjörn, Helene and Sara, I am happy to have you! Brigitte and Charlotte, thank you for your friendship and making me feel at home. To my dear mother and her sister Alice, although far away you are close to my heart! Thank you for always supporting me!

My fondest thoughts go to Jörgen and Leonie. Thank you for your patience, unconditional love and support! You mean everything to me!

Göteborg, October 2012
Gabriela Schaad

Abstract

Carbon emissions from energy production have a severe impact on the global climate. The slow transformation of the energy system towards low-carbon alternatives is thus a serious concern. Sweden is recognized as a forerunner in climate change mitigation. This thesis focuses on energy companies with an ambition to contribute to public welfare and the changeover towards a more sustainable energy system. It investigates how Swedish municipal energy companies with a high environmental commitment manage the transition towards environmentally sustainable business. Three areas of interest are addressed. Corporate strategies for environmental sustainability at the core of this transition are explored. Three case studies provide close insights into the corporate activities and practices that constitute such a strategy.

The second interest relates to the embedding of strategies for environmental sustainability in the companies. Five mechanisms facilitating environmental strategy implementation were identified: Environmental integration, communication and learning, innovation, cooperation and local embeddedness. The mechanism scheme is interwoven with a framework drawing on the natural-resource-based view to investigate the third area of interest: how strategies for environmental sustainability can contribute to the sustainable development of municipal energy companies and society. Capabilities and resources associated with such strategies are outlined and assessed in terms of their capacity to create value for the firm and shared value between the firm and society.

Bridging firm strategy and sustainable development requires that a broad set of challenges is addressed by the firms. Energy companies must be able to handle social complexity beyond the firm to successfully manage the transition towards a sustainable energy system. Strategies for environmental sustainability tend to be firm-specific, although some common patterns are found. It is positive news that municipal energy companies irrespective of size have good abilities to make the energy system more sustainable. Thanks to their local embeddedness, these companies are well-positioned to assist in the transition towards a sustainable society.

This thesis makes a contribution by exploring a novel way to create knowledge, linking the concepts of activities, mechanisms and capabilities to elucidate value creation from environmentally sustainable strategies in firms and by firms towards society. The mechanism scheme provides an alternative to how value creation processes can be studied.

Key words: climate change, environmental sustainability, strategy, energy system transition, case study, municipal energy company, natural-resource-based view, mechanism, value creation, shared value.

Table of Contents

Table of figures

List of tables

1 Setting the scene

We live in a civilization where we take for granted that there is electricity whenever we switch on the light; our homes should always be comfortably warm despite harsh winters and most of us have the convenience of a car to do our shopping. Rising concerns about irreversible climate change (Solomon et al., 2009) have, however, made obvious that the pattern of energy consumption in the Western world is unsustainable (e.g. Vera & Langlois, 2007). The burning of fossil fuels to generate energy results in carbon dioxide (CO_2) and other greenhouse gas (GHG) emissions which accumulate in the atmosphere and trap heat, causing global warming (e.g. WHRC, 2011). The resulting climatic changes are therefore fundamentally linked to energy production and consumption (IPCC, 2007a; IEA, 2010). The extensive use of fossil fuels is the primary cause for the increased atmospheric concentration of CO_2 since pre-industrial times (IPCC, 2007a). Industry, domestic heating and transportation were identified as the main culprits (UNFCCC, 2002). An industry that is particularly emission-intensive due to its widespread fossil fuel use is the stationary energy sector. The generation of electricity and heat is by far the largest producer of CO_2 emissions worldwide, causing 41 % of global CO_2 emissions in 2008. Overall, this sector relies heavily on coal, the most emission-intensive fossil fuel (IEA, 2010). Acknowledging the severe impact of energy generation on the global climate, the question is what needs to be done?

Governments worldwide have come to a consensus that human-generated GHG emissions need to be reduced to keep global average temperature rise below 2°C (UNFCCC, 2011a). This requires taking strong actions in a short period of time. The investments and measures taking place within the coming ten to twenty years will have a strong impact on the climate that we face in the second half of this century and beyond (Stern, 2006a). Energy efficiency and conservation measures play an important role in stabilizing carbon emissions, but are insufficient to halt climate change. Moreover, the global demand for electricity is expected to almost double by 2030 (OECD & IEA, 2009). The future emission intensity of the energy sector depends strongly on the fuels used for the generation of electricity and the share of non-emitting energy sources, such as nuclear and renewables (IEA, 2010). Evidently, above all, a real reduction in emissions entails a lower dependency on fossil fuels[1] (Pinkse & Kolk, 2009). This requires a drastic system change: the transformation of today's carbon-

[1] In particular if the roll-out of Carbon Capture and Storage (CCS) should be delayed (e.g. Johnsson, 2011; Naturenews, 2011)

based energy systems (e.g. Grubb, 2004). This is a major challenge for several reasons: Firstly, fossil fuels have been the drivers for economic development for more than a century and have turned into central building blocks of our society (e.g. Rockwell, 2004; Boyle, 2003; Perkins, 2003). Consequently, there is a close linkage between energy use and economic growth (Najam & Cleveland, 2008; UN, 2002). Secondly, security of supply is a major concern interfering with climate change mitigation and the associated reduction in fossil fuel use (e.g. Giddens, 2011). A transformation of the energy system has to make sure that tomorrow's energy supply is as reliable and plentiful as today's (Huberty et al., 2011). Hence, climate change mitigation and energy provision represents a combined challenge (e.g. Grubb, 2004).

A further obstacle for climate change mitigation is the abundance of fossil fuels in their various forms (Johnsson, 2011; IEA, 2010). In light of the plentiful supply of relatively cheap fossil fuels, coal in particular (IEA, 2010), decarbonizing the economy is an enormous challenge. Green growth has become a popular concept, but evidence on the successful greening of economies remains scarce (e.g. Huberty et al., 2011; Zysman & Huberty, 2010). Mitigating climate change goes thus far beyond solving an environmental problem. Through its linkage with energy, climate change mitigation is part of the wider challenge of sustainable development (IEA, 2010; Dincer, 2000).

The resource-intensive, high-emission nature of the energy business (Dixon & Whitaker, 1999) makes the stationary energy sector a critical player in the mitigation of global warming. Under the IPCC (2007b) scenarios, 60–80 % of anticipated greenhouse gas reductions should come from energy supply and use. Consequently, if we are to combat climate change successfully, the transformation of the carbon-based energy systems is the key challenge. Although the need for lifestyle changes is also acknowledged (e.g. Pacala & Socolow, 2004; Lorenzoni et al., 2007), solutions such as improving energy efficiency, switching to less carbon intensive-fuels and investing in sustainable energy technologies are regarded as important immediate steps towards sustainable development. Given that the necessary technologies to meet short-term targets are already widely available (Pacala & Socolow, 2004; Sandén & Azar, 2005; Stern, 2006b; Johnsson, 2011), technical solutions play a major role in climate change mitigation efforts. Nevertheless, there is no technological 'silver bullet' that can solve the climate change problem on its own (Pinkse & Kolk, 2009; Grubb, 2004). All available technologies and measures will need to be employed (e.g. Pacala & Socolow, 2004; Grubb, 2004; Johnsson, 2011).

Jacobsson et al. (2004:4) argue that the energy sector is in need of "a 'creative destruction' in which renewable energy technologies replace those using fossil fuels". Energy generation facilities based on high-carbon fossil fuels such as coal and fuel oil should be phased out and replaced by highly effective, sustainable bridging technologies (for example based on natural gas) or renewable energy technologies, such as wind turbines, solar power or biomass-based combined heat and power plants[2] (CHP), amongst others (Jacobsson et al., 2004). This corresponds well with the identified need for significant new investments in power generation facilities by the end of the next decade (e.g. Laurikka & Koljonen, 2006; Johnsson, 2007; IEA, 2009), accentuating the large potential for energy sector companies to reduce their impact. These arguments suggest that the energy sector is instrumental to achieving deep emission reductions and to propel the transition towards a low-carbon economy. It is thus little surprising that the stationary energy sector is one of the sectors that are most strongly confronted with climate change mitigation (Radgen et al., 2011; Pinkse & Kolk, 2009; Chidiak & Tirpak, 2008; Dunn, 2005).

What is then the role of business in such a changeover process? The importance of companies engaging in climate change mitigation seems evident due to their position of great influence and the far-reaching scope and consequences of their decisions (Bowen, 1953). Corporations possess the knowledge, resources and power to reverse global degradation (Shrivastava, 1995). To some (e.g. Hawken, 1993), business is the only institution powerful enough to bring about the enormous positive changes needed to achieve environmental sustainability. Companies represent a strong force in such a changeover process. They hold the key knowledge and competences to guide mitigation efforts in their industries, comparable to 'prime movers' that are technically, financially and/or politically powerful enough to initiate or contribute to the diffusion of new technologies (Johnson & Jacobsson, 2000; Hofman, 2005) Accordingly, the endeavors by energy sector companies are central to transforming the energy system towards the highly efficient low-carbon alternatives that are crucial for effective climate change mitigation.

From a corporate perspective, the issues at stake for energy sector companies are of an existential nature as climate change is highly probable to influence their value proposition (cf. Porter & Kramer, 2006). Mitigating their climate impact affects core business activities (Pinkse & Kolk, 2009). This requires a strategic response. The organization's core features need to be aligned to the changing environment (e.g. Hannan & Freeman, 1984). Energy companies have to ensure that their business activities remain viable throughout the transition in order to safeguard future competitiveness. The combined challenge to reduce their climatic impact and maintain their competitive position may encourage energy companies to reconfigure their business activities more broadly (Kolk & Pinkse, 2008). The creation of new capabilities to tackle the various challenges from changes in regulations, policies and consumer attitudes may be required. Moreover, the large investments necessary to improve the environmental sustainability of the energy business are likely to result in higher energy costs, which must be borne by energy users (Pinkse & Kolk, 2009; Radgen et al., 2011). Thus, the critical challenge for energy sector companies lies in providing low-cost reliable

[2] In combined heat and power plants, the waste heat from electricity production can be utilized in space heating through district heating networks (Korhonen et al., 1999). Total efficiency in biomass CHP plants may reach 85-90 % which is very high compared to the global average conversion efficiency in conventional thermal generation of 33 % (IEA, 2007; Werner et al., 2002).

energy with the least environmental impact possible (Dixon & Whittaker, 1999). The endeavors of energy companies to become part of the solution to climate change instead of remaining part of the problem very likely affect the way these companies conduct business in the future[3]. It is thus highly probable that the competitive landscape in the energy business will change (e.g. Fens & Rikkert, 2005). We do not yet know what the energy business is going to look like in the future and what the pillars of competitive advantage in a carbon-constrained economy will be, but presumably, environmental sustainability will be an important benchmark.

Despite hopeful signs of change (Radgen et al., 2011), we cannot ignore that too little is happening, rendering the prospects for a timely transition of the energy system gloomy. Large technological systems such as the energy system are characterized by high stability and inertia (Markard & Truffer, 2006). Some of the barriers to change will be discussed in Section 1.4. Although empirical evidence is mixed (Stenzel & Frenzel, 2008), incumbent actors with vested interests are seen to adhere to the dominant socio-technical regime, frequently resisting the adoption of new technologies (Jacobsson & Johnson, 2000; Jacobsson & Bergek, 2004; Tsoutsos & Stamboulis, 2005). For instance, Chappin & Dijkema (2009) report that half of the projected investments in new production capacity in Germany and the Netherlands is coal-based. A significant change towards using more renewable energy technology is thus going to be a "slow, painful and highly uncertain process" (Jacobsson & Johnson, 2000:638). The slow transition obviously is a serious concern and a threat to sustainable development. Much has been written elsewhere about the difficulties to induce major technological change in the energy system (e.g. Kemp, 1994; Rip & Kemp, 1998; Jacobsson & Johnson, 2000; Jacobsson & Bergek, 2004). In this thesis, however, the focus is put on actors in the energy sector who are committed to a transition towards a more sustainable energy system. The intention is to demonstrate that there are good examples that can be helpful in making sense of what is going on inside corporations that aim for a transition towards environmentally sustainable business.

It is valuable to understand how companies at the forefront of decarbonizing the energy system safeguard future competitiveness by asking questions like: What do their strategies to improve the environmental sustainability of their business entail? How are such strategies realized in the companies and what are the potential benefits? The aim of this thesis is to provide such insights in a Swedish context. The Swedish energy system has undergone significant changes in the past decades and is likely to continue developing towards improved environmental sustainability. As will be argued later in this chapter, there is reason to believe that municipal energy companies play an important role in this transformation. This is why their strategies to improve the environmental sustainability of their business are the core interest of this thesis. Further areas of interest are the mechanisms that allow embedding such

[3] Radgen et al. (2011) acknowledge that the electricity market already has undergone significant changes due to the EU Emissions Trading Scheme, together with the knowledge on climate change and the limitation of natural resources.

a strategy in the organization and its surrounding field, as well as the benefits such a strategy brings to firms and society.

In the remainder of this introductory chapter, the basics of climate science are presented first, followed by an overview of international and European efforts to combat climate change. Subsequently, the need for energy companies to transform towards environmentally sustainable business practices is substantiated, and barriers to change are discussed. Thereafter, Sweden is addressed in its nature as a forerunner in the transformation of the stationary energy system. Municipal energy companies are identified as important actors in this development and arguments are provided for why the focus of this investigation lies on studying environmentally sustainable strategies in municipal energy companies. The final part of this chapter presents the research questions and purpose of this investigation.

1.1 Climate change science in brief

There is no longer any doubt that the climate is changing and that humans have a discernible influence on this development (IPCC, 2001). Most of the observed increase in global average temperature over the last 50 years is very likely due to the increase in anthropogenic (i.e. human-induced) greenhouse gas concentrations (IPCC, 2007a). Meticulous records of the atmospheric concentration of CO_2, the dominant greenhouse gas, have been kept since 1958 (Gillis, 2010). By 2010, the concentration has risen from 316 ppm[4] to 390 ppm (NOAA, 2011). Since pre-industrial times, the average annual growth rate of CO_2 emissions from industrial activities has been 3.5 % (Elliot, 1983). To this, the increase of other GHG concentrations has to be added. Expressed as CO_2 equivalents (CO_2e) the current level is 425 ppm CO_2e (EC, 2011). In order to prevent dangerous global warming by more than 2°C, which will very likely result in harmful consequences such as changing precipitation and wind patterns, rising sea levels, heat waves and the extinction of species (IPCC, 2007c), the concentration of greenhouse gases in the atmosphere has to stabilize below 450 ppm CO_2e (e.g. EEA, 2010; IEA, 2009; IPCC, 2007b). Current climate science (Alcamo, 2010) suggests that, in order to reach this target, global emissions should decrease by 48 to 72 % by 2050 relative to the year 2000. Moreover, global emissions have to peak sometime between 2015 and 2021. However, uncertainties are great when estimating emission pathways, and even if greenhouse gases were to be stabilized at these levels, global temperatures and sea levels would continue to rise for centuries, given the time scales associated with climatic processes (IPCC, 2007a). This will pose challenges for the sustainable development of humankind on an unprecedented scale (e.g. IPCC, 2007c; Dincer, 2000).

In 2006, the annual costs for such a reduction[5] were estimated to be around 1 % of GDP by 2050 (Stern, 2006a). Given new evidence that climate change is happening faster than previously estimated (e.g. Swipa, 2011), requiring sharper measures, this estimate was

[4] The concentration of gases is typically measured in parts per million (ppm).
[5] Stern's calculation refers to a stabilization at 500-550ppm CO_2e.

adjusted to 2 % in 2008 (Jowit & Wintour, 2008). In any case, the estimated costs of inaction by far outreach the costs of avoiding dangerous climate change.

1.2 International and EU efforts to combat climate change

Under the Kyoto Protocol, industrialized countries as a group committed themselves to jointly curb GHG emissions by at least 5 % relative to 1990 under the first commitment period 2008-2012 (UNFCCC, 2011c). This binding agreement is by far the most comprehensive multinational effort to mitigate climate change, both politically and geographically (IEA, 2010). In addition to the goal to reduce domestic GHG emissions, the Kyoto Protocol also aims at stimulating sustainable development through technology transfer and investments by way of the market-based Kyoto mechanisms (UNFCCC, 2011b). However, despite its extensive coverage, the Protocol has limited potential to reduce global emissions as not all major emitters are included in reduction commitments.

The European Union (EU) has been a driving force in international negotiations on climate policy (Christianssen & Wettestad, 2003; McCormick & Kåberger, 2005), and has focused intensely on meeting the challenges posed by global warming. The European Climate Change Programme is an EU strategy to implement the Kyoto Protocol (EC, 2010). Under the Programme, companies face strong regulatory pressure, binding rules and new market-based policies. In particular, the emergence of carbon trading under the EU's Emissions Trading Scheme (EU ETS) introduced in 2005, increased the strategic relevance of climate change (Pinkse & Kolk, 2009). Assigning a price to carbon emissions and thus making the reduction of such emissions valuable, is considered an achievement of global significance (Grubb & Neuhoff, 2006). Indirectly, the price tag on emissions pushes the diffusion of low-carbon technologies such as renewables, gas and nuclear (Radgen et al., 2011). Furthermore, under the 20/20/20 goals[6], the EU introduces ambitious targets for the reduction of GHG emissions, the introduction of renewable energy sources and the improvement of energy efficiency (BDF, 2009). This will affect the way the European energy sector is operating in the coming decades in various ways (PWC, 2009).

1.3 A changing agenda for energy companies

For many decades, society seemed to have ignored the negative side effects of energy conversion (Gebremedhin, 2003). The climate change debate has caused a drastic change in public opinion under recent years (e.g. Globescan, 2006; Pinkse & Kolk, 2009; Löfblad & Haraldsson, 2011), with people increasingly worrying about the effects of climate change (Leiserowitz, 2007; Pew Research Center, 2009). This makes carbon mitigation a pressing issue not only from a regulatory perspective, but also from a social and market perspective. Given this shift, what are the likely benefits for companies operating in the stationary energy

[6] Goals to reduce GHG emissions by 20 %, to increase the share of energy consumed from renewables to 20 %, and to improve energy efficiency by 20 % until 2020 (EC, 2008).

sector from increasing their focus on environmentally sustainable business? In the following, the most important arguments for an increased focus on corporate environmental sustainability are outlined.

1) A very commonly stated argument is that cost savings can be made from reducing energy and resource consumption (e.g. Porter & van de Linde, 1995; Hart, 1995; Porter & Reinhardt, 2007), including for instance lower costs incurred for emission allowances under the EU ETS (Hoffmann & Trautmann, 2008). 2) Energy sector companies experience high environmental visibility[7], not only due to what is often their considerable size (cf. Henriques & Sadorsky, 1996), but also since they operate close to final consumers (Branco & Rodrigues, 2008). Highly visible organizations are more vulnerable to pressures from their environment (Bowen, 2000). Poor environmental performance can negatively affect a company's relationship with its stakeholders[8] (Buysse & Verbeke, 2003), which harms the company for instance due to a loss in reputation (Christmann & Taylor, 2002; Kolk et al., 2008). Consequently, firms may strengthen their legitimacy from acting visibly and credibly in the field of climate change (Pinkse & Kolk, 2009). Furthermore, companies in industries with a large potential impact on the environment (i.e. high-salience industries), such as the energy sector (Pinkse & Kolk, 2009), are subject to greater pressure from environmental concerns than companies in less sensitive industries (Bowen, 2000). 3) The shift in consumer preferences creates new market opportunities. Product strategies that are responsive to the demand for low-carbon and energy-efficient products and services can create a competitive advantage over competitors that do not embrace this opportunity (Lash & Wellington, 2007; Kolk & Pinkse, 2004, 2005). 4) Companies with inadequate environmental management practices may find it more difficult to attract or retain qualified workers, if these have a preference for proactive environmental management (e.g. Reinhardt, 1999).

These four reasons outline the benefits for energy companies from abandoning environmentally harmful business practices and reducing their environmental footprint. Nevertheless, implementing a strategy for environmental sustainability may be but one of many strategic concerns (Pinkse & Kolk, 2009; Hoffman, 2002). Adapting to a competitive situation following market liberalization (Rogge & Hoffmann, 2010; Hofman, 2005), ensuring security of supply (e.g. Vázquez et al., 2002; PWC, 2006; Fens & Rikkert, 2005), and managing regulatory risks and other risks (e.g. Wellington & Sauer, 2005; Lygnerud, 2008, 2009) may be other pressing issues facing the company.

[7] Bowen (2000) distinguishes between issue visibility and organizational visibility that together constitute environmental visibility.

[8] Freeman (1984:vi) defines a stakeholder as "any group or individual who can affect, or is affected by, the achievement of a corporation's purpose".

1.4 Slow transition towards sustainable energy systems

The transition towards a low-carbon energy system seems to be disturbingly slow (e.g. Jacobsson & Johnson, 2000; Jacobsson & Bergek, 2004). The IPCC (2007b) concludes that the widespread adoption of low-carbon technologies may still take many decades. Why is this transition progressing so slowly?

Several barriers to change can be found both in the macro environment and in industry characteristics or practices. For instance, the long planning horizon in the stationary energy sector is seen to result in a low speed of adjustment (Margolis & Kammen, 1999). Investments in power generation have a lead time of four to eight years, but delays due to uncertain application procedures and local opposition are not unusual (Radgen et al., 2011). The investment horizon does not support rapid adoption (Zysman & Huberty, 2010). Investments in power generation are of a long-term character (Margolis & Kammen, 1999; Fens & Rikkert, 2005), having an expected life span of at least 40 years[9] (Radgen et al., 2011). Hence, they depreciate over several decades (Zysman & Huberty, 2010; Grubb, 2004). The longevity of power plants makes technology choice a crucial issue. Once a production facility is operational, it is very unlikely to be phased out prematurely (Hoffman, 2002), resulting in a lasting technology lock-in. As a result, managers resort to measures to optimize the carbon performance of the existing production facilities instead of phasing out carbon-intensive technology (Enkvist et al., 2008; Hoffmann, 2007).

Furthermore, high capital intensity is an obstacle for the fast renewal of the sector (Margolis & Kammen, 1999; Fens & Rikkert, 2005). Investments in renewable energy technology, for instance biomass power production, are more capital intensive than investments in fossil fuel production technology (IEA, 2007; Chidiak & Tirpak, 2008). For biomass, the reason for this is the typically smaller size of power plants due to the limited availability of local feedstock and high costs for transportation. The small size doubles investment costs per kW and yields lower electrical efficiency compared to fossil fuel technologies (IEA, 2007). This might make the latter preferable despite the lower operating cost of biomass facilities[10] (Dincer, 2000). Model runs show that investments in biomass projects often are crowded out by fossil fuel technologies (NEP, 2006). An attractive cost level in carbon substitutes is crucial to improve their diffusion. Limited diffusion entails that the technology is less proven, resulting in larger uncertainty about its reliability and hence greater risk (Jacobsson & Johnson, 2000). Although new technologies are a source of risk in modern societies (Beck, 1992), their continuous development and utilization is vital to sustainable development (Fogelberg & Sandén, 2008).

A further concern is that the power sector is one of the least innovative sectors in modern economies. The same fundamental technology has dominated for roughly a century (Grubb,

[9] For hydroelectric power, the life span is considered to be up to 60 years (Vattenfall, 2008).
[10] Johnsson, Filip. Pathways seminary on 26 April 2007. Gothenburg: Chalmers.

2004). In view of the central role of energy technology in responding to climate change (e.g. Hoffert et al., 1998; Dincer, 2000), the extremely low R & D intensity in the energy sector compared to many other sectors is disquieting, especially in view of the long planning horizons and high capital costs involved to bring new energy technologies to commercial application (Margolis & Kammen, 1999). Grubb (2004) explains this near absence of R & D spending with the fact that innovation in power generation is about price and efficiency in delivering a homogenous product (electrons) and not about product differentiation as in R & D-intensive sectors. The former represent far weaker drivers for innovation. The value of low carbon innovations depends on rather uncertain government policies to internalize carbon costs (Grubb, 2004).

A related problem is that the strategic impact of climate change has been surrounded by great uncertainty (Brewer, 2005), affecting the pace and degree of actions to mitigate climate change (Stern, 2006b). Keeping in mind that many infrastructural investments are irrecoverable, uncertainties as to the long-term framework conditions for conducting business slow down the speed of the transition to low-carbon technologies (Jacobsson & Bergek, 2004; Hoffmann, 2007; PWC, 2006). As it is highly probable that we are more knowledgeable in the future, for instance regarding best technological option and the materialization of public policies, companies are likely to postpone decisions (Pinkse & Kolk, 2009; Stern, 2006b; Grubb & Neuhoff, 2006). The periodically high price volatility of emission allowances, regulatory uncertainties and doubts on the feasibility of emerging technologies inflict high risk on energy sector investments (Hoffmann, 2007; PWC, 2009; Fens & Rikkert, 2005). To foster the development of new relevant technologies, clear, credible and long-term market structures and incentives are required (Stern, 2006b). Under uncertainty, more certain short-term benefits are often preferable to less certain long-term gains, even if the latter offer much greater potential benefits (Ascher, 2006; Giddens, 2011). Although an environment characterized by low uncertainty is preferable to foster change (Hoffman, 2002; Grubb & Neuhoff, 2006), climate change can only be countered by displaying long-term thinking against the backdrop of uncertainty (Giddens, 2011).

Flawed capital budgeting practices are a further barrier (Sandoff, 2003, 2006a). For instance, by setting payback periods too short, companies require excessively high returns on investments. Strategic planning for sustainability in the stationary energy sector seems to conflict with the shorter time horizons inherent in market forces (Omer, 2008). Companies are often trapped in short-termism (e.g. Laverty, 1996), optimizing operations in a short-term perspective instead of taking a longer view that would better reflect the infrastructural nature of the energy business. A course of action that is favorable for the short term can be suboptimal in the long run, whereas a focus on long-run considerations can provide a platform for future competitive advantage (Laverty, 1996). The choice of technology exemplifies the problem of balancing between the short term and the long term. Investing in a technology that represents an incremental improvement is more profitable in the short term, whereas an investment in a breakthrough technology with larger up-front cost provides greater returns in the long run (Laverty, 1996). In sum, prevailing capital budgeting practices have a tendency to slow down the transition towards a more sustainable energy system (Sandoff, 2003, 2006a). Ascher (2006) concludes that promoting commitment to more far-sighted thinking and acting is the primary strategic challenge when adopting a strategy for sustainable development. This involves making short-term sacrifices to pursue longer-term gains. Evidently, there is a conflict between the logic of sustainability, requiring that long-term societal and environmental goals be taken into account, and the dominant business logic which focuses on short-term economic goals (e.g. Gore, 2010).

1.5 National differences in tackling the climate challenge

Despite being exposed to similar pressures from legislation, policy instruments and customer preferences in any given area, there are significant differences in management approaches between companies regarding environmental issues (Milstein et al., 2002; Dixon & Whittaker, 1999). Looking at energy companies in the EU, it is striking that their level of responsiveness to the pressure to take action on climate change varies significantly (e.g. CDP, 2010; Schaad & Sandoff, 2011; Innovest & WWF, 2006, 2007a, 2007b). Naturally, this reflects the different preconditions shaped by national climate policies, ownership structure (Zysman & Huberty, 2010), natural resource endowments, technologies (e.g. Stern, 2006b), and path dependence (Unruh, 2000). National policies change market rules, favoring new forms of energy production and use. This results in distinct national dynamics of demand and supply (Zysman & Huberty, 2010). Consequently, "there will not be one universal trajectory to a low carbon future and cannot be a single best regulatory strategy" (Zysman & Huberty, 2010:8).

Some countries perform better on environmental and climate issues than others. Where should we look in order to gather experience as to how the climate challenge can successfully be tackled? Sweden has been pointed out as a country with strong environmental awareness on a national and corporate level (e.g. Eckersley, 2004; Birkin et al., 2007) and sound and sustainable policies (OECD & IEA, 2008). The country is seen as a forerunner in environmental policy-making (Weidner & Jänicke, 2000), in particular 'setting the pace' for the implementation of Agenda 21[11] (Fudge & Rowe, 2000, in Nilsson, 2005). Since the mid-1990s, Sweden has pursued a path of ecological modernization with the aim to transform the Swedish welfare state into a green welfare state (Eckersley 2004). More recently, Sweden has been recognized as the most environmentally-friendly country within the EU[12] (EPI, 2010). The question is whether Sweden performs equally well on issues critical for climate change mitigation?

[11] Agenda 21 is a comprehensive action plan to be taken at a global, national and local level by organizations of the UN, governments, and major groups in any area in which humans directly affect the environment (UNEP, 1992).

[12] The EPI (Environmental Performance Index) ranks 163 countries on 25 performance indicators across ten policy categories covering both environmental public health and ecosystem vitality.

1.5.1 Swedish policy tools to mitigate climate change

Swedish energy policy highlights environmental protection as one of its key objectives[13], and climate change is seen as the biggest challenge (OECD & IEA, 2008). The government has the vision to achieve a sustainable and resource-efficient energy supply without net emissions of greenhouse gases by 2050 (Government Offices of Sweden, 2009b). Sweden's efforts to limit CO_2 emissions have mainly focused on taxation, the promotion of energy efficiency and renewable energy sources, employing various measures. These three building blocks of energy policy are briefly reviewed below.

Concerning environmental taxation, Sweden introduced a carbon tax in 1991 as one of the first countries in the world (EREC, 2004). According to Azar (2008:54), the Swedish carbon tax is "one of the most successful climate policy measures taken worldwide". In particular, it had a strong effect on district heating systems, given that it is only applicable to CO_2 emitted from the combustion of fossil fuels to produce heat and not electricity (e.g. Kåberger, 2002).

Regarding energy conservation, Sweden is recognized for having a long tradition of ambitious and successful policies to improve energy efficiency (OECD & IEA, 2008). For instance, the phase-out of fuel oil for domestic heating was promoted through conversion grants, which facilitated district heating expansion. In combination with the development of highly efficient large-scale CHP production, this further supported energy efficiency goals (SOU 2008:25).

With respect to promoting renewable energy, "Swedish energy policy strives for a sustainable energy system with a long-term vision for a growing supply from renewable energy sources" (IEA, 2008:1). In 1997, a bill on Sustainable Energy Supply[14] was adopted, which included a strategy for reducing the climate impact of the energy sector. In particular, increasing renewable electricity generation was promoted with a focus on biomass and wind power (EREC, 2004). In the Swedish climate strategy[15] adopted in 2002, a reduction of GHG emissions of 25 % by 2020 from 1990-levels was proposed (MSD, 2006). The main instrument for promoting renewable electricity in Sweden is the electricity certificate system introduced in 2003 (OECD & IEA, 2008). The scheme was recently extended to 2035, creating better long-term investment conditions for renewable energy (SEA, 2010c).

1.5.2 The role of district heating in Swedish climate mitigation efforts

District heating systems are a characteristic feature of the Swedish energy system. District heating is a collective, large-scale heating solution and a matter of public concern in Sweden (Henning & Mårdsjö, 2009). Heat is produced in a central plant and supplied to customers via pipelines entrenched in the ground (Lygnerud, 2010). District heating plants can run on a

[13] Other key objectives are a secure energy supply and economic competitiveness through efficient use and cost-effective supply (Swedish Government Bill 2001/02:143).
[14] Swedish Government Bill 1996/97:84.
[15] Swedish Government Bill 2005/06:172, National Climate Policy in Global Cooperation.

variety of fuels, using advanced methods (SDHA, 2011). In view of the cold Nordic climate, district heating is of strategic importance for Sweden (Ericsson et al., 2004), supplying nowadays over 50 % of the heating in buildings (SDHA, 2011).

District heating-networks were built from the late 1960s, mainly by municipal energy companies (Kåberger, 2004). Initially, oil provided 100 % of the fuel (OECD & IEA, 2008), but since the 1980s, the fuel mix has changed considerably: today, oil and coal have been almost completely phased out (WEC, 2009), and biomass accounts for nearly half of the fuels used[16] (SDHA, 2012). Other important energy sources are heat pumps, refuse or recycled heat from electricity production and industrial activities (SDHA, 2009; SweHeat & Cooling 2010; Ericsson et al., 2004).

The high share of biomass in the Swedish district heating systems is unique in Europe (Werner, 2006). Thanks to the widespread use and continuous expansion of district heating (Reidhav & Werner, 2008; Ericsson et al., 2004), Sweden is seen as one of the world leaders in bioenergy utilization (OECD & IEA, 2008). The diversity and flexibility of bioenergy systems enhances energy security (Helby et al., 2004), whereas utilizing domestic renewable resources reduces exposure to price and supply risks (Huberty et al., 2011).

Switching from fossil fuels to biomass is a powerful way to reduce anthropogenic CO_2 emissions (Wahlund et al., 2004). Compared to emissions from the average use of fossil-fuel for heating in Europe, emissions from the Swedish district heating systems are less than one fifth[17] (Werner, 2010). Society is seen to benefit most from this development (Hillring, 2002) as the significant decrease of fossil fuel emissions[18] improves the local air quality (Korhonen et al., 1999). Even so, there still is substantial potential to increase the use of biomass in district heating (Hillring, 2002), leaving room to further improve the sustainability of the energy system.

1.5.3 Green leadership in energy issues

Sweden's ambitious climate policy has been successful to date: In 2006, Sweden had the highest proportion of renewable energy in the EU (SEA, 2008). Furthermore, the emission-intensity of Swedish electricity and heat generation was the lowest among EU countries. Electricity supply is almost completely CO_2-free[19]. Domestic electricity production from fossil fuels (condensing power or gas turbine) stands for only 0.3 % of total production in 2009 (SEA, 2010a).

As a result of these developments, Sweden is widely perceived as demonstrating strong green leadership (Dual Citizen, 2010; Giddens, 2011), proving that it is possible to

[16] The use of wood residues from the wood processing industry (e.g. bark and sawdust) or the forest industry (such as tree tops and branches) in district heating plants is widespread (Juninger et al., 2006).

[17] Actual emissions for the Swedish district heating systems were 50 kg CO_2/Mwh during 2008, compared to 274 kg CO_2/Mwh heat when using a combination of natural gas and fuel oil (Werner, 2010).

[18] In particular sulphur emissions (SO_2).

[19] It should however be noted that the electricity supply is dominated by hydro and nuclear power, which account for approximately 90 % of domestic electricity generation.

successfully pursue economic development and environmental preservation at the same time. Between 1990 and 2007 carbon dioxide emissions from the stationary energy sector had decreased by 8 % (SEA, 2010b), despite a growing economy[20] (Government Offices of Sweden, 2009a). Sweden's emissions are low compared to most other developed countries[21].

Furthermore, Sweden is seen to provide policy initiatives that foster the future development of clean energy technology (Dual Citizen, 2010; Ministry of the Environment, 2007; Giddens, 2011). In particular, the country is considered leading within Europe regarding the development of sustainable energy systems based on bio-fuels (Wimmerstedt, 1999; Dalenbäck, 2002; Ericsson & Nilsson, 2004). Local energy companies have gained experience and competences with biofuels and conversion technologies since the 1970s (McCormick & Kåberger, 2005), and more advanced technical solutions to use biomass in CHP production based on gasification are under development (Johnson & Jacobsson, 2000).

1.5.4 A favorable climate for managing corporate environmental sustainability

What can the development in Sweden tell us about the management of environmental issues in Swedish energy companies? Some scholars emphasize the influence of the country context on organizational practices. For instance, national cultures are seen to affect organizational patterns (Clark, 1990; Grenness, 2003) by reinforcing norms and behavior within firms (Smircich, 1983a). Granovetter (1985) points at the interrelation of economic behavior and institutions with the social context, based on the embeddedness of economic actions in structures of social relations. Tomer & Sadler (2007) see the firm as a socio-economic entity that acts according to moral values, their commitment to the community and society, and other social bonds. According to this view, organizational practices are rooted in the wider organizational and social environment. Swedish society is regarded as relatively well-informed on environmental issues (Nilsson, 2005), and environmental protection has traditionally benefitted from strong public support (Nilsson & Persson, 2009). This is likely to have a positive impact on the management of environmental sustainability in corporations.

The Scandinavian countries are renowned for their management style, so-called 'stakeholder capitalism' (Bjerke, 1999; Grenness, 2003; Freeman, 1984), which is predominant in Sweden. It is based on collaboration, participative leadership and an endeavour for consensus. Under the Scandinavian model, long-term ties between managers, employees, owners and society are strived for. This entails that the role of companies embraces the promotion of societal goals at large (Grenness, 2003; Lindkvist, 1988). Countries with a culture of dialogue, consensus and cooperation are seen to be at an advantage with respect to environmental policy-making (Jänicke, 2005; Weidner & Jänicke, 2002). All in all, Sweden offers favorable regulatory as well as socio-economic conditions to

[20] Between 1990-2007 GDP increased by 48 per cent (Government Offices of Sweden, 2009a).

[21] Sweden emitted 0.19 kg of CO_2 per USD of GDP, which is 56 % less than the OECD average (OECD & IEA, 2008).

succeed in managing the transformation of its energy system towards low carbon intensity. Hence, placing the present study in a Swedish context seems a valid choice.

1.6 Municipal energy companies as a research focus

Similar to many other European countries, the Swedish energy sector is dominated by a few large actors (Sjöberg & Sandoff, 2010). However, alongside the 'big three'[22], a considerable group of small and medium-sized energy companies prosper. In Sweden, municipalities traditionally play an important role in the supply of infrastructural services such as electricity, district heating and gas (Damsgaard & Green, 2005) as a result of the long-standing history and strong anchorage of municipal self-government. Even after the deregulation of the Swedish electricity market in 1996, causing the conversion of municipal utilities into independent subsidiaries, concentrated public ownership of energy companies remained widespread (Sandoff, 2006b). In 2008, 79 % of the 127 companies that produce electricity and heat in Sweden were municipality-owned[23], whereas the remainder was mainly privately or state-owned. Furthermore, municipal energy companies own the majority of Swedish energy generation plants, 69 % of the approximately 635 combustion plants[24]. Municipal energy companies generated 30 % of CO_2 emissions, indicating that their combustion plants typically are of a smaller scale than privately or state-owned ones[25,26].

Also in Finland, Eastern Europe and many other developed countries, the management of energy supply has traditionally been an area of municipal operation (Luoranen, 2009). Even in the U.S. and Canada, municipal ownership of electric utilities is rather common. In the U.S., 62 % of electricity providers are publicly-owned, managing 10 % of the country's production capacity (APPA, 2012).

Ownership has been identified as an influential factor for the governance of sustainability issues, as private and publicly owned corporations seem to differ in their approaches (e.g. Russel et al., 2007; Emmons, 1997; Fisher, 1982). Public and private sector organizations differ in their purpose and are governed by different structures. This seems to result in diverging understandings of corporate sustainability, with private organizations tending towards economic priorities and public organizations taking a more holistic and systemic perspective (Russel et al., 2007).

---

[22] These are Vattenfall, E.ON and Fortum.

[23] Participants in the EU ETS producing electricity or heat from combustion plants or district heating networks with more than 20 MW capacity.

[24] Included in the EU ETS in 2008.

[25] Due to the lack of data on the installed capacity of combustion plants (SEPA, 2005) at a company level, no conclusions can be drawn on the emission intensity of the plants per owner category.

[26] This section is based on own calculations using data underlying Sandoff (2008), Sandoff et al. (2010) and data from the Energy Market Inspectorate.

With respect to energy issues, Emmons (1997) finds that publicly owned utilities in the U.S. charge 10-20 % lower prices than their privately owned counterparts[27]. In a Swedish context, Söderberg (2008) examines the welfare effects of different ownership forms in electricity distribution and concludes that privatization has resulted in a welfare reduction by 8.5 %, given that public utilities had lower costs per delivered kWh and charged lower prices. In Schaad (2010), Swedish municipal energy companies are identified as a particularly interesting group of companies to study with respect to the management of sustainability issues. Earlier research indicates that profit-maximization is not the prevailing logic for value creation in these companies; other factors that reflect the owner's values and goals are typically more dominating (Sandoff, 2006b, 2008; Ericsson et al., 2004). Public welfare, the possibility to influence the local energy system and the local environment are seen as strong alternative business drivers (Sandoff, 2008). Local authorities historically play a central role in physical planning and the choice of heating system. As a consequence, also fuel choice may be a political decision (Ericsson et al., 2004). For instance, biomass for the generation of electricity and heat has become part of a long-term commitment through local Agenda 21 processes (Ericsson et al., 2004). Accordingly, municipal energy companies frequently embody the local political ambitions to create a sustainable society (Rönnborg, 2009), resulting in the choice of environmentally-friendly fuels and technologies (Johnson & Jacobsson, 2000). These companies are seen to fulfill an important function, partly as suppliers of infrastructural services, partly as a link towards a sustainable society (Rönnborg, 2009). As municipal energy companies provide roughly 60 % of all district heat in Sweden (OECD & IEA, 2008), frequently in local 'natural monopolies'[28] (Roos et al., 1999), their actions potentially have a great impact on the environmental sustainability of the energy system.

Since the deregulation of the Swedish energy market, the electricity sector is exposed to market forces. This involves that also municipal energy companies are to be managed on businesslike conditions (SOU 2004:136). Due to changing conditions, companies are adopting a market-oriented business logic, putting greater emphasis on competitiveness and efficiency (Lygnerud, 2006; Munksgaard et al., 2005), which to some extent creates a breach with the 'municipal heritage' (cf. Lygnerud, 2006). After ten years of experience with a liberalized market, the business logic of Swedish municipal energy companies can best be characterized as a balance between prevailing values, profitability and infrastructural concerns (Sandoff, 2006b). Moreover, municipal energy companies are seen to act upon contemporary norms such as green consumption and increased interest in the local society (Rönnborg, 2009). Another fact that creates interest in these companies is that much of the Swedish district-heating knowledge (particularly system knowledge) resides in municipal

[27] In this study, privately owned refers to investor-owned companies and publicly owned to municipality-owned companies.

[28] High fixed costs and economies of scale result in that it is often not economically feasible to have more than one district heating supplier per municipality (Lygnerud, 2006).

energy companies (Henning & Mårdsjö, 2009). Given these circumstances, it seems relevant to deepen our knowledge on the endeavors of Swedish municipal energy companies to contribute to a sustainable energy system and society.

Naturally, also in a Swedish context energy companies differ in their level of environmental responsiveness and the way sustainability issues are handled. The preliminary study (Pathways, 2008) made clear that companies act differently despite meeting a similar institutional environment. While some companies take a reluctant stance, others contribute more vigorously to the sustainable development of the energy system, for instance by pioneering in the development of sustainable energy technology or by setting up ambitious environmental goals. Companies displaying a high environmental commitment are particularly interesting to study. High environmental commitment is expressed in corporate activities and practices that improve environmental sustainability (cf. Henriques & Sadorsky, 1999). These are a result of allocating resources towards environmental improvements (Hart, 1995; Judge & Douglas, 1998). Although it is premature to define how a high environmental commitment manifests itself in the energy business, investments in renewable energy, ambitious emissions reduction targets and a broad set of environmental initiatives are likely indicators of high environmental commitment. These efforts should go beyond standard business practices and environmental regulations (Sharma & Vredenburg, 1998). Highly committed companies act with the well-being of the environment in mind, allowing environmental considerations to influence business decisions and actions (e.g. Sharma et al., 1999). Thus, managing the impact on the natural environment is a strategic concern for such companies.

How then do highly committed municipal energy companies manage sustainability issues, and what activities do they engage in to reconcile the need to develop the energy system sustainably with strengthening their competitive position? A first step to create knowledge on these questions was taken in Schaad (2010), investigating Swedish energy-intensive corporations' strategies and practices to mitigate climate change. Concluding from that and earlier studies, Swedish municipal energy companies hold a special position with regard to adopting strategies and measures that aim at improving energy system sustainability. The opportunities arising for these companies to fill a gap in the changeover towards environmental sustainability are increasingly recognized and utilized as a business driver. Three conditions favor this development: Firstly, municipal energy companies' long-term actions can be explained by underlying values and goals, rather than profit-maximization (Sandoff, 2006b). Secondly, municipal energy companies frequently embrace the environment as a core value (e.g. Rönnborg, 2009) and opt at improving their reputational space on these grounds. Good environmental performance is seen to strengthen customer trust (Schaad, 2010). Accordingly, taking strong actions to mitigate the environmental impact of energy generation not only benefits climate protection, but also conveys good citizenship to stakeholders, creating legitimacy for corporate activities (Hart & Milstein, 2003; Pinkse & Kolk, 2009; Rönnborg, 2009). Thirdly, new business opportunities are opening up: Market-demand for energy-related products with good environmental qualities is growing, particularly from commercial customers aiming to reduce their environmental impact (Gode et al., 2009; Henrik Törnsjö, 2008, personal communication). This creates additional financial incentives to manage the changeover, for instance by investing in renewable energy technologies.

Against the background of stringent national policies and regulations encouraging climate protection, and an ownership mission that prioritizes sustainable development at the municipal level, the above are strong drivers for municipal energy companies to manage the transition towards a sustainable energy system. Seeing the environment as a strategic issue means that environmental considerations are incorporated at all levels of business strategy (Dixon & Whittaker, 1999). However, what this entails in practice is more difficult to come to terms with. It requires a greater understanding of the strategies pursued by highly committed companies to develop their business towards environmental sustainability. What do such strategies entail? How are they realized, and what benefits do they bring about? Despite numerous studies on organizations and the natural environment, our understanding of how sustainability issues are managed by companies remains incomplete (e.g. Bansal, 2005), particularly regarding the energy business (Wüstenhagen, 2006).

Gaining knowledge on how corporations at the core of the problem manage the urgently needed transition towards environmental sustainability and the likely benefits this brings about is critical. There is a need to understand the processes underlying the development towards a carbon-restrained economy and corporations' catalyzing role in this. Municipal energy companies represent an arena where environmental sustainability takes form. Given the overt difficulties to reconcile profit maximization with sustainability goals (Walley & Whitehead, 1994; Wagner et al., 2001; Klassen & Whybark, 1999; Gore, 2010), at least in the short run (Hart & Ahuja, 1996; Ascher, 2006), the combination of high resource-intensity and high consciousness as to their role in society makes environmentally sustainable management in municipal energy companies a particularly interesting research topic. There is a need to enrich the discussion on sustainable practices in organizations (Wikström, 2010). Sustainable practices should be at the centre of attention to gain insights into how environmental sustainability is embodied in corporations. If this could lead to theories that capture the 'logic of practice' (Bourdieu, 1990; Sandberg & Tsoukas, 2011), the theory-practice gap between management and organizational science (e.g. Sandberg & Tsoukas, 2011) could be narrowed.

Studies focusing on environmentally sustainable management in the stationary energy sector are scarce (notable exceptions are Marcus & Geffen, 1998, Dixon & Whittaker, 1999 and Roome & Bergin, 2000). What frameworks - if any - conceptualize the management of sustainability issues in energy companies? How could we capture the 'logic of practice' in this sector and create knowledge that helps advance management practice? What are the capabilities created by managing the transition towards environmental sustainability in the energy sector? Can environmental sustainability be a foundation for firm value creation while contributing to the sustainable development of society? These are questions that deserve further investigation.

Gaining insights into environmentally sustainable strategies of highly committed municipal energy companies could provide a better conception of their future role in the development of the stationary energy system. Knowledge of companies' role and potential to facilitate climate mitigation efforts is crucial to bridge between corporations and policy-makers. Moreover, it is of interest from an academic viewpoint to gain a better comprehension of how energy companies embed a strategy for environmental sustainability in the organization and its surrounding field. Investigating energy companies with a high commitment to environmental sustainability should offer insights on how such a major transition can be managed. Based on these reflections, it seems warranted to present the research questions and purpose of this study.

1.7 Research questions

The main research question is:

How is the transition towards an environmentally sustainable business managed by municipal energy companies with a high environmental commitment?

This question is broken down into three sub-questions. These address different areas of inquiry embodied in the main research question. The first sub-question puts the focus on strategies for environmental sustainability as a central research interest:

Q1 What do strategies for environmental sustainability entail in municipal energy companies with a high environmental commitment?

The second sub-question aims at illuminating how strategies for environmental sustainability are embedded in the organization:

Q2 What are the mechanisms that facilitate the implementation of a strategy for environmental sustainability in municipal energy companies with a high environmental commitment?

The third sub-question directs attention to the broader issue of how value can be created for the firm and society by engaging in a strategy for environmental sustainability:

Q3 How can strategies for environmental sustainability contribute to the sustainable development of municipal energy companies and society?

1.8 Purpose

The main purpose of this research is to elucidate how the transition towards environmentally sustainable business is managed by municipal energy companies with a high environmental commitment. This encompasses exploring the strategies at the core of an ongoing transition towards an environmentally sustainable business. Strategies for environmental sustainability will be mapped systematically in order to delineate what such strategies entail from an empirical and a conceptual perspective. This involves providing a comprehensive insight into how municipal energy companies work with strategies for environmental sustainability, and offering a conceptual framework, outlining how such strategies can be operationalized.

A further purpose is to investigate how highly committed municipal energy companies embed environmental sustainability in the organization and its surrounding field. To this end, specific mechanisms that facilitate the implementation of strategies for environmental sustainability shall be identified. These represent dynamic elements that underlie the transition towards environmentally sustainable business. The empirical findings and previous research will be used to construct a scheme of mechanisms, delineating how the transition towards environmental sustainability is propelled in this context.

The third purpose is to examine the link between sustainable development and corporate strategy to analyze the contribution of strategies for environmental sustainability to the sustainable development of municipal energy companies and society. This aims at providing insights into how value can be created from a strategy for environmental sustainability, and how the transition towards a more sustainable energy system can be promoted. To accommodate the different research interests, an overarching analytical model will be built, providing the conceptual toolbox for meeting the purposes of this study.

1.9 Outline of the thesis

In the next chapter, the methodological approach pursued to answer the research questions is presented. This includes accounting for the assumptions underlying how such knowledge can be created and introducing the elements that constitute the basic building blocks of such knowledge. Furthermore, the research design and the processes of data collection and analysis are explained. Subsequently, Chapter 3 presents the theoretical approach of this study. An overview on the concept of sustainable development and its implications for management research forms the background against which the theoretical base is developed. Chapter 4 provides an operationalization of strategies for environmental sustainability and introduces the model of analysis that should allow answering the research questions in a structured way. Chapter 5 presents the empirical findings, which are analyzed in Chapter 6. Finally, in Chapter 7, the findings are discussed and conclusions from the study are drawn.

2 Methodological approach

Part I Designing the study

2.1 Initial reflections

The primary purpose of methods is to bring us closer to what we are trying to understand (Huff, 2009). The methodological approach should thus first and foremost be concerned with how the research questions can be answered in the best possible way. Before going into the practical details, it is worthwhile to acknowledge some general assumptions that form the backdrop for this study and have an impact on research design.

Firstly, the fact that human agents are reflective puts a stamp on how certain issues can be studied. Study design and methodology are affected by the fact that human agents "contemplate, anticipate, and can work to change their social and material environments and they have long-term intentions as well as immediate desires or wants" (George and Bennett, 2005:129). This matters given that qualitative research methods "start from the perspective of actions of the subjects studied" (Bryman, 1989, in Alvesson & Sköldberg, 2009:7).

Another widely acknowledged foundation is that organizations are open systems (Scott, 2003), meaning that interaction with the environment is important for the functioning of the system, respectively the company. According to this view, it is a prerequisite to take contextual factors into account when studying organizations. In the same spirit, Sayer (1992:60) holds that "meaning is context-dependent", and therefore events need to be contextualized in order to make sense of them.

A further important point is the distinction between physical behavior and the meaning of the actions involved in such practices (Sayer, 1992). It is argued that "practices, material constructions and systems of meaning are *reciprocally confirming*" (Sayer, 1992:33, emphasis in original). This involves that usually, changes in practices and meanings go hand in hand. This point can be illustrated by the example of global warming, which has increasingly been recognized as a serious threat. Hence, the change in meaning brought along changes in practice; for instance, renewable energy sources have become more widely accepted. It makes sense to study practices to find meanings and thereof build concepts.

From a realist perspective, knowledge about social reality can only be gained if we go beyond the empirically observable. The essential task is to ask questions about and develop concepts of the more fundamental conditions of the phenomena under study (Danermark et al., 2002).

Sayer (1992) considers method foremost as a practical matter, arguing that "methods must be appropriate to the nature of the object of study and the purpose and expectations of our inquiry" (1992:4). Depicting these relations in a triangle, each corner should be considered in relation to the others (see Figure 2.1). When making a choice about one of them, the implications for the other two need to be taken into consideration. Thus, "it is the nature of the object under study that determines what research methods are applicable, and also what knowledge claims one may have" (Danermark et al. 2002:70).

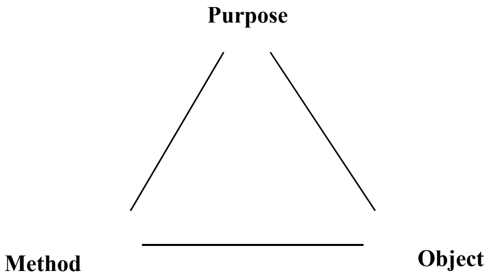


Figure 2.1: Interrelatedness of purpose, method and object
Source: Adapted from Sayer (1992, p. 4).

Given the nature of the object under study, qualitative method is a given choice. Qualitative methods are concerned with identifying the characteristics of empirical evidence from "easy-to-apprehend external appearances to internal, difficult-to-capture characteristics" (Huff, 2009:183). However, according to Denzin (1994:300), "the world we encounter is neither easy to make sense of nor neat". To cope with the messy complexities of qualitative research (Cooper & White, 2012), a hermeneutic approach provided room for reflection, allowing to test out different ideas and perspectives. This permitted the research interest to evolve and mature over time. In the course of the research process, it became evident that a broad approach is preferable to frame the research in a contemporary perspective and capture the complexities of the study object. This may stand in contrast to the traditional view of science advocating a narrow disciplinary approach to investigate a phenomenon in depth (e.g. Kincheloe, 2001). Kellner (1995) maintains that researchers must learn various ways of seeing and interpreting to avoid one-sidedness and partial vision. Thus, the object of inquiry in question and the researcher's understanding of it direct attention to the conceptual and analytical frames that may be best suited.

The overarching interest pursued in this research is to examine how the the transition towards environmentally sustainable business is managed by municipal energy companies with a high environmental commitment. This involves gaining insight into strategies for environmental sustainability in such companies. Moreover, it is of interest to study the mechanisms that enable these companies to embed such a strategy in the organization and its surrounding field, as well as how this strategy can benefit the firm and society. This puts companies at the center of attention as the objects of study, although only a part of the companies' endeavors, those connected to moving towards environmental sustainability, are the actual research interest. It is, however, difficult to single out these activities a priori, since they form part of a larger corporate strategy (Hart, 1995). In addition, following Bansal (2005:204) "practices associated with sustainable development are often context-specific". Given the lack of prior studies on the subject in the chosen context, it is an empirical question what strategies for environmental sustainability involve in municipal energy companies with a high environmental commitment. This will crystallize during the research process.

2.1.1 Studying strategies for environmental sustainability

My initial understanding of what a strategy for environmental sustainability involves, gained from the preliminary study conducted in summer 2007[29], was that it was not simply a question of technology transition. The strategy involved at the very least a joint effort between environmental management and investments in sustainable technologies. Further features were identified in the preliminary study that indicated that such a strategy permeated the company more thoroughly. It involved a multitude of activities that affected various corporate areas and also involved or were directed at stakeholders.

The aim to investigate strategies for environmental sustainability gives rise to the more general question: what is a strategy and how can it be studied? There are widely diverging views on these questions (e.g. De Wit & Meyer, 2004). Mintzberg (1987) holds that multiple definitions are needed to guide through this difficult field, suggesting that strategy can be regarded as a plan, a pattern, a position, a ploy, and a perspective. Mintzberg and Waters (1985) regard strategy as a pattern of actions. Sharma (2000) adopts this view and applies it to the field of organizations and the natural environment, resulting in the below definition of an environmental strategy, which is used as a working definition for the purpose of this research.

> The environmental strategy of an organization refers to 'a pattern in action over time' (Mintzberg, 1989:27) intended to manage the interface between business and the natural environment. (Sharma, 2000:682)

This definition is sufficiently broad to accommodate a strategy for environmental sustainability. However, I would like to add that the 'management of this interface' should involve the purposeful pursuit of objectives and opportunities with the inbuilt logic of aiming towards a transition to environmentally more sustainable business. Following earlier research

[29] With a focus on providing an overview of European energy companies that heavily engaged in renewable energy technologies.

(Hart, 1995; 1997; Berry & Rondinelli, 1998), environmental sustainability is considered to be of strategic relevance, in particular to companies with a high carbon exposure (Porter & Reinhardt, 2007) or a proactive stance to the environment (Okereke, 2007). This involves that there is a tight connection between environmental sustainability and corporate strategy, which follows the earlier reasoning on what high environmental commitment entails.

2.1.2 Activities as units of analysis

Left with a tentative definition of a strategy for environmental sustainability, what are the methodological implications of choosing this perspective? How can such a strategy be studied? In line with Mintzberg and Waters' (1985) notion of a 'realized strategy', a practical approach would be to study strategy through its proxies. Following Whittington (2006), strategy is something that people do rather than something that organizations have. It is the activities and practices performed by the firm that disclose its strategy for environmental sustainability. These activities and practices can have two origins according to Minzberg and Waters (1985). Viewed from a top-down approach, they can result from the strategy process, i.e. they are deliberate. Alternatively, activities and practices can originate from a pattern of actions within the organization, representing the emergent part of such a strategy. Porter (1985) holds that the result of the strategy process contains particular actionable steps that are outlined at the activity level. "Competitive strategy is manifested in the discrete activities a company performs in competing in a particular business" (Porter 1994: 266). This view on strategy (Porter 1985; Johnson et al. 2003) can conveniently be applied in an environmental strategy setting. Accordingly, environmental strategy manifests in the discrete activities performed that aim at improving a company's environmental sustainability. Hence, by studying activities and practices that mitigate the environmental impact of companies, a better understanding can be gained of what a strategy for environmental sustainability entails.

It follows that the units of analysis of this research are corporate ***activities that directly or indirectly contribute to making the business environmentally more sustainable***. Activities are considered as the basic components and smallest analytical units of a strategy for environmental sustainability. Performing activities seems the most neutral description of what companies actually do. These activities can take the form of corporate initiatives, practices, routines, measures or simple actions. Accordingly, the first step taken to answer sub-question one, "*What do strategies for environmental sustainability entail in municipal energy companies with a high environmental commitment*?", is to identify activities conducted in highly committed municipal energy companies that directly or indirectly improve the environmental sustainability of business. This allows filling strategies for environmental sustainability with content and meaning**.** Activities are also seen to provide an adequate basis for identifying potential mechanisms that facilitate the implementation of such a strategy, which is the purpose of sub-question two. The means for making this connection are presented later in this chapter.

Studying strategy through the activities that constitute it has a methodological advantage. It enables the researcher to study what managers are concerned with and what employees more widely engage in (Johnson et al., 2003), making strategy a more readily accessible topic for research. Moving on, the next important decision to be taken relates to the research methodology.

2.2 Case study methodology

Given the comprehensive and multidimensional nature of strategy, some researchers see strategy as a situational art that is best investigated through case studies, whereas strategy is described and interpreted qualitatively (Hambrick, 1980). The essence of case studies can be defined as "rich, empirical descriptions of particular instances of a phenomenon that are typically based on a variety of data sources" (Eisenhardt & Graebner, 2007:25), whereas case study methodology is a research approach that has its focus on understanding the dynamics at play within a single setting (Eisenhardt, 1989). The author further holds that case studies are suitable to accommodate various aims such as providing description and building or testing theory. In particular, case research is well-suited to capture the knowledge of practitioners and develop theory thereof (Benbasat et al., 1987). It is anticipated that case studies offer unique insights into the activities and practices performed by practitioners, which should result in a stable foundation for conceptualizing strategies for environmental sustainability and identifying the mechanisms that facilitate them. Hence, case studies seem the most promising methodological approach to find out how the transition towards an environmentally sustainable business is managed by highly committed energy companies.

Yin (2003) sees case study methodology as favorable when the research questions addressed are "how" and "why" questions, when the researcher investigates contemporary phenomena that are closely related to real-life, and in cases where the researcher has little control over the events. Yin further argues that case study methodology is particularly useful when the researcher wants to catch "holistic and meaningful characteristics of real-life events" (Yin, 2003:2) in the shape of for example organizational and managerial processes. In line with Yin (2003), Flyvbjerg (2001) points out that the advantage of case study methodology is "that it can 'close in' on real-life situations and test views directly in relation to phenomena as they unfold in practice". This reflects well the ambitions for this research.

Another aspect is that case studies are seen as appropriate for problems in which research and theory is in its early, formative stage (Benbasat et al, 1987). Case studies are appropriate when the research aim is increased understanding and interpretation of a phenomenon, as the methodology takes contextual factors into account (Merriam, 1994). Also George and Bennett (2005) emphasize the importance of detailed considerations of contextual factors, which are considered as a means to strengthen the conceptual validity of emerging theory. The ability of case studies to accommodate context is a strength of the methodology, making it a useful means for theory development. A further advantage of case studies lies in that they allow for the exploration of complex causal relations (such as path dependence) (George &

Bennett, 2005). The methodological features described above seem instrumental to successfully pursue the objectives of this research. They allow creating the necessary understanding for the problem at hand and conducting the research in a meaningful way.

This methodological choice nevertheless requires awareness of the criticism raised against case studies and meeting it in an adequate way. A weak point is seen in the difficulty to make generalizations based on case studies, given the limited number of cases that can be studied. However, case study researchers usually have no aspiration to select a representative sample. As a consequence, case studies are necessarily unrepresentative of wider populations (George & Bennett, 2005). In contrast to statistical studies, case studies “allow for a conceptual refinement with a higher level of validity over a smaller number of cases” (George & Bennett, 2005:19). Case study researchers should thus point out that their findings apply to the subclass of cases that share similar features as the cases under study in a contingent way (George & Bennett, 2005).

A further criticism is that case studies often are not robust enough to contribute to scientific development (Flyvbjerg, 2001). It is argued that many case studies provide data that give at best partial support to particular theories. They are frequently but rich descriptions of events from which the readers are expected to draw their own conclusions (Easton, 1995). This was kept in mind when analyzing and writing up the case studies. Easton (1995) recommends to more strongly invest in theory in order to improve the explanatory power of case studies, which has been taken into account in the later phase of the research process.

Eisenhardt (1989) cautions that, before engaging in case studies, an initial definition of the research question is necessary. In her view, a well-defined focus is vital to avoid becoming overwhelmed by the amount of data collected. Equally helpful is the preliminary specification of constructs, preferably with some reference to extant literature. Nevertheless, she warns against thinking too much about specific relationships between variables and theories, especially at the outset of the process, in order not to bias or limit the findings. She also emphasizes that it is important to understand that both initial questions and constructs are prone to changes in the course of the investigation. This reflects well the experiences made during this research. While research questions changed only slightly, constructs evolved in pace with the growing understanding of the object of study.

2.3 Case study design

Stoecker (1991) argues that the case study as a research strategy is an all-encompassing method covering the logic of the design, techniques for data collection as well as particular approaches to analyzing the data. Some options and the choices made in this study are presented next.

Design options relate to questions such as number and type of cases. The case study literature distinguishes between single and multiple case studies (e.g. Yin, 2003; Dubois & Gadde, 2002). Yin (2003) explains that multiple case studies follow replication logic. Eisenhardt (1989) clarifies that in replication logic, cases confirming emergent relationships strengthen the confidence in the validity of such relationships, whereas cases disconfirming these relationships can open up for refinement and extension of the theory. Thus multiple cases function as "discrete experiments that serve as replications, contrasts, and extensions to the emerging theory" (Eisenhardt & Graebner, 2007:25). A multiple case design is seen to enable broader exploration of research questions and better theoretical refinement (Eisenhardt & Graebner, 2007). Consequently, some authors consider multiple case studies to provide better explanations and more solid theory than single cases (Yin, 2003; Eisenhardt, 1989), whereas others see negative effects (Dubois & Gadde, 2002; Easton, 1995). Evidently, researching a large number of cases leads to more breadth but less depth of the study. According to Esaiasson et al. (2007), collecting in-depth information about a small number of cases is preferable to collecting little information about many cases, in particular if the intention is to investigate causal relationships.

Judging from these arguments, the number of cases is a critical question. Yet, it should be remembered that case studies follow the logic of analytical or theoretical generalizing as opposed to statistical or numerical generalizing (Yin, 2003; Flick, 2002). Preferably, theoretical saturation should determine the number of cases to be investigated (Esaiasson, 2007). A multiple case design seems preferable for the purpose of this study since studying several case companies leads to a richer set of data from which to develop concepts and answer the research questions. Naturally, strategies for environmental sustainability differ between corporations. Thus, studying several companies offers a broader spectrum of findings. If the investigations should lead to similar findings in a number of cases, this can be interpreted in the light of previous research (e.g. Bansal & Roth, 2000) and the theories chosen. Irrespective of the outcome, investigating several companies is a means to strengthen external validity. Consequently, this research has been designed as a multiple case study, covering three cases.

The second important choice is the type of cases to be studied. In principle, two strategies can be applied. One is *random selection* which is contrasted by *information-oriented selection*. In the second strategy, cases are chosen on the basis of expectations about the information they contain, aiming at maximizing the utility from a small sample or single case (Flyvbjerg, 2001). Corresponding to the general research idea, the cases studied in this investigation were chosen according to the second strategy. Furthermore, the concepts of *extreme cases* and *theoretical sampling* are of relevance. Flyvbjerg (2001) emphasizes the importance of selecting atypical or extreme cases as opposed to representative cases given that

> […] the typical or average case is often not the richest in information. Atypical or extreme cases often reveal more information because they activate more actors and more basic mechanisms in the situation studied. (Flyvbjerg, 2001:78)

The basic aim is to choose cases that are of strategic importance in relation to the research problem. Theoretical sampling can be seen as an extension of Flyvbjerg's (2001) reasoning. According to Eisenhardt and Graebner (2007:27), "theoretical sampling simply means that cases are selected because they are particularly suitable for illuminating and extending relationships and logic among constructs”. The authors add that the choice of case is not so much based on the uniqueness of the given case, but rather on the contribution to theory development within a set of cases. This comprises also the notion that decisions about which data to collect next are determined by the theory in progress (Eisenhardt & Graebner, 2007). Summing up, Pettigrew (1988, in Eisenhardt, 1989:537) reasoned that “given the limited number of cases which can usually be studied, it makes sense to choose cases such as extreme situations in which the process of interest is ‘transparently observable’ ”.

Applied to this study, selecting extreme cases refers to identifying municipal energy companies with a high environmental commitment. These companies should display a range of remarkable features or activities that signal their ambitions to improve the environmental sustainability of their business, making them valid candidates for conducting a case study. Clearly, without extreme cases, this investigation would be pointless. Only by studying companies with an active interest in the environment and a strong commitment to managing the changeover to a sustainable energy system can emerging strategies for environmental sustainability and the mechanisms that work in their favor be identified. Moreover, following the idea of theoretical sampling, the companies should differ in ways that would increase the explanatory power of the study. Here the most important variable was size. To make the most of what can be learned from the field study, the choice of case companies from which understanding of strategies for environmental sustainability should be gained was given careful consideration. The selection procedure for identifying suitable case companies is described next.

2.4 Selection of cases

Case selection required a preliminary operationalization of what strategies for environmental sustainability involve in the context of municipal energy companies. For the selection of Swedish municipal energy companies to be studied in-depth, secondary data collected during the preliminary study, covering energy companies from various European countries, including the Nordic region, came to good use. The sources of information for the preliminary study included corporate websites, company press releases as well as, for the Nordic companies, articles in newspapers and energy journals. Furthermore, the websites of the Swedish climate and eco-communities[30] were searched for highly committed energy companies. Information was also collected on a continuous basis by subscribing to e-mail news releases from companies initially considered interesting for the study.

As noted earlier, high environmental commitment is evidenced by corporate activities and practices that improve environmental sustainability (cf. Henriques & Sadorski, 1999). For the identification of highly committed companies, particular focus lie on finding companies that recently implemented or were in the process of planning investments in

[30] For further information see http://www.klimatkommunerna.infomacms.com and http://www.sekom.nu/

renewable or bridging technologies, as this represents a substantial long-term resource commitment to pursue sustainability goals. Such investments are irreversible and have a significant, lasting effect on a firm's future opportunities or choices (Ghemawat, 2001). Furthermore, the carbon intensity of the current energy generation portfolio as well as emission reduction targets were taken into account. In addition, a broad set of corporate initiatives, measures or activities aiming at improving environmental sustainability were seen as a promising feature. The intention was to acknowledge that corporations can engage in a wide range of activities that directly or indirectly contribute to sustainability. It is argued that all measures should be accounted for when judging on a company's strategy for environmental sustainability, although the immediate effect of reducing greenhouse gas emissions naturally is an important factor. The aims was to find a balance between quantitative, measurable sustainability improvements that usually are in the center of attention, and softer actions with a more long-term effect which frequently remain unnoticed.

The approach to select case companies is based on systematic procedures balanced with a portion of personal judgment with the aim to identify the most interesting and committed companies within the field of study. This attempt to evaluate corporate sustainability efforts should be seen as breaking new ground, rather than designing the perfect benchmarking scheme. To operationalize environmental sustainability in the context of the energy business, the wide array of actions and measures aiming at improving the environmental sustainability of corporate activities were collected and arranged under two headings, labeled 'technical measures' and 'bonding measures'. These two categories emerged from analyzing the secondary material mentioned earlier. Technical measures show the full range of renewable or bridging technologies that the studied energy companies employed to make their production portfolio more sustainable. They include renewable energy production techniques such as solar, wind and geothermal power as well as different applications of biomass in energy generation. Bridging technologies feature coal-gasification, carbon capture and storage as well as nuclear power and the use of natural gas. Other technical measures promoting sustainability are: improving the energy efficiency of current installations, upgrading power plants, and extending the use of district heating.

Given the intention to also catch the softer activities contributing to improved environmental sustainability, a second category, 'bonding measures', was created. This category captures non-technical aspects enhancing environmental sustainability either within the firm or externally. To mention just a few, operational bonding measures include setting reduction targets for carbon emissions and working with a certified environmental management system. Collaborative arrangements with stakeholders, other industries and competitors represent channels through which sustainable activities can be promoted. Other bonding measures are the promotion of energy efficiency with customers, environmental training for employees and supporting relevant research and development projects, both internally and outside the firm. Publishing environmental reports (containing information beyond minimal law requirements), engaging in other environmental communication, and taking part in the public debate on environmental issues, are seen as further signs of a company's commitment. Table 2.1 presents the technical and bonding measures identified and taken into account when selecting case companies (in alphabetical order for each category).

Table 2.1: List of measures for environmental sustainability

TECHNICAL MEASURES (Renewable and bridging technologies)	**BONDING MEASURES**
Biofuels production/distribution	Ambitious environmental policy
Biogas recovery from landfills or sludge	Carbon emission reduction targets
Biomass-fired power production/project	CDM/JI project participation [31]
Biomass gasification plant/project	Certified environmental management system (ISO 14001, EMAS)
Coal gasification plant/project	Collaboration with public administration and other stakeholders
Cogeneration (CHP) plants/project (combined heat and power)	Cooperation with local forest or agricultural industry
Working on CO_2 capture and storage techniques	Collaboration with other utility companies (common projects)
District heating extension plans/projects	Domestic heating solutions other than district heat
Energy efficiency improvements	Energy services to customers
Energy recovery from waste	Environmental awards received / Included in climate index
Fuel cells (hydrogen) projects	Environmental communication
Fuel switching (coal to gas, fossil to renewable, etc.)	Environmental reporting (climate specific, e.g. carbon intensity)
Gas-fired power plants, other gas projects	Environmental training (internal)
Geothermal power/projects	Environmental or energy related education (external)
Hydroelectric power/projects	Internal green research and development
Natural gas combustion for electricity or heat production	Promoting energy efficiency measures with customers
Natural gas distribution (as car fuel or to buildings)	Supports external green research and development
Nuclear power plants/projects	Taking an active role in climate debate
Solar panel (photovoltaic cells) project	Other voluntary measures for sustainability
Upgrading of power plants	
Wave power project	
Wind power/wind farm projects	

At the outset, potential case companies identified with the help of secondary material were analyzed in broad terms to get a preliminary overview on which further investigation could be based. This involved collecting the main features of the companies' sustainability

[31] Project-based mechanisms CDM and JI under the Kyoto Protocol.

measures. Simultaneously, knowledge about possible measures that energy companies could undertake to increase the environmental sustainability of their business was accumulated, which resulted in the above list of measures (which obviously is non-exhaustive). Based on this preliminary analysis, the twelve most suitable Nordic energy companies were investigated further to narrow down the candidates. The company webpage was searched more thoroughly and sustainable activities were looked for in the annual report and/or environmental report, as available. The evaluation of the company's activities for environmental sustainability was complemented with general information such as location, size, ownership, production portfolio, financial information etc., resulting in a fact sheet for each potential case company (see Appendix 1).

Even though these procedures for gaining an overview on sustainable activities of Swedish energy companies did not allow for an in-depth longitudinal analysis of corporate activities for environmental sustainability, they gave a good overview of events during a limited time-window. This could be considered a limitation. Conversely, it is argued that the procedure created a natural bias towards companies that are continuously working with sustainability issues, which indeed seems an essential condition to improve environmental sustainability. Thus, the chosen procedure supports the validity of the selection process. Nonetheless, once the most interesting companies had been identified, their past achievements were investigated over a longer period to gain a deeper insight.

2.5 Selection criteria

No rigid selection criteria based on quantitative benchmarks were applied when judging on a company's suitability for further study. Rather, following the line of arguments about case study design, it was the prospect of high information content for the purposes of this study that made some companies more prominent than others. This prospect was judged upon more intuitively. Since the general idea behind studying extreme cases is to achieve high relevance, this does not seem to create a bias. A particularly important selection criterion was ongoing investment projects focusing on renewable energy technology. A pronounced vision embracing environmental concerns or sustainability was seen as a promising feature. A large number and variety of technical and bonding measures made a company more interesting for the purpose of this study than a single comprehensive measure. The potential case companies were ranked on the basis of the information collected in the company fact sheet, resulting in a list of suitable case companies for further investigation. A further selection criterion was that the companies should differ in interesting ways, which ought to result in more diverse insights. Primarily, company size was considered a variable that could indicate differences in approaches among firms. The literature suggests that company size has an influence on how environmental issues are managed. Firstly, it is suggested that company size is positively linked to environmental efforts (e.g. Arora & Cason, 1995; Aragón-Correa, 1998; Sharma, 2000). Larger firms seem to have access to more resources and are therefore in a better position to integrate environmental concerns into their activities (Roy et al., 2001). Large firms are frequently seen to be at a more advanced stage of environmental management, being more likely to implement the technologies, programs and systems necessary to improve environmental performance (e.g. Hillary, 2000; Roy & Thérin, 2008; Worthington & Patton, 2005). Secondly, large companies are seen to be more aware of environmental obligations and experience greater environmental pressures (Baylis et al., 1998). Small firms, in contrast, are generally considered more reactive and resistant to environmental issues (Harris, 1985; Baylis et al., 1998). The number of employees is a common criterion to classify company size (Brooksbank, 1991), which is also used in this thesis[32].

A second variable that potentially results in differences in the way environmental issues are handled is organizational structure. Divergence in organizational configuration can lead to differences in the scope and organization of environmental management (Jabbour & Santos, 2006; Atkinson et al., 2000).

Two companies that differed in size and organizational structure were selected based on their measures taken to improve environmental sustainability. Subsequently, initial contacts were established with these companies to get approval for conducting a case study. The third case company was decided upon on theoretical grounds at a later stage.

Moreover, it is acknowledged that even other municipal energy companies may be strongly committed to the environment, which possibly led them far in their 'greening' process. They may have identified the need for this changeover at an earlier stage and thus preceded the chosen case companies in taking similar actions. It would, however, be inappropriate to study these companies, given that their changeover process has reached a later stage, resulting in a lower intensity of activities and thus little left to study. Without intending to depreciate their endeavors, such companies were not considered suitable for this study. Placing the study at the center of an ongoing transition in the chosen firms was seen to result in richer and more reliable empirical material.

2.6 Data collection method and study layout

A further choice to be made is *how* the empirical material should be collected. Case studies enable the researcher to process data from a variety of sources, such as company documents, interviews and observations (Yin, 2003). However, given that interviews are a highly efficient way to gather rich empirical material, they are often the main source (Eisenhardt & Graebner, 2007). Conducting personal interviews in combination with studying company documents and desk top research was considered an appropriate approach to gathering interesting and novel data for the purposes of this study. Interviews with company representatives were chosen as the main source of data collection, as the key to gaining knowledge on what environmentally sustainable strategies entail are the practitioners working with these issues in the company. In addition, corporate documents and webpages were

[32] Lower and upper limits applied here are: small: 0-100 employees, medium-sized: 101-500 employees, large: more than 500 employees.

studied to create an adequate knowledge base before entering the companies. This preparation also served as a means to cross-check the interview material and detect possible inconsistencies or conflicts.

Interviewing different informants is seen as favorable since each informant can contribute with slightly different pieces to an often complex picture (Esaiasson et al., 2007). A strategic selection of informants in line with different criteria is beneficial to give width to the investigation. The foremost selection criterion applied was that informants should be involved in performing, developing or implementing activities or practices that potentially form part of the company's strategy for environmental sustainability. This follows the call for more practice-based research (e.g. Sandberg & Tsoukas, 2011). Practitioners possess rich tacit knowledge of what the transition to more sustainable business practices entails, which this research aims at making more explicit. Close engagement with practitioners should therefore allow for the joint production of knowledge about how the transition to a more sustainable business is managed. The focus on practitioners in this research ensures relevance of the empirical study and strengthens the validity of the research. Taking into account how practitioners understand the world allows for linkages to be made between professional practice and theoretical development.

Interviewing practitioners with different occupations from various departments seemed an appropriate layout for the interview study, allowing to catch multiple views as to what sustainable activities the company engages in and how sustainability issues are dealt with. Practitioners in different positions can contribute with their individual picture of reality and raise new interesting aspects that can be illuminated in the investigation. These clues give direction as to how to proceed further, and point to relevant theory that could be used to construct an analytical framework. The preliminary operationalization of what a strategy for environmental sustainability involves gave closer guidance to develop the study layout. Initially, a number of departments and occupations that seemed particularly important for finding answers to the research questions were identified. The most promising areas for finding knowledgeable informants were the environmental department, energy production, the finance department and business development. Furthermore, it was of interest to include some informants in higher positions such as members of the management team or heads of relevant business areas. However, these should not dominate the investigation as focus lies on the knowledge and experience of practitioners, which assumingly is less pronounced at higher levels.

At this point, mentioning potential pitfalls of interview studies seems warranted. Eisenhart and Graebner (2007) see impression management and retrospective sense-making as the main sources of bias. This limitation can be moderated by using a data collection approach drawing on various well-informed interviewees from different areas and levels, who shed light on the phenomenon of interest from different angles (Eisenhart & Graebner, 2007). This has been taken into account when designing the interview study. Moreover, the risk for retrospective sense-making has been reduced by focusing mainly on events that evolve simultaneously with the study, or events from the recent past.

The identification of informants from different corporate areas with a high potential to contribute to this research was a crucial task. Different strategies have been used to locate suitable interview candidates. First, secondary sources such as newspaper articles, the company webpage and earlier research reports dealing with related issues were searched. Second, interviewees were asked for the names of further prospective informants (i.e. 'snowballing'). Possible interview candidates were contacted by telephone or e-mail to provide general information about the project and convey an idea of the scope of the interview, including how the material was going to be used. This also involved assuring confidentiality and anonymous use of the data. Once a contact had been established, the candidate's willingness and suitability to contribute to the project was assessed. The plan was to conduct between five and ten interviews for each case company, depending on company size. Naturally, restrictions given by the companies had to be taken into account[33]. A further limitation is the time available for the study. An initial estimation based on the first interviews gave an average time spent per interview of one week, including preparatory work, travel time, and transcriptions. An estimated minimum of 15 interviews would thus amount to roughly four months dedicated to the interview study, to which document studies had to be added. To collect all empirical material and perform a preliminary analysis, eight months of work seemed a valid estimate, which was considered feasible within the given time frame.

2.6.1 Semi-structured interviews

The empirical material was collected by conducting semi-structured interviews. The concept of semi-structured interviews entails that questions are open to such an extent that they allow the interviewer to follow up aspects of interest for the study, although these aspects were not initially considered when outlining the questionnaire (Stjernberg, 2006). Using semi-structured interviews constitutes a middle ground between the ethnographic style of interviewing that uses hardly any guidelines and the positivistic, structured way of interviewing with closed-ended questions (Leech, 2002). Accordingly, open-ended questions were used (as opposed to yes-or-no question), giving the interviewee ample room to speak freely. A useful tool was also to use prompts that encourage the informant to explain further or help him to elaborate on a certain topic of interest. An important rule for interviewing taken into account was to give the respondent sufficient space to talk. Trying to control the interview situation too tightly might result in losing important, unexpected information (Leech, 2002).

[33] Due to high work pressure at the third case company during the constructions of the new heat and power plant, the field study was limited to three interviews. This was considered sufficient, given the company's small size and the abundance of relevant written material.

2.6.2 Interview guide

When conducting interviews, what you already know is as important as what you want to know. What you want to know influences which questions you ask, while what you already know affects the way you ask them (Leech, 2002). This is relevant for this study in several aspects. With regard to theoretical knowledge, interview questions should not be influenced by theory to such extent that they attempt to test earlier theory. Getting caught up in the footsteps of earlier theory could inhibit forming fresh ideas and result in a theoretical tunnel-vision. On the one hand, the belief that field work can be approached completely void of theories seems unrealistic. On the other hand, a basic knowledge of the practical contextual background is a necessity. For this aim, I have familiarized myself with the context and specific conditions under which the companies operate. This involved for instance acquiring a basic understanding of the way the energy sector functions and the production techniques available to generate its two main products, heat and power. My involvement in two Nordic research networks investigating sustainability issues in the energy sector[34] has been very helpful to this end. Having knowledge about these aspects benefitted the quality of the interviews, as more appropriate questions could be asked. Also, spontaneous follow-up questions were more likely to turn out meaningful. This encouraged informants to discuss issues on a more professional level, resulting in that the interview time could be used more beneficially. Consequently, having a fair pre-understanding of the business logic of municipal energy companies, their operating conditions, and the principal challenges faced by them at the time of the investigation, was essential for drafting a relevant questionnaire and creating a favorable interview situation.

The interview guides were divided into sections of questions, grouped around main themes. For ease of preparation and analysis, interview guides and hence also the interviews followed a similar structure. However, each interview guide was tailor-made to the informant's position and the company's particular efforts to contribute to environmental sustainability. Nevertheless, some blocks of questions were addressed to all interviewees in a similar fashion (in italics below), especially around themes for which it was interesting to know whether practitioners held similar views. The main themes addressed were:

- The role of the environment in the company and in the informant's work
- *Driving forces for the changeover to environmentally sustainable business*
- The relationship between business and the environment
- Environmental work and investments in sustainable energy generation
- Structures and processes surrounding environmental work and sustainability issues

[34] 'Nordic Energy Perspectives', an interdisciplinary Nordic energy research project aiming at demonstrating means for stronger and sustainable growth and development in the Nordic countries, and 'Pathways to Sustainable European Energy Systems' an international project with the overall aim to evaluate and propose robust pathways or bridging systems towards a sustainable energy system in Europe.

- Important working areas for the changeover to environmentally sustainable business
- *Future areas for environmentally sustainable business and societal development*

To prevent linguistic misunderstandings, all interview guides where checked by a native Swedish speaker before sending them to the interviewees for consideration prior to the interviews. A sample interview guide can be found in Appendix 2.

Table 2.2: Profile of interviewees per case company

Area / Interviewee Function*	***Case Company***		
	WestEnCo	***SouthEnGroup***	***LocalEnCo***
Environment	• Environmental Controller (4) • Environmental Engineer (1)	• Environmental Manager (7)	• Environmental Controller (15)
Energy Production	• Facility Manager (3)	• **CEO of production company (9)**	
Finance	• Finance Manager District Heat (6)	• **Chief Financial Officer (CFO) (11)**	• **CEO and Investment Project Manager (17)**
Business Development	• Business Development Manager, District Heat (6) • Energy Systems Analyst, District Heat (5) • Head of Energy Services Department (12) • Wind Farm Development Project Manager (2) • Business Development & External Affairs Manager (14) • Business Development Manager Renewable Energy Gases (13)	• **Business Development Manager (8)** • Head of Market Analysis, Energy (10)	• **Head of Markets (16)**
Number of interviews	***9****	***5***	***3***
Total interview time	***11 hours 45 min.***	***7 hours***	***3 hours 40 min.***

*** Interviewee functions written in bold indicate that the interviewee is part of the management team.**

**** In interview (6) two informants participated, resulting in 10 people interviewed in total.**

To give an overview, the actual interview study details are compiled in Table 2.2, showing the informants' profiles, the number of interviews, as well as the total interview time for each case company.

Concerning the interview situation, all interviews were held at the company site. Interviews were recorded after making sure that the respondent had no objections. The interviews lasted between 45 minutes and two hours. To be able to concentrate on the informants' responses and maintaining the flow of the conversation, no notes were taken during the meetings. Instead, meeting notes were taken after each interview to catch the most important or unexpected issues raised, and get new ideas and reflections triggered by the interview on paper. This enabled moving on with the study before the interview was transcribed, if necessary, and follow-up new theoretical openings of potential importance. Moreover, the notes also facilitated orientation during the final analysis of the empirical material. Finally, all interviews were transcribed in their entirety.

The interview study was conducted between December 2007 and May 2009. Accordingly, it stretched over a period of one and a half years. Two case companies, SouthEnGroup and WestEnCo were followed roughly from November 2007 until the end of the interview study. This involved regular visits to the company webpages, reading press releases and other available documents, such as annual reports, environmental reports and company newsletters. To obtain a broader and more objective picture of the activities the companies engaged in, occasionally also other media were consulted. For instance, information related to developments within the respective municipality or region was gathered from the daily press and news releases from the Swedish Environmental Protection Agency, amongst others. This in order to improve the contextual understanding and catch developments that did not surface during the interview study. The third case company, LocalEnCo, was chosen on theoretical grounds at a later stage. The company was followed for roughly one year starting in December 2008, using similar material and procedures as for the other two companies.

Part II Case study analysis – from empirical material to answering the research questions

2.7 An abductive approach

Summarizing the dominant processes related to data collection and analysis during this study, three interrelated methodological concepts are particularly important: 'abduction', 'constant comparison' and 'analytic induction'. The concepts and their relevance for this study are explained next.

Alvesson and Sköldberg (2009) argue that induction has its starting point in the empirical material and deduction in theory. Abduction, in contrast, while starting from an empirical base, does not reject theoretical preconceptions. Hence, "the analysis of empirical facts may very well be combined with, or preceded by, studies of previous theory in the literature as a source of inspiration for the discovery of patterns that bring understanding" (Alvesson & Sköldberg, 2009:4). Alternation between theory and empirical facts characterizes the research process, whereas "both are successively interpreted in the light of each other" (Alvesson & Sköldberg, 2009:4). This process reflects well the research reality experienced during this study. Periods of data collection alternated with intense literature studies, which allowed gaining a deeper understanding of the empirical material in the light of different theories. New aspects could be included in the empirical study and interview questions were refined.

Dubois and Gadde's (2002) abductive approach to case studies highlights the process of systematically combining the empirical fieldwork with the emerging theoretical framework. Systematic combining is particularly useful when developing new theories (Dubois & Gadde, 2002). The lack of readily available theory that could be applied to make sense of the data made the use of an abductive approach and systematic combining well-motivated.

The analytical process occurred in parallel with data collection. According to Eisenhardt (1989), the overlap of data analysis and data collection is a prominent feature of research attempting to delineate patterns from case studies. It gives the researcher a head start in the analysis and offers room for making adjustments to the study according to emergent themes. Flexible data collection was considered a crucial advantage, given the rapidly changing conditions that the energy industry faced during the period of study[35], which created further incentives to pursue environmentally sustainable strategies.

The analytical procedure was dominated by two processes: 'Constant comparison' and 'analytic induction'. Berkowitz (1997:4-10) describes constant comparison as "an intellectually disciplined process of comparing and contrasting across instances to establish significant patterns". Constant comparison allows for emerging themes to be sorted out based on similarities and differences (Goulding, 1998). In this study, constant comparison is relevant in several aspects: Initially, the findings from the empirical study were compared with the preliminary operationalization of what a strategy for environmental sustainability involves (see Table 2.1). This allowed gaining a deeper understanding of such strategies and refining emerging concepts, which led to a first categorization of environmentally sustainable activities. Second, during data collection, a continuous "within-case analysis" took place, comparing and adding together the pieces of the puzzle with which each informant contributed. Furthermore, the findings from the interviews were compared with the written sources of information, enabling triangulation of the case material, which should provide stronger evidence of the emerging constructs (Denzin 1984; Yin 2003). Once sufficient material had been collected of several cases, findings were compared across cases.

[35] For instance, the ratification of the Renewable Energy Directive by the European Union in December 2008, setting the 20/20/20 goals to be reached by 2020 (20 % cut of energy consumption through energy efficiency measures, 20 % reduction of GHG emissions and raising the share of energy consumed from renewables to 20 %) increased the pressure on energy companies to manage the change-over to environmentally sustainable business.

After mapping the sustainable activities and practices identified in the case companies, these needed to be systematized. Analytic induction (e.g. Robinson, 1951; Hicks, 1994; Mitchell, 2006; Pascale, 2011) was helpful to formalize the empirical material. Using abstraction, activities with similar characteristics were clustered around overarching concepts that represent empirical categories. These were organized under central themes that could later be aggregated into an ordering framework. This procedure follows Porter's (1996) advice to think of activities in terms of systems of tightly linked activities circling around a central theme. These so-called 'activity-systems' (Porter, 1996) provided a first systematization of the activities, which was the basis for the licentiate thesis (paper II), leading to a preliminary ordering framework that conceptualized what a strategy for environmental sustainability involves (cf. Schaad, 2010). This conceptual framework has subsequently been refined and provides an operationalization of the phenomenon of interest in this thesis (please see to Section 4.2).

In a parallel inductive process, the empirical material was coded using different colors, and emerging patterns were analyzed in search for mechanisms that facilitate the development towards environmental sustainability within the case companies. Analytic induction was part of the heuristic process of pattern identification, trying to catch different logics that propel corporate actions towards more sustainable ways of business operations. Starting out from the notion that observations are theory laden but not theory determined (Mitchell, 2006), openness towards what the data can convey is essential. Mitchell (2006:130) observed that "evidence can surprise us and force us to revise our theories and explanations". Correspondingly, the study progressed by testing and refuting different working hypotheses, leading to a more fine-grained understanding of 'what is going on' at the case companies. Five mechanisms were identified as prominent recurring themes in the empirical material. To examine the relevance and validity of the hypothesized mechanisms, the case analyses were compared across companies, searching for similarities and differences in the patterns. The term 'greening mechanism' is used hereafter when referring to the specific mechanisms identified in this research, whereas the term 'mechanism' refers to the concept as such. Preliminary analyses of the data material, including the findings on the greening mechanisms, were presented at research workshops within the frame of the project groups that this research related to. These and other occasions to discuss results of this research allowed for the greening mechanisms to gradually develop and mature.

The processes described in Section 2.7 are henceforth referred to as 'Analysis 1'. Analysis 1 pursued two aims: The first was to organize and categorize the activities and practices gathered in the field, and the second to identify mechanisms that facilitated the implementation of strategies for environmental sustainability in the case companies. Analysis 1 occurred in parallel with data collection using an abductive approach which allowed for the systematic combining of the empirical material with relevant theories from literature. Analytic induction and constant comparison were used to systematize and analyze the empirical material. Figure 2.2 depicts these processes:

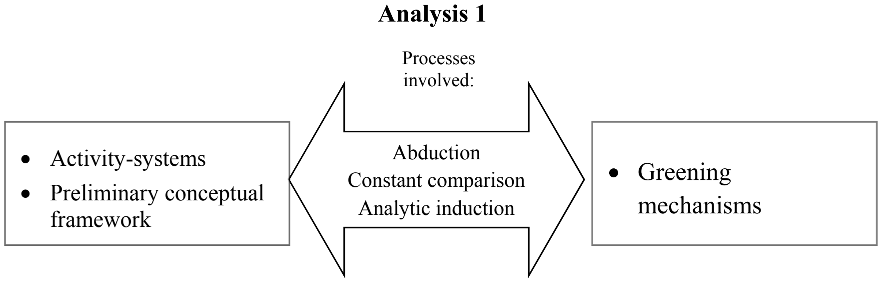


Figure 2.2: Processes and outcomes of analysis 1

2.8 Causal mechanisms

Studying the multitude of activities and practices that move the case companies closer towards environmental sustainability, it is relevant to ask what these activities represent. Practice-based research can generate theories by looking at patterns across different contexts and studying the underlying forces that shape them (Sandberg & Tsoukas, 2011). This is reflected in the research aim to find mechanisms that enable municipal energy companies to embed a strategy for environmental sustainability in the company, as raised in the second research question.

The use of mechanisms as a means of explanation may evoke questions such as: What are mechanisms and what are they good for? Alvesson and Sköldberg (2009:42) define a generative mechanism loosely as "that which is capable of making things happen in the world", whereas Mahoney's (2001:580) definition of causal mechanisms is that of "an unobservable entity that – when activated – generates an outcome of interest". This study aims at delineating particular approaches regarding how strongly committed municipal energy companies work with sustainability issues, enabling them to effectively implement an environmentally sustainable strategy. Mechanism-based explanation is a way to catch this essence. Hedström and Ylikoski (2010:54) argue that "(t)he primary epistemic, in contrast to practical aim, of science is to understand phenomena, and this is precisely what mechanisms provide".

Hedström and Ylikoski (2010) clarify that a mechanism scheme provides a 'how-possible' explanation. It intends to explain by what means a certain effect could be produced. According to Cummins (2000), mechanism-based accounts pursue the purpose to explain observable regularities. Hedström and Ylikoski (2010) hold that although mechanism-based explanations still rely on causal generalizations about properties, activities and relations of underlying entities, they do not have to satisfy the traditional criteria for laws. The mechanism-based vision of knowledge has therefore similarities with middle-range theories (e.g. Merton, 1968; Laughlin, 1995). An ideal theory of the middle range is clear, precise, and simple. It aims at isolating a few explanatory factors that clarify important but delimited aspects of the phenomenon to be explained (Hedström & Ylikoski, 2010).

When building a scheme of mechanisms, some points should be kept in mind as to the claims that can be made. George and Bennett (2005) point out that it is rarely possible to determine whether a mechanism identified is a necessary condition for that particular case, for the sort of case it represents, or for the outcome more in general. Furthermore, *whether* a mechanism is necessary for the outcome in a case is different from *how much* it contributed to the outcome. Even if a plausible claim can be made that a factor is necessary for the result of a particular case, no general claim can be made that its causal role is true for other cases (George & Bennett, 2005). Hedström and Ylikoski (2010) argue that the requirement that a mechanism is sufficient for an effect is too strong; rather it should be seen to affect the probability of a certain effect. Moreover, Sayer (1992) points out that the same mechanisms can produce different results in different occasions (multifinality) and conversely, different mechanisms can produce similar empirical results (equifinality). In any case, a positive characteristic of mechanisms-based explanation is its ability to accommodate complexity (George and Bennett, 2005).

Little (1998) highlights the important role of micro-foundations in mechanism-based explanations. There needs to be consistency between the mechanisms postulated and the observed processes at a detailed level of analysis (George & Bennett, 2005). In other words, "to explain is to provide causal mechanisms, to open up the black box and show the nuts and bolts" (Elster, 1983:24). It is evident that mechanism-based explanation cannot be founded upon excessive reductionism. To convincingly show the relevance of the greening mechanisms identified in this study, the empirical material will be presented through the lens of the greening mechanisms. Anticipating later steps of the analysis, it should also be mentioned that the greening mechanisms are seen to provide a link between the activities constituting the strategy for environmental sustainability and value creation.

2.9 Constructing a model of analysis

Subsequent to the first analysis of the case material, decisions had to be taken as to how the material could be further processed and analyzed to pursue the general research aim and answer the research questions. This goes back to the epistemological understanding how knowledge can be created. After thorough contemplation of earlier publications of a similar nature, both conceptual and empirical, it became evident that there was no readily available model to study the questions addressed. An own analytical model had to be developed, and it seemed feasible to tailor such a model. Earlier research from different fields provided the body of the model, allowing for existing frameworks to be adapted and combined. This would permit assembling the analytical tools deemed appropriate to pursue the different research interests. Constructing a coherent model of analysis was thus a heuristic process evolving in parallel with the growing understanding of how the research questions could best be answered. The choice of a theoretical perspective was an important linchpin in this process. The analytical model is built up stepwise in Chapter 4, presenting the finalized model in Figure 4.7.

2.10 Writing up the case studies

Whetten (1989) sees description and explanation as the essential ingredients of a simple theory. The researcher should, however, be sensitive to the competing virtues of comprehensiveness and parsimony. George and Bennett (2005:31) explain that "case studies involve a trade-off among the goals of attaining theoretical parsimony, establishing explanatory richness and keeping the number of cases to be studied manageable". The focus when writing up the case studies was to give explanatory richness and illustrate at a detailed level what a strategy for environmental sustainability entails at each case company. Eisenhardt and Graebner (2007) hold that presenting the evidence for the claims made is a critical aspect of empirical research. They acknowledge that case material, typically consisting of rich and detailed qualitative data, cannot be summarized so tightly. Also Pascale (2011) highlights the importance of providing sufficient information for readers to evaluate the credibility of the arguments made. Reflecting these views, the evidence presented in the empirical part of this study has been carefully analyzed and structured. However, to create understanding, rich description was given priority over parsimony.

Mitchell (2006:37) argues that "(t)he presentation of a case study is significant only in terms of some body of analytical theory". Consequently, intertwining theory with the narrative is a good way to show the close connection between empirical material and emerging theory, whereas quotations from key informants can illustrate and give support to the points made (Eisenhardt & Graebner, 2007). During the research process, different ways of presenting the case material have been tested[36]. In the final version, the greening mechanisms are used as an organizing structure, whereas quotations bear up many of the important points and make the material 'come to life', which is considered preferable to more abstract ways of description[37]. By making these choices, each case becomes a self-contained unit of meaning from which conclusions can be drawn by the researcher *and* by the reader.

A further choice made was to anonymize the case companies and use the pseudonyms 'SouthEnGroup' (Southern Energy Group), 'LocalEnCo' (Local Energy Company), and 'WestEnCo' (Western Energy Company) throughout the thesis. The reason for this is that the identity of the companies could divert the reader from the descriptions provided. At the same time, such knowledge would not improve the understanding of the conceptual elements of environmentally sustainability strategies and their underlying mechanisms.

Following the write-up of the case studies, the second step of the analysis was performed ('Analysis 2'). During this step, depicted in Figure 2.3, the empirical material presented

[36] In Schaad (2010) the activities have been organized in 'activity systems' following central themes, whereas another version (Schaad, 2011) used the conceptual areas to structure the empirical material presented.

[37] I am thankful to Irene Henriques for giving me valuable insights on data presentation.

through the lens of the five greening mechanisms was analyzed with the help of the framework of conceptual areas (presented in Figure 4.1). This reflects the interest to combine the dynamic concept of greening mechanisms with the more static conceptual areas to analyze how the greening mechanisms bear upon the conceptual areas and how activities and practices give meaning to the theoretical concepts. Hence, Analysis 2 involved examining how the conceptual areas are reflected in the empirical material and carving out in what way they become relevant in the empirical context. Each conceptual area was projected upon the activities of the respective company reported under each greening mechanism to examine the interaction between greening mechanism and conceptual area at every intersection. The resulting analysis is case specific, resulting in 20 short analyses per case company, synthesizing relevant insights from the empirical description.

Analysis 2

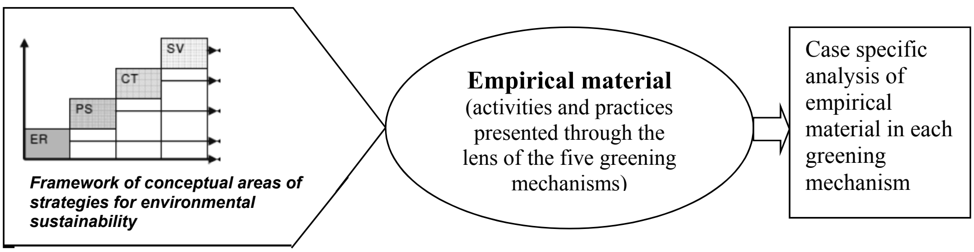


Figure 2.3: Analysing activities and practices with the framework of conceptual areas

2.11 Choosing a theoretical perspective

The third research question: "*How can strategies for environmental sustainability contribute to the sustainable development of municipal energy companies and society?*" suggests a connection between the greening mechanisms and sustainable development on a firm and a societal level. Sustainable development is a recurring theme in this research. Providing an answer to the third research question requires a sound theoretical base that permits connecting firm value creation to sustainable development. The choice of theory being an important crossroad for the research, alternatives have been carefully evaluated. Empirical observations influenced the choice of theoretical base, reflecting the dominant drivers for adopting a strategy for environmental sustainability mentioned by respondents in the field. Although a broad range of drivers such as ethical concerns, compliance and legitimacy issues were named, long-run competitiveness surfaced as the predominant rationale for pursuing such a strategy. This finding made the strategic management field appear a valid theoretical choice. Theory from this field matches this research's focus on company-wide strategies for environmental sustainability. However, the field's emphasis on sustained competitive advantage creates a minor conflict, as municipal energy companies reportedly do not follow a strict profit maximization logic (Sandoff, 2006b). Other goals such as achieving efficiencies and enhancing social welfare are more relevant measures of success (Sandoff, 2006b; Magnusson & Vallstrand, 2007). This circumstance makes municipal energy companies a special case and somewhat difficult to fit into mainstream strategic management thinking. However, informants emphasized the strategic relevance of corporate environmental sustainability, given the increasing carbon constraints encountered by their company. This establishes the link to future competitiveness, making stable, long-term financial performance the primary goal, rather than outperforming competitors. The research methodology gave further guidance for selecting a theoretical perspective. As case studies allow the researcher to study corporations from the inside, choosing a theory with the same point of departure seems appropriate. This condition was met by the resource-based view on strategy (RBV) (Wernerfeldt, 1984; Barney, 1986, 1991; Dierickx & Cool, 1989, Peteraf, 1993) which puts focus on internal firm characteristics, in particular its resources and capabilities, as sources of competitive advantage. A further reason for the choice of the RBV is its capacity to accommodate sustainable development issues, as argued for in Section 3.2.3, and its previous use in studies of environmental and social sustainability (e.g. Sharma & Vredenburg, 1998; Bansal, 2005; Rodriguez et al., 2002; Branco & Rodrigues, 2006). While the theory is presented in the theoretical chapter, resources and capabilities as concepts embodying the capacity to create value are introduced below. Furthermore, the relationship between activities, resources and capabilities in the literature as well as in this research is explained.

2.12 Resources and capabilities as sources of value creation

Activities as well as resources and capabilities have been used to explain how firm value can be created; the former are the building blocks of the activity-based view (Porter, 1985), whereas resources and capabilities form the basis of the resource-based view (e.g. Barney, 1991). These theories share objectives and underlying assumptions and are therefore compatible to some extent (Sheehan & Foss, 2007). Attempts to integrate the two perspectives have been made (e.g. Sheehan & Foss, 2007), but without any major impact. Considering the linkages between the concepts of activities, resources and capabilities, it can be observed that a firm’s resources generally determine what activities it can engage in at any point in time (Ghemawat, 2001), whereas the activities of a firm can lead to the development of resources over time (Penrose, 1959). Capabilities play yet another role: According to the resource-based view (RBV), they are seen to enable a firm to deploy its resources to effect a desired end (Amit & Schoemaker, 1993). There is some overlap between activities and capabilities, although capabilities entail that the firm possesses the ability to perform an action (in a latent sense), whereas activities relate to the actual act of executing that action. Furthermore, capabilities are typically broader in scope and more integrative than activities (Sheehan & Foss, 2007).

The choice of entity that can explain value creation is necessarily linked to the theoretical perspective adopted. Yet, there are methodological issues associated with such choice. An experience made during data collection is that corporate activities can be easily identified and captured, whereas resources and capabilities are more elusive to study. When addressing capabilities during the interviews, respondents had difficulties to relate to the concept in a beneficial way for this study[38]. Activities, in contrast, were unproblematic. Being a natural topic of conversation and corporate communication, e.g. in annual reports, newsletters and on webpages, they were readily understood. This further motivated the choice of activities as basic units of analysis. However, Ghemawat (2001) argues that the activity-based view cannot convincingly explain how value can be created in a changing environment; its potential to address dynamic issue is seen as limited. Although activities and practices are the basic units of analysis in this research, they are not considered suitable to study value creation as such. In line with the RBV, resources and capabilities are the preferred concepts to explain value creation. Capabilities resulting from proactive environmental strategies or required to pursue such strategies have been the focus of previous research[39]. Resources and capabilities as sources of competitive advantage are well established in the literature; their choice as a means of value creation is therefore not discussed more in depth. To explain value creation from a strategy for environmental sustainability, sharing perspective with similar earlier studies allows comparing the results and building cumulative knowledge. Identifying the resources and capabilities developed from the case companies' engagement in a strategy for environmental sustainability, as described in the next section, exposes in a tangible way how value can be created from high environmental commitment in a specific empirical context. This makes the process more explicit and may contribute to the understanding of value creation.

2.13 Identifying capabilities and resources

The aim of the 3rd step of the analysis ('Analysis 3') is to identify the capabilities and resources created by way of engaging in a strategy for environmental sustainability. The scheme of greening mechanisms serves as a screen to detect capabilities and resources created in each conceptual area of such a strategy (see Figure 2.4). This results in a list of discrete capabilities and resources that the case companies' engagement in environmentally sustainable strategies gave rise to (see Appendix 3). The usage of the concepts of capabilities and resources does not fully live up to the criteria of the resource-based view (to be discussed in Section 3.2). A broader, more inclusive denotation is applied, which even includes skills, abilities or simply 'things that the companies seem to perform well'.

The question may arise whether capabilities and resources cannot be identified without the intermediate step via greening mechanisms. As mentioned, there are methodological

[38] Answers indicated that respondents had different interpretations of the concept.
[39] A review will be provided in the theoretical chapter.

limitations in addressing capabilities directly in interviews. A second option would have been to identify capabilities and resources directly from the activities and practices found in the case companies. Although this may in principle be possible, it does not seem straightforward. Presumably, the analysis would have been less systematic and thus not as reliable. Several advantages with a mechanism-based analysis can be discerned. As such, mechanisms are intangible forces that underlie organizations' efforts towards a desired end. Activities are the empirical manifestations of such mechanisms (cf. Machamer et al., 2000). Mechanisms thus have a higher level of abstraction than both, the units of analysis (activities), and capabilities and resources. Sharing similarities with middle range theories (e.g. Merton, 1968; Laughlin, 1995), the mechanism scheme is a condensation of how the outcome of interest was generated at the case companies. Hence, mechanisms can create understanding at a meta-level and are thus more widely applicable. Whereas mechanisms potentially are generic across firms, resources and capabilities (as well as activities) tend to be more firm-specific. Mechanisms are therefore well-suited to detect capabilities and resources generated in the four conceptual areas of a strategy for environmental sustainability in a systematic way.

Beyond methodological considerations, the workings of a scheme of mechanisms, enabling municipal energy companies to embed an environmentally sustainable strategy in the company, are a core interest of this study. Identifying capabilities and resources with their help is a way to learn more about the greening mechanisms' potential to contribute to value creation from such strategies.

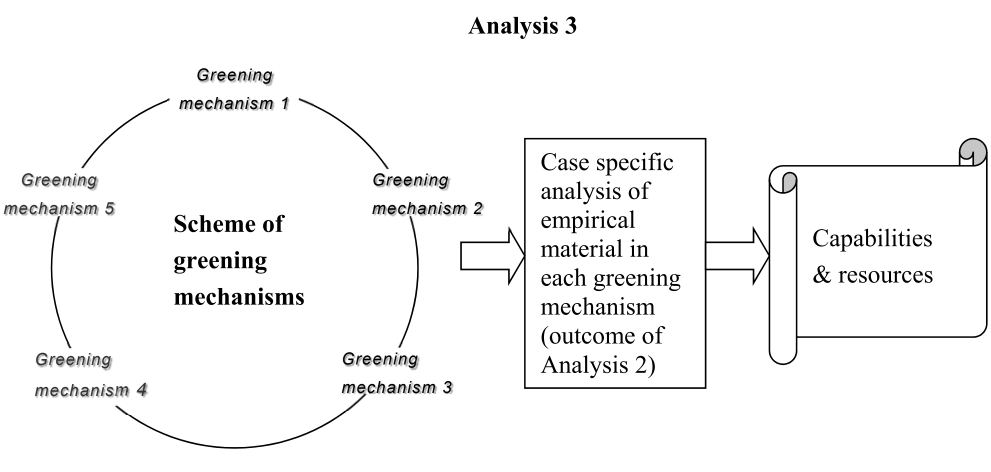


Figure 2.4: Identifying capabilities and resources by means of the greening mechanisms

The selection of firms with different size, organizational structure as well as diverse activities for environmental sustainability is expected to result in distinct outcomes. This reflects that the companies chose different solutions depending on their characteristics and strategic focus, resulting in distinctive capabilities. Appendix 3 therefore indicates which company or companies that have acquired the suggested capabilities. This allows analyzing whether a capability or resource is firm-specific or generic among the studied companies, and why this might be so. Please note that in order for a capability to be considered present in a firm, it had to be prominent; i.e. clearly apparent from the collected material. Hence, a company that lacks a mark for a certain capability may possess that capability to some degree, but not in a prominent way. It follows that if a certain capability or resource could be found in a company according to the analysis, then the company very likely possessed that capability or resource at the time of the study. Vice versa, if a company lacks a capability or resource that other companies possess, one of three options may apply: it may not have been prominent, it may not have become apparent during the empirical study, or it may effectively be lacking in that company.

Evidently, due to the explorative character of the investigation and the inevitable researcher bias, further research on the suggested capabilities is necessary to strengthen the findings. Moreover, capabilities and resources are not the focal interest as such. Rather, elucidating the effect of the greening mechanisms on value creation for the firm and society was aimed at. Capabilities and resources are expressions of the anticipated relevance of the greening mechanisms and, importantly, provide a link to prior research.

Furthermore, the initial intention was to focus on identifying organizational capabilities only. However, during the analysis findings surfaced that did not fit the category of capabilities. These can best be described as invisible assets (Itami, 1987) of a resource character. As these resources are tightly linked to the capabilities, they are not reported separately, but additional comments are made in the analysis chapter. It should further be noted that the analysis does not touch upon tangible resources created from a strategy for environmental sustainability, such as specific investments in clean technology.

2.14 Analysis of capabilities and resources' value creation capacity

The final analytical step, 'Analysis 4', involves examining the capabilities and resources developed from engaging in a strategy for environmental sustainability in terms of their value creation potential. The capabilities and resources were analyzed with a focus on their capacity to create *value for the firm* and *value that is shared between the firm and society*. Their capacity to create value for the firm is evaluated along three dimensions that were derived from the literature on the resource-based view and the natural-resource-based view. The capabilities and resources' potential to create shared value between the firm and society is assessed in terms of their capacity to alleviate wicked problems. The identification of relevant evaluation criteria was a heuristic process, taking into account several strands of literature, mainly related to sustainability, wicked problems and the resource-based view. Relevant criteria for the analysis of value creation are discussed in Sections 4.4.1 and 4.4.2. Figure 2.5 depicts this final analytical step.

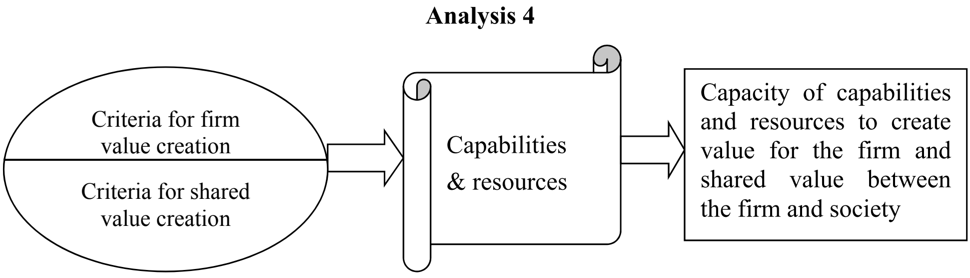


Figure 2.5: Analyzing the capacity to create firm value and shared value

2.15 Other aspects analyzed

Subsequent to Analysis 4, some further aspects of interest appeared that should yield interesting insights into strategies for environmental sustainability. The analysis chapter is therefore divided in three parts. The first part (Section 6.3.1) provides a 'bird's-eye view' on the capabilities and resources identified. Their occurrence in each conceptual area, in each greening mechanisms and at each intersection is analyzed. This should give a more fine-grained understanding of the greening mechanisms' importance for each conceptual area of a strategy for environmental sustainability. An analysis is also performed for each company, pointing at strengths and weaknesses. The subsequent section (6.3.2) analyzes the capabilities and resources under each greening mechanism generating mainly firm value, and those producing shared value between the firm and society. Results are then compared. Thereafter, Section 6.3.3 analyzes generic capabilities (found in all three firms) with firm-specific capabilities and compares the results. Throughout these analyses, parallels are drawn between prior literature on capabilities necessary for corporate greening and present findings. In the last part (Section 6.3.4), a synthesis of the capabilities with the potential to create shared value is made, suggesting a number of capabilities identified in this research that complement the natural-resource-based view.

2.16 Time-line over the research process

The research process outlined chronologically in Figure 2.6 indicates a two-step procedure. Doctoral studies towards a licentiate were initiated in 2007, leading to a licentiate degree in summer 2010. The second stage leading towards the doctoral degree lasted from autumn 2010 to autumn 2012.

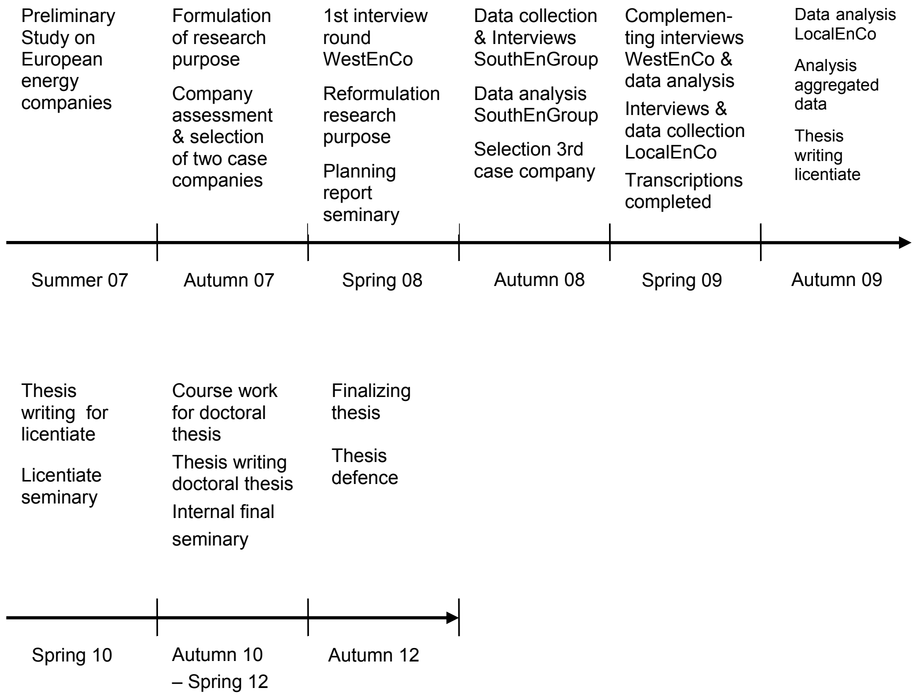


Figure 2.6: Time-line over the research process

3 Theoretical foundations to explain strategies for environmental sustainability

This chapter aims at creating a theoretical base for understanding strategies for environmental sustainability of municipal energy companies with a high environmental commitment. Metaphorically speaking, constructing a theoretical framework can be compared to building a house. A foundation, walls, a roof, etc. are needed. This first part of the theoretical chapter, however, does not deal with the building blocks of the house, but with its surroundings, i.e. the question where the house is going to be built. The characteristics of the surrounding environment influence the design of the house. For instance, its building blocks should be functional in the face of the prevailing climate. Accordingly, before building a house we need to be familiar with its environment. Similarly, before constructing a theoretical framework, we need to understand the background against which it is constructed. What is the wider context of the problem investigated? The need for knowledge production to be increasingly integrated with its social context has been addressed by several authors (e.g. Nowotny et al., 2001; Flyvbjerg, 2001). To be able to answer what a strategy for environmental sustainability entails, and what the likely consequences of pursuing such a strategy are, broader contextual understanding is needed. This does not only relate to the conditions framing the actions of the companies in question, but also to the broader normative assumptions that underlie such a research aim.

3.1 From sustainable development to sustainable business

A broader view puts the theoretical framework that should guide this investigation into perspective and makes it better grounded in the larger research context. As a first step, we require knowledge of what environmental sustainability, a core concept in this research, involves at a principle level, and how it can be pursued. Getting more familiar with the concept, it soon becomes evident that environmental sustainability cannot be considered in isolation. Its interconnectedness with social concerns and the question how these two are to develop in harmony inevitably directs our attention to questions of sustainability and sustainable development. To pursue this research in an open-minded and constructive way, it is necessary to be receptive to what the literature on sustainability and sustainable development can contribute to the debate on business and the natural environment. What are the commonalities and conflicts when translating these concepts to the corporate sphere? It is also important to be knowledgeable about the conceptual and practical challenges immanent in these concepts. What are the issues discussed, and are there any parallels we can draw when studying strategies for environmental sustainability? So how can deeper knowledge of these concepts inform this study? Trying to integrate separate fields with different rationalities addresses an important blind spot in the literature, and may help to increase the relevance of this research.

Accordingly, this first part of the theoretical chapter provides basic knowledge about the elusive concepts of sustainability and sustainable development (Marshall & Toffel, 2005; Palmer et al., 1997), and how they are handled in the relevant literature. Such knowledge serves as the backdrop of the theoretical framework that is established in this chapter. The next section introduces the concept of environmental sustainability. Subsequently, literature touching on sustainable development and sustainability from a social science perspective is reviewed. Thereafter, the main arguments as to the implications of these concepts for management research are outlined. Finally, conclusions are drawn for the theoretical framework, and its building blocks are introduced.

3.1.1 Environmental sustainability

In recent decades, the nature of environmental problems has fundamentally changed. These problems can be characterized as problems of emergent complexity (Dimento & Ingram, 2005). They have both multiplied and changed character from local to global, from distinct to diffuse, and from relatively low complexity to high complexity (Robèrt et al., 1997). The physical limits of our planet have been well established in the past decades (e.g. Meadows et al., 1972, 1992; Rockström et al., 2009), pointing at the urgent need to redirect our development path towards sustainability (Goodland, 1995; Robèrt et al., 1997). Moreover, environmental sustainability is a prerequisite to achieve social sustainability (Goodland, 1995) and represents the bottleneck for sustainable development more in general.

Environmental sustainability is a natural science concept and therefore obeys biophysical laws[40]. It is generally defined as the "maintenance of natural capital" (Goodland, 1995:10; Bartelmus, 2003), whereas natural capital is "any stock of natural resources or environmental assets, such as oceans, forests or agricultural land, that yield a flow of useful goods and services now and into the future" (MacDonald et al., 1999:74). Environmental sustainability refers to two fundamental environmental services: the source and the sink function. These must remain unimpaired in order to sustain global life-support systems. While the source capacities of the global ecosystem provide raw material inputs such as food, air, water and energy, the sink capacities assimilate outputs and wastes[41]. These source and sink capacities

[40] These evidently supersede man-made laws (Robèrt et al., 1997).
[41] For instance the atmosphere's capacity to absorb pollution (MacDonald et al., 1999).

are finite and in general non-substitutable, and their self-regenerating properties are frequently slow (Goodland, 1995). From an anthropocentric perspective, maintaining these life-support systems is a question of survival. This is why many aspects of environmental sustainability provide the very base of the sustainability hierarchy established by Marshall and Toffel (2005)[42]. The question remains how the existing biophysical constraints can be translated into guiding principles for sustainable development. Few scientific frameworks provide such clear guidance as The Natural Step (TNS) (e.g. Robèrt et al., 1997; Robèrt, 2000; Robèrt et al., 2002). Bridging environmental sustainability and a sustainable society, the framework presents four system conditions, i.e. basic principles towards a sustainable future. The first three refer to the need to maintain ecosystem functionality and to restrict waste streams to the pace at which natural systems can absorb them. Accordingly, in order for society to be sustainable, nature is not systematically subject to (i) increasing concentrations of substances extracted from the Earth's crust; (ii) increasing concentrations of substances produced by society; (iii) physical impoverishment by over-harvesting or other forms of ecosystem manipulation, and (iv) resources are used fairly and efficiently in order to meet basic human needs worldwide[43] (Robèrt, 2000; Robèrt et al., 2002).

3.1.2 Sustainable development and sustainability

Contrary to environmental sustainability, the concepts of sustainable development and sustainability are socially constructed (Robinson, 2004). Sustainable development and sustainability are often used as synonyms, although the choice of label can indicate the likely viewpoint of a commentator (Palmer et al., 1997). Historically, the conflicting standpoints relate to the relative importance of technology and individual human responsibility for finding solutions to environmental degradation. Those propagating a technocentric approach, oriented towards efficiency gains and improvements in technology, tend to prefer the term sustainable development. The other side follows an eco-centric approach, focusing on value-related questions and fundamental changes in individual attitudes towards nature. The adherents of this view preferably use the term sustainability[44] (Robinson, 2004). Besides ideological aspects, pragmatic reasons may guide the choice of terminology. For instance, Diesendorf (2000) treats sustainability as the goal or endpoint of a process called 'sustainable development'. Likewise, Robèrt et al. (2000) treat sustainable development as a process that, when following certain principles, leads to a favorable outcome, sustainability. This is the preferred interpretation of the terms throughout this thesis.

[42] These authors have categorized and prioritized diverse sustainability issues, reflecting their urgency, severity, uncertainty of consequences as well as temporal and spatial dimensions.

[43] For a more detailed explanation of the four system conditions please refer to Robèrt et al., 2002, pp. 198-199.

[44] Gladwin et al. (1995) provides an in-depth discussion of the consequence of a technocentric or eco-centric approach to sustainability.

Benn and Dunphy (2007) reflect on the challenges presented by sustainability and state that “(s)ustainability is an open and contestable concept with many layers of meaning”. Sustainability is seen as a value-based concept, frequently subject to political discussions. It spans over space and time, giving rise to implementation problems on various levels. Local concerns must be balanced against global ones, short-term objectives against long-term objectives and economic targets against social and environmental targets. In addition, it has relevance for entities of all sizes, from individuals to companies and from countries to regions and the world community (Benn & Dunphy, 2007). It is also obvious that sustainability embodies a long-term perspective (e.g. Dincer, 2000).

Bergström et al. (1998) call sustainable development a ‘living paradox’. Sustainable development is seen as a problem-solving idea with the ambition to take care of many contemporary problems simultaneously. It is the ‘liberté, egalité et fraternité’ of the 1990s and embodies a vision of the society we all should strive for. The authors stress that one should make a choice between considering sustainable development merely as a utopia or as a formula for development. The former might be rather value-laden, whereas treating sustainable development as a formula requires a more hands-on approach.

On a political level, the term sustainable development has had a central role since the late 1980s. The concept has been widely used as a foundation for the formulation of international treaties and policies (Bergström et al., 1998). The report ‘Our Common Future’ established by the Brundtland Commission for the UN in 1987 was a milestone in delineating and popularizing the concept of sustainable development (CWIB, 2009). It promoted the idea of economic growth while preventing environmental degradation (Kallio et al., 2007). The shorthand characterization of sustainable development, being “development that meets the needs of the present without compromising the ability of future generations to meet their own needs” (WCED, 1987:23) is still the most widely accepted and commonly applied definition (Munda et al., 1994). It has been endorsed by governmental and other organizations worldwide as an approach to achieving sustainability (Gladwin & Krause, 1997), in particular since it was used at the 1992 Earth Summit (Dunphy et al., 2003). A more comprehensive definition was coined by The National Round Table on the Environment and the Economy, whereas sustainability is defined as “principles that seek to establish a dynamic balance between economic, environmental and social priorities, and to improve or maintain human and ecosystem well-being together, both now and into the long-term, locally and globally” (Sustainability, 2008). This definition emphasizes that sustainability is a three-dimensional concept balancing between environmental protection, social development and economic growth (UNEP, 1992). The systemic and long-term nature of environmental, social and economic development highlights complexity and uncertainty as key issues for sustainability (Voss & Kemp, 2006), clearly showing that the concept has a large magnitude in time and space and hence is challenging to negotiate.

For obtaining a broader understanding, it seems useful to address the ethical paradox within sustainable development. Sustainability means that something is not depleted

(Bergström et al., 1998). The term suggests that an ecosystem can subsist over time with hardly any alteration. Adding the idea of development made sustainability shift in focus. It is no longer looked at from the perspective of the environment but from that of society and the capital economy. While 'sustainability' bears the environmental emblem, 'development' stands for the economic perspective. Sustainable development as a term hence aims at mitigating and moderating the paradox between the two sides (Jabareen, 2008). This seems to hold out the promise that ecological sustainability and economic development can be reconciled, which is believed to be the reason why the concept enjoys wide support (Sachs, 1993). Sustainable development seems to reassure that it is possible to cope with the ecological crisis without affecting existing economic power relationships. Baeten (2000) argues that under the banner of sustainable development, ecology and capitalism are no longer contradictory and the limits to growth are thus negotiable and manageable. Should this interpretation prevail, there is clearly great risk that the status quo is perpetuated. Dobers et al. (2001:338) conclude that two opposing perspectives emerge, illustrated by the two statements: "Society can reach sustainability within the present conditions of market economy!" and "Society must undergo major and drastic changes to reach sustainability!", respectively.

In an academic context, sustainable development can be called a meta-organizing concept or paradigm that allows researchers both to transgress disciplinary borders and to trespass boundaries between academia and practice (Füssel, 2005). However, the concept is not seen as unproblematic. Jabareen (2004) argues that there is a lack of a comprehensive theoretical framework for understanding sustainable development and its complexities. Researchers like Villanueva (1997) and Marshall and Toffel (2005) point at a disagreement over what should be sustained, since operative definitions are missing. In addition, definitions of sustainable development are considered to be vague (Gow, 1992; Jabareen, 2004, 2008). Yet others regard definitional diversity as very probable during the early period of any potentially grand new idea of general usefulness and compare sustainability to democracy, liberty and equality (Gladwin et al., 1995). Following Kuhn (1970), it is to be expected that emerging paradigms based on entirely new fundamentals do not possess a full set of concrete rules or standards. Although creating confusion in the various debates on sustainable development, Robinson (2004) sees the openness of meaning as an advantage. Sustainable development may profit from what can be called 'constructive ambiguity', as a precise definition might exclude those whose views are not expressed in that definition. In the messy world of negotiations around sustainable development, the lack of a precise definition may represent a political opportunity (Robinson, 2004).

While some argue that the 'openness of meaning' of the concept never can be closed (Lafferty & Langhelle, 1999), and perhaps not even should be closed (Robinson, 2004), Gladwin et al. (1995) propose that it is feasible to deduce some principal components of sustainable development, pointing at shared conceptions within academia. Their content analysis of numerous definitions of sustainable development suggests that the concept stands for “a process of achieving *human development* in an *inclusive, connected, equitable, prudent*, and *secure* manner” (Gladwin et al., 1995:878). Lafferty and Langhelle (1999) argue that, despite its weaknesses and ambiguities, the concept of sustainable development is the best available idea for achieving ecological balance while taking into consideration both global and generational equity. In their view, sustainable development should be treated as an ethical code for human survival and progress.

3.1.3 Implications for management research

Making sustainable development turn into a genuine concern for business and integrating it into day-to-day practices is undoubtedly one of the big challenges of our time. Ehrenfelt (2004) asks whether the management of environmental issues differs from ordinary tasks and if so, why it is different. On the one hand, there are researchers arguing that issues surrounding organizations’ management of the natural environment require no new management theories; researchers should thus attempt to solve these problems with existing theories (Boons, 1997; Wolff, 1998). Ehrenfelt (2004), on the other hand, argues that the study of environmental management in firms differs from other strategic pressures and deserves a distinct treatment. He asserts that other management issues can be framed in two-by-two matrices, whereas sustainability and the environment are more complex notions surrounded by extremely complex institutional fields. Hall and Vredenburg (2003) point out that managers have experienced considerable difficulties to deal with sustainable development pressures, particularly due to the fact that their strategies often are inadequate to accommodate demands of highly complex and uncertain nature. Hence, many firms are struggling with how sustainability can be linked with corporate strategy (AMA, 2007). According to Elliot (2011:198), for many business leaders the essential dilemma is

> […] why, how, where, and when to transform the organization to become environmentally sustainable while planning for and developing business initiatives for a future market that will fundamentally change, applying technologies that are still emerging, and needing to comply with regulations that are yet to be determined.

Post (1991) argues that environmental issues force managers to think at levels of abstraction not normally used in managerial decision making. In the same vein, McGee (1998) questions if the dominant strategic management theories can be made ‘ecologically sustainable’, i.e. if they can be augmented by adding sustainability principles. The alternative is the development of a new paradigm with sustainability elements at its core (Jennings & Zandbergen, 1995).

Gladwin et al. (1995) see it as a great challenge to transform management theory and practice in order to make a positive contribution to sustainable development. We can hypothesize how sustainable development reasoning impacts on organizations and organizational research. Eccles et al. (2011) studying companies with a strong culture of sustainability find that these companies are characterized by distinct governance mechanisms that link executive compensation to sustainability objectives and directly involve the board in sustainability issues. The adoption of social and environmental policies is strong among these firms. Further characteristics are a more long-term orientation and an active stakeholder management process. Gladwin et al. (1995) expect that sustainability-oriented companies can improve quality of life by focusing on maintaining or reducing energy and matter throughput. For the society at large, they anticipate that development should replace growth as the main objective. Assumptions of infinite growth ought to be removed from theories of strategy and organization. Qualitative improvements instead of quantitative expansion should be the base for theorizing. Gladwin et al. (1995) further raise the question whether sustainability requires organizations to develop a sense of place, becoming rooted in communities, a question that is relevant also for this research.

Berke and Conroy (2000) lend support to the argument that there is no general agreement on how to translate sustainable development into management practice. On a critical note, when it comes to how sustainable development relates to actual practice, Andrews (1997:19) observes that "sustainable development is primarily symbolic rhetoric, with competing interests each redefining it to suit their own political agendas, rather than serving as an influential basis for policy development". Luke (2005) holds that the concept of sustainable development is being used, if not abused, to promote more efficient but still unsustainable consumption. Conversely, Newman (2007) finds that sustainable development, despite being a contested concept, continues to be popular at all levels of organizations. Likewise, Gladwin et al. (1995) see a broad, overlapping consensus around the goal of sustainable development forming. All the same, greater attention needs to be paid to transformational change and operationalization along these lines (Gladwin et al., 1995). Two factors are seen as decisive. Given that corporations are the primary engine of economic development (Shrivastava, 1995; Hart, 1997) that possess the financial resources, technical knowledge and institutional capacity to foster the necessary changes towards ecological and social sustainability (Schmidheiny, 1992; Hawken, 1993), business needs to be 'on board'. At the same time it is obvious that sustainable behavior must become a source of competitive advantage if this power is to be harnessed (Shrivastava, 1996).

3.1.4 Delineating the theoretical framework

Summing up the main points from the previous sections, we face highly complex global sustainability issues which involve large uncertainties and long time horizons. Integrating such concerns into management research and practice has proven to be a difficult undertaking. Hence, drawing parallels from the all-inclusive concepts of sustainability and sustainable development to the firm-level concept of environmentally sustainable strategies is an intricate task. Three prominent issues surface that merit attention when constructing a theoretical framework: 1) Competitiveness is clearly a key concern if we expect committed involvement by business in sustainability issues. 2) It seems adequate to specifically look for management theories that can accommodate long-run considerations. 3) The theories should allow for complexity to be handled rather than reduced. Considering that the transition towards an environmentally sustainable business by municipal energy companies is studied from the inside, and that these companies see environmental sustainability as a vital strategic issue to reposition themselves in a carbon-constrained world, management theories that reflect these facts are required.

The resource-based view (RBV) on strategy (Wernerfeldt, 1984; Barney, 1986, 1991; Dierickx & Cool, 1989; Peteraf, 1993), shedding light on the internal resources and capabilities necessary to achieve a sustainable competitive advantage, seems to correspond well with this research approach and the larger problem context. Naturally, it is of interest whether a strategy for environmental sustainability has the potential to create resources and capabilities that are vital for firm competitiveness, and if so, how? Returning to the metaphor of building a house, the RBV represents the cornerstones of the framework. The theory is introduced in Section 3.2. However, against the background of the pressing sustainability challenges, it seems important to investigate whether and in what way the RBV can accommodate broader sustainable development concerns. This is considered in Section 3.2.3. To complement the theoretical framework, the natural-resource-based view (NRBV) launched by Hart (1995), a theory[45] that connects the RBV with the challenges posed from reconciling business activities with the natural environment, is added. The NRBV specifically addresses how environmental sustainability can be pursued in a competitive context. Metaphorically speaking, this theory provides the foundation walls. The NRBV is presented in Section 3.3. Critical reflections on this theory and its capacity to take sustainability issues into consideration are provided in Section 3.4.2. Subsequently, the roof of the construction is raised, represented by the 'Sustainable Value Framework' (Hart & Milstein, 2003), which is presented in Section 3.5. Furthermore, against the background of the aim to bring RBV and sustainable development closer together, the concept of shared value creation (Porter & Kramer, 2006, 2011) is introduced. In a metaphorical sense, this concept represents the windows through which to look at the surroundings, offering the opportunity to develop resource-based reasoning further in alignment with sustainable development. Finally, Section 3.6 presents a review of organizational capabilities addressed in the NRBV.

3.2 The resource-based view (RBV)

The main principles that the RBV (Wernerfelt, 1984; Barney, 1986, 1991; Dierickx & Cool, 1989; Peteraf, 1993) introduced to strategic management, after a decade dominated by the industrial organization (IO) perspective[46] (Porter, 1980; 1985), were firstly that resources of firms are heterogeneous and imperfectly mobile, and secondly that firm attributes rather than

---

[45] Based on criticism of the RBV (Priem & Butler, 2001), it is arguable if the NRBV should have the status of a theory of the firm or if it rather represents a view or an organizing framework. The use of the term theory does not contain any value judgment on this.

[46] This perspective focuses on product markets, viewing the sources of profitability to be the characteristics of the industry as well as a firm's position within it (Amit & Shoemaker, 1993).

industry structure matter. Accordingly, factors inside organizations are seen as the principal source of competitive advantage[47] (Rouse & Daellenbach, 1999).

In his seminal article, Barney (1991) examines the link between firm resources and sustained competitive advantage. Resources are defined as physical capital, financial capital, human capital and organizational capital (Barney & Clark, 2007). More precisely, firm resources encompass all assets, capabilities, organizational processes, firm attributes, information, knowledge, etc. possessed by the firm that enable it to "conceive of and implement strategies that improve its efficiency and effectiveness" (Barney, 1991:101). However, not all resources enable a company to create a competitive advantage, let alone to achieve a sustained competitive advantage (i.e. which cannot be imitated by competitors). To obtain a sustained competitive advantage, resources must be strategically relevant, which involves that they have to be *valuable, rare* and *imperfectly imitable*. In addition, *no close substitutes* may exist. These four characteristics are also referred to as the VRIN model.

Valuable refers to the ability of firm resources to create sustainable value for a company. Accordingly, resources are valuable when they enable a company to conceive or implement strategies that increase its efficiency and effectiveness (Barney, 1991). *Rarity* means that valuable resources should be heterogeneously distributed across firms. They should not be easily accessible to competitors and ought to be possessed only by a small number of firms (Barney, 1991; Barney et al., 2001). *Imperfect imitability* refers to resources being costly to imitate[48] (Barney & Clark, 2007). This is due to three resource characteristics, singly or in combination. First, valuable and rare resources can be imperfectly imitable due to *unique historical conditions*, meaning that the resources originate from particular circumstances in space and time[49] or as a result of path dependence. Second, *causal ambiguity* can make resources imperfectly imitable. Causal ambiguity denotes that the management has a poor understanding of the link between a resource and the sustained competitive advantage it creates. Third, *social complexity* can make a resource imperfectly imitable. Social complexity refers to relational attributes among firm members and/or stakeholders which can be difficult to achieve despite systematic efforts to do so. A company's reputation among customers or suppliers and corporate culture are examples of socially complex resources (Barney, 1991). Barney (2001) considers the reasons why valuable and rare firm resources can be costly to

---

[47] According to Peteraf and Barney (2003:314) '(a)n enterprise has a Competitive Advantage if it is able to create more economic value than the marginal (break even) competitor in its product market'.

[48] Imitation as such can be defined as the "the diffusion of successful business models – defined in terms of resources deployed and/or activities performed – across the population of firms" (Ghemawat, 2001:84).

[49] A firm that obtains valuable and rare resources as a result of its unique path through history will be able to exploit those resources and implement value creating strategies that cannot be imitated by other firms (Barney, 1991). Unique historical conditions reflect contexts (time, location, etc.) that determine the relative importance of a resource or capability (Michalisin & Stinchfield, 2010). A related term is time-compression diseconomies (Dierickx & Cool, 1989).

imitate an important part of his 1991 article as they specify the conditions under which firms could possess a sustained competitive advantage.

Barriers to imitation increase the cost of other firms aiming at duplicating the resources of a successful firm. However, if substitutes for these resources exist which are not costly to imitate, then the strategy can be duplicated at low cost, invalidating the competitive advantage. Consequently, the last requirement refers to the *non-substitutability* of rare, valuable and imperfectly imitable resources. No alternative resource may exist that enables a competitor to implement the same strategy and in that way invalidate the company's sustained competitive advantage (Barney, 1991). Makadok (2001a) however contends that in reality, many strategically-relevant resources are at least partially imitable or substitutable.

In his later work, Barney (1999) extends his framework to address the question "(i)s a firm organized to exploit the full competitive potential of its resources and capabilities?" (Barney, 1999:171). Hence, the aspect of 'Organization' is added, which results in the VRIO framework, refining the last portion of the model. Factors such as a company's formal reporting structure, management control systems and compensation policies, often called *complementary resources and capabilities*, are seen to be relevant for the framework since they, in combination with other resources and capabilities, enable the organization to exploit the full potential of their competitive advantage (Barney, 1999).

3.2.1 The role and nature of capabilities

Several authors (e.g. Stalk et al., 1992; Amit & Shoemaker, 1993; Hitt et al., 1997; Grant, 2008) distinguish between resources and capabilities. It is suggested that resources represent a firm's fundamental financial, physical, individual and organizational capital attributes. Hence, resources are assets that managers deploy. Capabilities are attributes that enable a firm to exploit its resources in implementing strategies. They are the skills and abilities captured within a firm. Amit and Shoemaker (1993:35) depict capabilities as "information-based, tangible or intangible processes that are firm-specific and are developed over time through complex interactions among the firm's *Resources*." Even other authors describe capabilities as the "cumulative outcomes of historical processes" (Marcus, 2005:29).

Makadok (2001a) concludes that two key features distinguish a capability from other types of resources. Firstly, capabilities are firm-specific as they are embedded in the organization and its processes. As a result, the ownership of capabilities cannot be easily transferred. Marcus (2005:29) concludes that capabilities are "less measurable, analyzable, understandable and tradable than resources". The second distinction is that capabilities have as their primary purpose to enhance the productivity of other resources possessed by the firm.

Nelson and Winter (1982) portray firms as developing capabilities from an incremental and path dependent process of learning from experience. Another way of creating capabilities is through learning from inter-organizational ties (Dyer & Singh, 1998; Lorenzoni & Lipparini, 1999). Firms learn about capabilities through networks and exploit external knowledge with the help of their absorptive capacities (Cohen & Levinthal, 1990). According to Prahalad and Hamel (1990), capabilities are 'building blocks' that aggregate into core competencies. Thus, capabilities represent a system's separate components and suggest a potential. Prahalad and Hamel (1990) further argue that companies possess many capabilities, 30 or more, but only a few competencies. Amit and Shoemaker (1993) comment further that capabilities can provide strategic flexibility. As Teece and Pisano (1998) argue, capabilities typically must be built since they cannot easily be bought. Kraaijenbrink et al. (2010) see, however, limitations with the capabilities approach. Resources and capabilities should both be considered as capacities that enable (and at the same time constrain) a firm's actions.

Penrose (1959) emphasizes the path dependent nature of firm resources. It is argued that the activities of a firm lead to the development of resources over time. As a result, a firm's resources are directly related to its past activities. To conclude from the above, sustained competitive advantage and the unique resources necessary to implement a value creating strategy cannot be purchased on open markets (e.g. Barney, 1986; Dierickx & Cool, 1989). Rather, firms must look inside to find competitive advantages in the rare, imperfectly imitable and exploitable resources they already control (Barney & Clark, 2007) or build the necessary resources and capabilities internally. The key message is thus that firms should build their strategies on internal strengths (e.g. Grant, 2008).

3.2.2 Value creation through reduced costs and improved opportunities

From a resource-based perspective it is of interest to know how resources and capabilities affect current or future costs, as well as perceived benefits arising from seizing future opportunities. Within the RBV and related literature, there are several definitions regarding the characteristics that indicate the value of a resource or a capability. The thrust of these definitions is in line with Barney (1991:101), stating that the value of a resource is associated with the degree to which it enables the firm to "conceive of and implement strategies that improve its efficiency and effectiveness" (Leiblein, 2011). Efficiency is expressed in the ability to reduce costs, whereas effectiveness relates to the capacity to increase value (Kraaijenbrink et al., 2010). The value of a resource or capability in terms of its contribution to efficiency is related to its efficiency properties. These can be determined by judging upon the technical fitness or productivity of the resource or capability (Leiblein, 2011). Regarding the effectiveness criterion, several authors address that heterogeneous expectations may affect future opportunities. For instance, Barney (1986:1231) holds that

> Strategic factor markets will be imperfectly competitive when different firms have different expectations about the future value of a strategic resource. In these settings, firms may obtain above normal economic performance from acquiring strategic resources and implementing strategies.

Heterogeneous expectations in strategic factor markets[50] involve that different strategizers will have different expectations about the future value of a strategy. As a result, it is possible for some strategizers to generate rents from acquiring or developing the resources needed to conceive and implement a certain strategy and implementing that strategy subsequently (Barney & Clark, 2007). Strategizers with more accurate expectations about the future value of a strategy are able to avoid economic losses from optimistic expectations. Furthermore, they are more likely to anticipate and exploit potential opportunities for competitive advantage in strategic factor markets. Consequently, such firms are expected to perform better than firms with less accurate expectations about the future value of strategies. Nevertheless, as a result of the difficulty in estimating a strategy's return potential, luck can always play a role in shaping a firm's competitive advantage from strategy implementation (Barney, 1986; Barney & Clark, 2007).

According to Rumelt (1987), there is a difference between the ex ante cost of acquiring resources and the ex post value of implementing them. As stated in Peteraf (1993), firms can develop strategic assets and distinctive competencies because they possess the insight to identify critical environmental resources and capabilities ex ante and then limit competition for such resources and capabilities by raising barriers to imitation. Following this view, the characteristics constituting the value of a resource or capability refer to the future opportunities embedded in the resource that allow the firm to achieve a competitive position in the marketplace. For instance, Kogut and Kulatilaka (1994) view capabilities as platforms that create a generic set of resources and hence represent investments in future opportunities.

Attempting to clarify the RBV notion of value creation, Makadok (2001a) distinguishes between resource-picking and capability-building. The former creates value when the resource is selected, i.e. a priori. In contrast, capability-building creates value only after resource deployment, given that the purpose of a capability is to enhance the productive value of other resources possessed by the firm. By implication, capability-building can only create economic value if a firm is successful at acquiring the resources on which relevant capabilities can exert their productivity-enhancing influence (Makadok, 2001a).

Furthermore, it is debated whether the value of a resource should be determined endogenously (e.g. Makadok, 2001b) or exogenously, i.e. by the market (Priem & Butler, 2001; Barney, 2001; Ambrosini & Bowman, 2001). As Ambrosini and Bowman (2001) point out, resources can be destroyed through competitor imitation or substitution, while shifts in demand can make resources redundant. Consequently, environmental contexts affect the competitive value of a resource (e.g. Miller & Shamsie, 1996).

Another discussion emphasizes that a difference should be made between value creation and value appropriation (e.g. Barney & Clark, 2007; Mizik & Jacobson, 2003). Firms do not

[50] Defined as markets where the resources necessary to implement a strategy are acquired (Barney, 1986).

necessarily appropriate all the competitive advantage (economic rents) they generate[51]. Moreover, according to Barney and Clark (2007) firm profit refers to that part of the economic rents that the firm is able and willing to appropriate.

Summing up, the RBV suggests that it is possible to develop a theory of persistent superior firm performance, using a firm's resources and capabilities as units of analysis (Barney & Clark, 2007). Several implications follow from this view on sustainable competitive advantage. Firstly, the correct level of analysis for resource- and capability-based logic is at the level of the resource, not at the level of the firm (Barney & Clark, 2007; Leiblein, 2011). However, the firm is commonly the unit of accrual. As a consequence, scholars are encouraged to look inside the firm, where resources are located, in order to learn more about the relationship between resources and strategies (as opposed to correlating aggregate measures of resources with aggregate performance measures) (Barney & Clark, 2007). From their review, Armstrong and Shimizu (2007) conclude that empirical research from a resource-based perspective has mainly focused on the effect of firm-specific resources on the overall performance of the firm. Barney and Clark (2007) maintain that research findings are in general consistent with the resource-based expectations.

Despite its popularity, the RBV has been subject to considerable criticism. For instance, Priem and Butler (2001) question the ability to operationalize and test the RBV. They argue that the theory is tautological, i.e. true by definition. Other criticism addresses the all-inclusive definition of resources (Priem & Butler, 2001). This is seen as problematic for several reasons. For instance, there is no distinction between resources that are inputs to the firm and capabilities that enable the firm to select, deploy and organize such inputs. Furthermore, the RBV does not address in what way different types of resources may contribute to a sustainable competitive advantage in a different manner (Kraaijenbrink et al., 2010). Further criticism relates to the indeterminate nature of the value of a resource (Priem & Butler, 2001; Kraaijenbrink et al., 2010) and the definition of a competitive advantage in general (e.g. Leiblein, 2011; Kraaijenbrink et al., 2010). A criticism relevant to the present research addressed by Sheehan and Foss (2007) is that the RBV lacks a concern with the processes of building strategic resources. Neglecting the process 'black box' makes the link between resources and their contribution to value creation less transparent. The RBV's failure to address important implementation issues results in a lack of managerial guidance.

Various scholars (e.g. Leiblein, 2011; Kraaijenbrink et al., 2010; Lockett et al., 2009; Sheehan & Foss, 2007) have suggested ways forward to advance the RBV. In spite of the deficiencies addressed, Barney and Clark (2007) consider the RBV to have the potential to continue generating new theoretical and empirical insights.

[51] This may be the case in municipal energy companies, given their multiple business objectives (Sandoff, 2006b).

3.2.3 The RBV and sustainable development

The aim of this section is to establish a conceptual link between the RBV and sustainable development[52]. Characteristics and underlying assumptions of the two concepts will be compared first. Thereafter, an overview will be given of how the RBV has been used and framed in order to accommodate environmental and, to a lesser extent, social sustainability issues. For this purpose, literature addressing corporate sustainability concepts such as environmental management, environmental strategy, corporate sustainable development, corporate social responsibility etc., has been reviewed. The main interest is to investigate the current practice of addressing sustainability issues from a resource-based perspective and to assess the usefulness of such choice, as argued for in previous research (Sharma & Vredenburg, 1998; Bansal, 2005; Rodriguez et al., 2002; Branco & Rodrigues, 2006).

The primary focus on value creation and sustainable competitive advantage makes the RBV (and any other strategic management perspective) somewhat at odds with that kind of sustainability that is referred to in the term 'sustainable development'. However, similarities in underlying assumptions and characteristics allow for a fruitful link between the RBV and sustainable development to be established, as argued below.

Reconciling features are for instance a similar view on *the role of time*. A sustainable competitive position cannot be created rapidly. The build-up of valuable, rare, difficult to imitate and non-substitutable resources and capabilities requires a long time-frame and evolves in a path dependent manner (e.g. Penrose, 1959). For instance Dierickx and Cool (1989:1506) describe the development of strategic assets as "the cumulative result of adhering to a set of consistent policies over a period of time". According to Barney (1991) a single 'big decision' will not lead to a competitive advantage. This can rather be achieved through the aggregate effect of hundreds of small decisions as these are difficult to duplicate or imitate by competitors (Dierickx & Cool, 1989). This view is also brought forward when studying 'green' strategies (e.g. Sharma & Vredenburg, 1998). According to McGee (1998), 'green' strategies are developed over a long time-span and are therefore hard to comprehend and imitate by other actors. Etzion (2007) concludes that it is due to the continuous and cumulative process by which a 'green' strategy is shaped that a firm can create a competitive advantage based on its environmental performance. Similarly, Michalisin and Stinchfield (2010) argue that a strong environmentally-oriented corporate reputation is a path dependent resource, accumulating through strategic investments over time which competitors cannot quickly replicate. The time dimension is also expressed in the RBV's emphasis on historical events, resource endowments and isolating mechanisms, in particular time compression diseconomies (Leiblein, 2011; Dierickx & Cool, 1989). Likewise, sustainable development strategies entail that a long-term perspective is adopted, which requires far-sighted thinking

[52] In an organizational context, sustainable development concerns are expressed in various notions. Some of them are referred to below.

and actions. It is thus necessary to accept short-term sacrifices in order to achieve longer-term gains (Ascher, 2006).

According to the RBV, there is substantial *ambiguity* as to what the best strategy might be, which might only show after a considerable period of time (Nelson & Winter, 1982). This has parallels to the sustainable development debate. Hall and Roome (1996) portray sustainability as a 'shifting goal' that changes as our knowledge evolves, new environmental challenges arise and future generations express their needs. Ehrenfelt (2004) cautions that there is no assurance that current best practices aiming at sustainable development actually are sustainable in the longer run. Actions can only be taken in the present, whereas sustainability relates to a future state that societies, organizations and politicians strive for. As a consequence, actors can only assume that the tools and measures presently implemented will suffice to drive business strategies and other practices towards sustainability. As argued by Newman (2007), the sustainability challenge requires a constant process of adaptation between humans and natural ecosystems to ensure the survival of both. It is thus not surprising that both strategy making and sustainable development have occasionally been conceptualized as 'wicked problems'[53] (Rittel & Webber, 1973; Camillus, 2008; Noteboom, 2006).

Both the RBV and sustainable development take the perspective of a *continuous process*. While both in principle aim for an enduring state[54], it is recognized that there is no final end point to one's engagement, i.e. both concepts are open-ended (Kraaijenbrink et al., 2010; Jokinen et al. 1998; Newman, 2007). From a resource-based perspective this is so because of changes in the competitive and other environments[55] (e.g. Miller & Shamsie, 1996; Fiol, 2001). Concerning sustainability, scholars argue that sustainability is embedded in complex changing systems (Newman, 2007) and should thus be pursued as a continuous process of change, rather than as a final objective (Jokinen et al., 1998). Consequently, sustainable development has often been described as a never-ending journey (Kallio et al., 2007).

Sustainability is a core concept underlying both the RBV and sustainable development, although referring to different meanings. In the RBV, the term refers to economic sustainability, whereas sustainability in the sense of sustainable development is commonly seen to consist of an economic, an environmental, and a social dimension (UNEP, 1992). Relating the notion of sustainable development to corporations has resulted in its conceptualization as the 'Triple Bottom Line' of economic viability, environmental quality and social justice as well as the notion of 'People, Planet, Profit' (Elkington, 1994, 1997). To

[53] 'Wicked problems' (Rittel & Webber, 1973) distinguish themselves from 'tame problems' by evading any single definition, having many causes and no final solution, involving multiple interests, and requiring social change.

[54] In the case of the RBV, the persistence of a competitive advantage in terms of superior profits sustained over time (Leiblein, 2011).

[55] Please note that scholars typically distinguish between stable, predictable environments and changing, unpredictable environments (e.g. Miller & Shamsie, 1996).

my knowledge, no explicit theoretical connection has been made between the RBV and this broader conceptualization of corporate performance. Related discussions can be found around the notions of 'enlightened self-interest' and 'sustainable strategic management', to name just a few.

Sustainability appeals to the proponents of 'enlightened self-interest', promoting the view that companies should operate in ways that safeguard long-term economic performance by avoiding short-term behavior which is socially harmful or environmentally wasteful (Porter & Kramer, 2006). Lee (2008) notes that, in parallel with the developments in the field of corporate social responsibility, the notion of corporate performance as used in strategic management has changed, shifting away from single-minded financial performance to a broader notion including both financial and social dimensions. The mission of companies should thus be to identify opportunities that are beneficial both for itself and for society (Rodriguez et al., 2002). Along similar lines, Stead and Stead (2008) coin the concept of 'sustainable strategic management', which they see as the next evolutionary stage in the strategic management field.

The necessity for 'sustainable strategic management' is seen to arise from the practical environmental and social reality, as the relationship between business, the society it operates in, and the environment is of critical concern for the welfare of humankind. These authors further argue that organizational success in the 21st century will increasingly be defined by social, ecological and economic performance. Sustainability has become increasingly tightly coupled (cf. Weick, 1976; Lee, 2008) to the strategic management agenda (Stead & Stead, 2008; Porter & Kramer, 2006, 2011; Eccles et al., 2011) and, therefore, implicitly to the resource-based view. However, if this link was explicitly acknowledged by RBV scholars, this would be quite likely to have theoretical consequences.

The RBV's usefulness for studying sustainability issues lies in its focus on internal firm characteristics, notably its resources and capabilities. The theory envisions the firm as a bundle of heterogeneous resources, both tangible and intangible (Barney et al., 2001), whereas firm resources are seen as "strengths that firms can use to conceive of and implement their strategies" (Barney, 1991:101). In essence, the RBV examines the link between internal firm characteristics and performance (which arguably can be seen to include environmental and social performance). The theory is particularly suited to study the emergence of intangible resources whose creation is path dependent, socially complex and, as a result, difficult to imitate.

A review of relevant literature at the interface of RBV and sustainability shows that the resource-based view has been linked to sustainable development in various ways. The dominant reasoning connecting the RBV with corporate sustainability issues is the hypothesized relationship between environmental or social performance and firms' financial performance, using resource-based reasoning. For instance, Bansal (2005) argues that resource-based rationales apply well to corporate sustainable development given that corporate sustainable development has proved to influence firm performance (e.g. Hart &

Ahuja, 1996; Russo & Fouts, 1997). King and Lennox (2001) partly confirm this view, adding that firm characteristics and differences in strategies for environmental improvement act as moderators of the relationship between environmental performance and financial benefits. Furthermore, changes in technology, legislation and market forces, reflecting sustainable development concerns, are seen to create new resource-based opportunities from corporate sustainable development (Porter & van der Linde, 1995).

Rodriguez et al. (2002) argue that sustainable development, by changing the competitive landscape, influences the way companies develop their resources, capabilities and activities. Branco and Rodrigues (2006) argue that their rationale for using the RBV to study corporate sustainability issues is that engaging in corporate sustainability can help firms to create resources and capabilities that are valuable, rare, difficult to imitate, and for which no perfect substitute is available. In line with this, Sharma and Vredenburg (1998) argue that competitive advantage can be explained as an outcome of the development of valuable organizational capabilities stemming from a proactive environmental strategy. In addition, as pointed out by Russo and Fouts (1997), the importance of intangible concepts such as know-how (Teece, 1980), corporate culture (Barney, 1986), and reputation (Hall, 1992; Hart, 1995) are explicitly recognized within the RBV. Accordingly, the theory's usefulness for studying sustainability issues is reinforced by its emphasis on the importance of particular intangible resources that are difficult to imitate and substitute (Branco & Rodrigues, 2006). Such knowledge-based resources are seen to offer a competitive advantage due to their causal ambiguity and social complexity (Hart, 1995). As a result, the RBV is considered well-suited to analyze qualitative aspects of the influence of corporate sustainability on firm performance, in particular with a view to the frequent time-lag between corporate sustainability activities and corresponding pay-offs (Branco & Rodrigues, 2006).

Scholars' understanding of environmental management and similar concepts is increasingly grounded in the resource-based view of the firm (Klassen & Whybark, 1999), although the rationale for this choice is less often mentioned. The RBV is frequently used to establish the context for some empirical research, without questioning potentially conflicting normative assumptions. The link between the RBV and corporate sustainability is made implicitly on the grounds that value-creating assets in the spirit of the RBV are created by pursuing a sustainability strategy. A further observation is that the link between sustainability-related concepts and the RBV has mainly been made to investigate the relationship between sustainability measures and performance measures, primarily based on quantitative methodologies (e.g. Klassen & McLaughlin, 1996; King & Lennox, 2001; Russo & Fouts, 1997; Menguc et al., 2010). The underlying dynamics have been less in focus (although there are some notable exceptions, e.g. Sharma & Vredenburg, 1998; Litz, 1996; Aragón-Correa & Sharma, 2003). Furthermore, environmental strategies and the resources and capabilities these create are rarely placed in the broader context of the firm's business strategy (Christmann, 2000).

3.3 The natural-resource-based view (NRBV)

Numerous empirical studies bolstered the business case for proactive corporate environmental practices, linking environmental and financial performance (Sharma & Ruud, 2003). The notion that it might ‘pay to be green’ caught further attention when it was linked to the RBV (Berchicci & King, 2007). This line of research became more sophisticated “when the black box of the environmental–financial performance linkage was opened up based on resource-based arguments that proactive environmental strategies could lead to valuable organizational capabilities” (Sharma & Ruud, 2003:208), i.e. with the advent of the natural-resource-based view (Hart, 1995).

The natural-resource-based view (NRBV) opened up a new area of inquiry by infusing management theory with constraints originating from the natural environment. Having its roots in the resource-based view of the firm (Barney, 1986, 1991; Wernerfelt, 1984; Dierickx & Cool, 1989; Peteraf, 1993), the NRBV is based on the notion that the main drivers for the development of new resources and capabilities in companies are the limitations and challenges imposed by the natural environment. Accordingly, the NRBV builds on the strengths of the RBV while addressing a deficiency inherent in this and many other management theories, i.e. that constraints imposed by the natural environment are likely to affect a firm's resource-based advantage in the long run (Michalisin & Stinchfield, 2010). In short, Hart (1995) suggests that companies could create a competitive advantage by pursuing proactive environmental strategies due to lower costs, product differentiation and favorable competitive positioning. The three interconnected strategies to gain this advantage proposed by the author are pollution prevention, product stewardship and sustainable development. The first strategy is seen to offer savings through reduced costs and higher efficiency, whereas the second strategy potentially contributes to a better reputation from developing green products and the inclusion of stakeholders. The third strategy is built upon a shared vision and nurtured by a “strong sense of social-environmental purpose” (Hart, 1995:1002). The competitive advantage brought about by a sustainable development strategy lies in a favorable future position.

The NRBV posits that, as firms comprehend the constraints imposed by the natural environment, environmental sustainability will become increasingly important to their strategic management process, aiming at sustaining their resource-based advantage (Michalisin & Stinchfield, 2010). Consequently, the NRBV focuses on identifying strategic resources and capabilities that are sources of both competitive and environmental sustainability. Berchicci and King (2007) see the NRBV as a theory of how firms may gain a competitive advantage by ‘going green’. These authors also address that the NRBV, despite being rooted in the RBV, differs from it on two important points. Firstly, the NRBV holds that external actors can play an essential role in stimulating firms to achieve superior performance[56]. Secondly, it assumes that managers not only make heterogeneous investments in resources but also that managers systematically invest too little in resources needed to protect the natural environment (McWilliams & Siegel, 2001). The theory therefore presumes that firms can achieve a competitive advantage by improving their environmental performance (Berchicci & King, 2007).

After this presentation of the main ideas brought forward by the NRBV, the remainder of this chapter is organized as follows: Firstly, the three interconnected strategies[57] are presented in more detail together with other noteworthy aspects of the theory[58]. Secondly, subsequent publications based on the NRBV are reviewed. Thirdly, a summary of the suggestions for improvement by the founding father revisiting his theory after 15 years is provided. Finally, some concluding reflections are made.

3.3.1 Pollution Prevention Strategy

Hart (1995) describes reducing emissions and waste as the primary aim of a pollution prevention strategy. There are two basic strategies available for controlling pollution: 'end-of-pipe' pollution control technology and preventing pollution at the source. However, in accordance with Roome (1992), Hart (1995) sees pollution prevention in parallel with total quality management to rely on extensive employee involvement and continuous improvement of emissions reduction, rather than depending on 'end-of-pipe' technology (Roome, 1992). Continuous improvement methods focusing on well-defined environmental goals are thus at the very heart of the emissions reduction strategy (Rooney, 1993). Hart (1995) regards the capability to achieve continuous improvements as a key resource of a firm. Environmental management systems (e.g. ISO 14000) are frequently operational in developing systematic processes for the continuous improvement of environmental performance. Furthermore, emissions reduction is seen as a people intensive strategy, depending on the development of tacit skills through employee involvement. Following resource-based argumentation, emissions reduction is seen to potentially offer a competitive advantage through the accumulation of tacit and causally ambiguous resources in the people involved (Hart, 1995). Hence, by following an emissions reduction strategy new capabilities can be built in production and operations.

The more familiar argument for a pollution prevention strategy is that costs can be reduced in various ways (e.g. Klassen & Whybark, 1999). For instance, costs can be lowered through increased productivity and efficiency gains (Smart, 1992; Schmidheiny, 1992), whereas a better utilization of inputs results in lower costs for raw materials and waste disposals (Young, 1991). Cutting emissions below required levels reduces the firm's compliance and liability costs (Rooney, 1993) and reduces risks (Hart & Milstein, 2003).

[56] This is in line with the view of companies as 'open systems'.
[57] Sometimes also addressed as strategic capabilities.
[58] Please note that for a better organization of the chapter, the review includes arguments by the author addressed in subsequent publications.

However, as the 'low hanging fruit'[59] become scarcer, further reductions in emissions become increasingly more difficult. Often, extensive changes in processes or even switching to new production technologies might be required (Frosch & Gallopoulos, 1989). This implies that the closer to 'zero emissions' the company moves, the more capital intensive are the reductions (Walley & Whitehead, 1994).

Hart (1995) expects that there are limits to a strictly internal pollution prevention strategy, given increasing demands by local communities and other external stakeholders for more transparent corporate practices. As a consequence, firms may need to open their operations to greater public scrutiny, for instance by publishing voluntary environmental reports, which may allow them to maintain legitimacy and build reputation. Given the tacit nature of the pollution prevention capability, Hart (1995) sees no risk that increasing transparency could jeopardize a competitive advantage.

3.3.2 Product Stewardship Strategy

A product stewardship strategy has the objective to minimize the environmental impact of products in various ways, for instance through the choices in raw materials and product design (Hart, 1995) as well as by considering the entire product life cycle (Hart & Milstein, 2003; Henn & Fava, 1994). For a product to achieve low environmental costs, the use of non-renewable materials mined from the earth's crust should be minimized and the use of toxic materials avoided. Furthermore, renewable resources ought to be used according to their rate of replenishment[60] (Robèrt, 1995). Once in use, the product should have a low environmental impact and at the end of its life-time it must be easily composted, reused or recycled (Shrivastava & Hart, 1995). To accomplish a successful product stewardship strategy based on these principles, it is seen as important that environmental staff, marketing staff and customers work closely together, hinting at the resource-based argument of social complexity.

It is argued that firms experience increasing pressure to minimize the life-cycle environmental costs of their products, which offers new opportunities. Hart (1995) argues that a product stewardship strategy creates the possibility to exit environmentally hazardous business, redesign existing product systems or develop new products with lower life-cycle costs. Furthermore, the author holds that it might be necessary to pre-empt competitors when pursuing such a product stewardship strategy. This can be achieved by gaining preferred access to resources such as raw materials, locations or productive capacity. Another way is to establish rules, regulations or standards that specifically fit the firm's capabilities. If the firm can establish itself as an early mover on green products, product stewardship potentially creates a base from which to differentiate products and build reputation. Hart (1997:75) goes even further by stating that "companies can and must change the way customers think by

[59] Targets or goals which are easily achievable and do not require a lot of effort (Urban Dictionary, 2009).
[60] In line with the principles for sustainability in the The Natural Step framework.

creating preference for products and services consistent with sustainability". This involves that companies ought to educate customers instead of simply marketing their products.

Hart (1995) suggests that a product stewardship strategy also involves interaction with external stakeholders such as environmentalists, communities, regulators, and the media, whose interests should be included into business processes for the strategy to become accepted as socially legitimate (Westley & Vredenburg, 1991). This requires an organizational ability to integrate perspectives from external stakeholders, involving coordination and communication not only within the firm but also across organizational boundaries (Hart, 1995). The benefits of involving stakeholders in the conduct of business activities are increased confidence in the firm and improved community relations, which in turn leads to enhanced reputation and legitimacy. In addition, product stewardship is seen to potentially offer a sustained competitive advantage through the accumulation of socially complex resources. In sum, product stewardship is characterized as an externally-oriented strategy with the potential to create value in the near term (Hart, 1997; Hart & Milstein, 2003).

3.3.3 Sustainable Development Strategy

A sustainable development strategy is built against the background of a strong sense of social-environmental purpose that guides the firm's corporate and competitive strategy (Hart, 1995; Shrivastava & Hart, 1995). Such a sustainable development strategy is driven by the endeavor to minimize the environmental burden of firm growth and development (Hart, 1995). The pursuit of sustainability involves for instance working with the development and deployment of low-impact technologies over a long period, particularly in emerging markets. Unserved markets at the bottom of the economic pyramid are of particular importance for a sustainable development strategy throughout Hart's writings[61]. This aspect of sustainable development is however not given further attention here. Consequently, the more general features are in focus.

Sustainable development, it is argued, requires a shared vision of the future. Accordingly, in the context of the firm, a sustainable development strategy is built upon a shared vision for the corporation, which is seen as a rare, firm-specific resource (Hart, 1995). Following Hamel and Prahalad (1989), a shared long-range vision or intent that fosters organization-wide commitment can generate internal pressure and enthusiasm for innovation and change. The development of sustainable competencies and technologies required to enact a sustainable development strategy is considered a fundamental challenge for every industry for decades to come (Hart, 1995). In addition, Hart (1995) argues that due to the required change of socio-technical systems, broader collaboration for system redesign might be required, imposing

[61] At the bottom of the pyramid are low-income markets in the undeveloped world. Hart (1995) encourages firms to build markets in the South while curbing the environmental damage involved with such new economic activities.

limits on exclusively internal strategies for sustainable development. He therefore hypothesizes that a sustainable development strategy will, over time, extend beyond the firm to include collaboration between public and private organizations to bring about substantial technological change. In sum, a sustainable development strategy offers the opportunity for a sustained competitive advantage by accumulating rare and firm-specific resources which are created through the development of new technology and competencies under the umbrella of a shared vision for the future (Hart, 1995). Its benefit arises from favorable future positioning.

In the NRBV framework, reducing emissions is evidently the main aim of a pollution prevention strategy, whereas the product stewardship strategy integrates stakeholder views and influences product design so as to minimize the environmental impact of products throughout their life cycle. Hart (1997) describes these two strategic areas as focused on incremental improvements to today's processes and products, whereas the sustainable development strategy is more progressive and future-oriented. A sustainable development strategy is fostered by a strong sense of social-environmental purpose and relies on a shared vision of the future. While Hart (1995) sees sustainability commitment as encouraged by an externally driven, legitimacy-based logic, the pollution prevention strategy is seen as mainly internally driven.

Commenting on his theoretical argumentation, Hart (1995) holds that seeing these three strategic domains as separate, isolated spheres of activities seems unsatisfactory. Instead, they should be considered as constituents of an overarching strategy under which activities for environmental sustainability unfold. The implications of the areas' interconnectedness and aspects relating to path dependence, as raised by Hart (1995), are discussed subsequently.

3.3.4 Interconnectedness of the strategic domains

Hart (1995) proposes that the strategies associated with the NRBV are interconnected. This interconnectedness can be viewed through two lenses: path dependence and embeddedness. Path dependence involves that the acquisition of one resource might depend on the previous development of other resources (Dierickx & Cool, 1989). Hence, there is a sequential logic to the strategic domains. For example, it might be difficult to adopt a product stewardship strategy successfully without having significant experience and capabilities within pollution prevention. Moreover, the deployment of a product stewardship strategy based on 'green' products would not be credible to stakeholders if the company lacked a pollution prevention strategy. This could be conceived as hypocritical, putting corporate reputation at risk (Hart, 1995). Other research (Hart & Ahuja, 1996; Schmidheiny, 1992) supports the notion that early accumulation of capabilities in pollution prevention and product stewardship might provide the foundation for a more comprehensive strategy for sustainable development.

A competing logic for the interconnectedness of the strategies is the concept of embeddedness. It highlights the importance of accumulating resources from the named strategies in parallel, given that they are overlapping and mutually embedded (Hart, 1995). Working with the different strategic domains simultaneously is thus seen as beneficial.

Taking an entirely sequential path, the firm may fail to take advantage of the synergies existing across strategies. For instance, progress made under the product stewardship strategy might help to identify opportunities for emissions reductions, whereas experience from pollution prevention can lead to new suggestions for product improvements, hence cross-fertilizing each other. Moreover, it might be more difficult to develop a new resource without other resources also being present (Dierickx & Cool, 1989)[62]. Clearly, a shared, firm-wide sustainability vision should help to accumulate valuable resources and capabilities in the other strategic domains (Hart, 1995). This would involve that the drivers of a sustainable competitive advantage associated with a pollution prevention strategy and a product stewardship strategy are embedded in the sustainable development strategy, and hence in the sustainability vision.

Before presenting a review of the literature based on the NRBV, a final remark seems appropriate as to the subsequent use of and referencing to the strategic areas both by the author and by other scholars, which has been partly inconsistent. For instance, Hart (1997) presents a Sustainability Portfolio consisting of four stages: pollution prevention, product stewardship, clean technology and sustainability vision. Likewise, a later paper by Hart and Milstein (2003), building on the 1997 article, introduces the 'Sustainable Value Framework' consisting of the four strategies just mentioned. These articles draw on similar reasoning without making any reference to the NRBV. Furthermore, some authors (e.g. Seller, 2010) address pollution control as a fourth strategy under the NRBV. In the following, articles with the NRBV as their main theoretical base are reviewed[63].

3.3.5 Subsequent research drawing on the NRBV

The NRBV of the firm is an adaptation of the RBV that explicitly addresses the constraints imposed on the firm by the natural environment (Menguc & Ozanne, 2005). The work of Hart (1995) is of a conceptual nature, proposing a new way of analyzing firms based on resources developed from addressing the environmental challenge as an opportunity for firm development. According to Walls et al. (2011), researchers have increasingly turned to the NRBV to create an understanding of how an environmental strategy creates value for a firm. Despite being one of the most cited works in the corporate environmental management literature (Dobers et al., 2001), the NRBV has given rise to little empirical research and is considered to still be in its developmental stage of empirical testing (Michalisin & Stinchfield, 2010). Reviewing the relevant literature has shown that since the publication of Hart (1995), the NRBV has occasioned eleven academic publications[64] that are exclusively grounded in the theory. In the following, a short summary is provided.

Overall, seven studies have the relationship between companies' environmental performance (or environmental strategy) and their financial performance as their main

[62] Addressed as the 'Interconnectedness of Asset Stocks' (Dierickx & Cool, 1989).
[63] Articles using other frameworks parallel to the NRBV, are excluded.
[64] Ten journal articles and one PhD dissertation.

research interest (Armas-Cruz, 2011; Michalisin & Stinchfield, 2010; Sellers, 2010; Aragón-Correa et al., 2008; Menguc & Ozanne, 2005; Chan, 2005; Judge & Douglas, 1998). The thrust of this research is that this relationship is positive. Likewise, seven studies intend to make a theoretical contribution to the NRBV or empirically investigate other aspects of the theory (Walls et al., 2011; Sellers, 2010; Aragón-Correa et al., 2008; Fowler & Hope, 2007; Menguc & Ozanne, 2005; Hastings, 1999; Sharma & Vredenburg, 1998). Furthermore, a number of these studies add new perspectives to environmental strategy research from a natural-resource-based view, either by empirically testing the framework in sectors that face particular challenges (Armas-Cruz, 2011; Hastings, 1999; Sharma & Vredenburg, 1998), by applying the framework to SMEs (Aragón-Correa et al., 2008) or an emerging economy (Chan, 2005), or by addressing new pressing environmental issues such as climate change (Michalisin & Stinchfield, 2010). Seven studies elaborate on capabilities[65] that are potentially created by firms by virtue of pursuing a proactive environmental strategy along the lines of the NRBV (Walls et al., 2011; Sellers, 2010; Aragón-Correa et al., 2008; Menguc & Ozanne, 2005; Hastings, 1999; Judge & Douglas, 1998; Sharma & Vredenburg, 1998). These capabilities are seen to have performance implications in terms of cost reductions, improved reputation, and an improved ability to compete in the future (Hart, 1995; Sharma & Vredenburg, 1998). The following summarizes this line of research:

Sharma and Vredenburg (1998) empirically explore and test whether companies can gain a competitive advantage from organizational capabilities developed due to a proactive environmental strategy. Based on case studies, the authors find evidence that such strategies lead to the development of capabilities that include stakeholder integration, higher order learning and continuous innovation. Similarly, Walls et al. (2011) argue that a bundle of valuable environmental capabilities form a firm's environmental strategy[66]. Based on this, the authors developed a measure of environmental strategy that is coherent with the NRBV. Judge and Douglas (1998) argue that the ability to integrate the natural environment into the strategic planning process offers firms the opportunity to develop a valuable, rare, and difficult to imitate organizational capability. Sellers (2010), extending this view, considers simultaneous investments in five Hart-type resource domains as manifestations of corporate environmental strategy. These investments are seen to directly lead to the development of firm-specific environmental capabilities[67]. According to the study by Aragón-Correa et al. (2008), SMEs that adopted proactive environmental practices display specific organizational capabilities; these are shared vision, stakeholder management, and strategic proactivity. Menguc & Ozanne (2005) examine the effect of a natural environment orientation (NEO), composed of the simultaneous commitment to the valuable, rare and difficult to imitate capabilities of entrepreneurship, corporate social responsibility, and environmental

[65] More precisely described as either strategic, environmental or organizational capabilities.
[66] Six types of environmental capabilities were conceived: historical orientation, network embeddedness, endowments, managerial vision, top management skills and human resources.
[67] These are divided into two main types: higher-order learning and stakeholder integration.

commitment, on firm performance. Hastings (1999) concludes from her case studies in the oil industry that proactive firms operating according to a new paradigm that addresses social and environmental impacts develop strategic capabilities that could lead to a sustained competitive advantage due to greater access to sensitive areas and enhanced reputation. A more comprehensive review of the capabilities addressed by the literature embracing the NRBV is provided in Section 3.6.

3.4 Closing the circle

After fifteen years, Hart and Dowell (2011) revisit the NRBV, commenting on the progress made in testing elements of the theory and drawing conclusions on how certain parts could be improved. The most significant alteration to the NRBV proposed is the refinement of the sustainable development strategy which is divided into two distinct areas: Clean technology and bottom of the pyramid (BoP). Although the two are partially interlinked, only the former is of interest to this thesis and hence addressed here. Consequently, building on Hart (1995, 1997) and Hart and Milstein (2003), the clean technology strategy extends the original NRBV framework. Reviewing this fourth strategic area, Hart & Dowell (2011) and earlier writings by Hart and his co-authors are referred to.

3.4.1 Clean Technology Strategy

While clean technology is solely one out of several aspects of the sustainable development strategy in Hart's (1995) NRBV, it is granted the status of a separate strategy in later writings (Hart, 1997; Hart & Milstein 2003; Hart & Dowell, 2011). In Hart and Milstein's (2003) 'Sustainable Value Framework', clean technology figures as one of the future-oriented strategies. Accordingly, it refers to developing and acquiring skills, competencies and technologies that form the basis for future growth. Such a strategy deals with the way that firms position themselves for competitive advantage as their industries evolve (Hart & Dowell, 2011). The pursuit of clean technologies provides for human needs without straining the planet's resources thanks to reduced material and energy consumption. Contrary to pollution prevention and product stewardship which focus on incremental improvements to today's products and processes, clean technology focuses on tomorrow's technologies and markets (Hart, 1997; Hart & Dowell, 2011). The focus lies on repositioning the firm with the help of innovations. Hence, firms pursuing clean technology strategies possess the ability to create organizational environments that support the necessary innovation process (Hart & Milstein, 2003). Companies investing in clean technology often pursue pioneering approaches to solve long-term problems. This is, however, associated with increased risks as investments in clean technologies often show delayed pay-offs and are determined more by trial and error than by internal hurdle rates (Hart & Milstein, 2003). A clean technology strategy may require firms to disrupt the core technologies that form the basis of the current business. Internal competencies are instead repositioned around more sustainable technologies, as Hart and Milstein (2003:62) argue below:

> The rapid emergence of disruptive technologies such as genomics, biomimicry, information technology, nanotechnology and renewable energy present the opportunity for firms – especially those heavily dependent upon fossil fuels, natural-resources and toxic materials – to reposition their internal competencies around more sustainable technologies.

Hart & Dowell (2011) highlight in particular the commercialization of clean technology as an important new area. They see the key challenges to lie in understanding which firm resources and capabilities are likely to be associated with effective clean technology commercialization. It is suggested that the development of clean technology strategies requires a focus on innovation and future positioning as the metric for success. This in turn requires building a better understanding of factors that affect the likelihood that firms are willing to invest in innovation. Moreover, the commercialization of clean technologies requires developing abilities to deal with areas of knowledge that are uncertain, constantly evolving, and dynamically complex (Hart & Dowell, 2011). The authors even question whether firms will be able to sustain competitive advantage through the development of clean technologies, as pursuing such a strategy entails the organizational capacity to protect and nurture disruptive clean technologies, including those technologies that may eventually cannibalize parts of the existing core business.

In essence, by pursuing a clean technology strategy firms can generate sustainable competencies that are crucial when repositioning the firm for the development and exploitation of future markets (Hart & Milstein, 2003). Hence, firms with the ability to develop and exploit disruptive technologies that address society's needs are seen to drive future economic growth.

3.4.2 Reflections on the NRBV framework

Being familiar with the NRBV, its origin and development to date, the circle is closed. However, after integrating the Hart and Dowell (2011) article I feel somewhat bereft of the overarching corporate mission of contributing to sustainable development. What has completely gone lost by dividing the sustainable development strategy into the two areas of clean technology and bottom of the pyramid is the sustainability vision which was so vividly addressed in the 1995 article[68]. Although addressing the competitive aspects of the NRBV is relevant, the omission of the sustainability vision deprives the NRBV of its social-environmental purpose. This equals the belief that new technology is capable of and sufficient to pursue sustainable development. This, however, is a narrow and increasingly criticized view of how sustainable development can be achieved[69]. In this concluding paragraph I therefore attempt to reinstate this lost mission with the help of other writings by Hart and his co-author.

[68] The sustainability vision is not mentioned in Hart & Dowell (2011).

[69] For instance Azar (2011) points at the fact that despite the availability of adequate technology at non-prohibitive costs, global carbon emissions are increasing dramatically.

As noted, both Hart (1997) and Hart and Milstein (2003) advocate four strategic areas to foster sustainable business, i.e. pollution prevention, product stewardship, clean technology and sustainability vision. According to Hart (1997), the sustainability vision should direct the company towards the solution of social and environmental problems as well as guide the development of new technologies, markets, products and processes. The vision works like a road map for the future by showing how products and services should evolve and identifying the competencies needed to get there (Hart, 1997). Consequently, the sustainability vision follows a logic that goes beyond the internal operational focus of greening today's business. It provides guidance to employees as to the setting of priorities in the organization with regard to resource allocation, technology development and business model design that are decisive for the future (Hart & Milstein, 2003). Accordingly, the sustainability vision is seen to provide direction to the firm's activities in the other strategic areas (Hart, 1997). Hart and Milstein (2003) frame the sustainability vision as the external dimension associated with future performance. Hence, the firm is seen to require a clear vision of its future development path that is aligned with the sustainability agenda.

3.5 The 'Sustainable Value Framework'

Hart & Milstein (2003) have compiled the central ideas as to how sustainable development can be embedded into firms and the rationales behind this engagement the 'Sustainable Value Framework' depicted in Figure 3.1. It is organized along two dimensions, illustrating two central tensions in corporate strategies very clearly. The first is about orientation, internal versus external, illustrated by the horizontal axis. There is a tension between managing internal resources and capabilities and transgressing organizational boundaries to infuse the firm with new perspectives and knowledge from the outside. The second tension, today versus tomorrow, is captured by the vertical axis. It refers to the need to manage today's business and create tomorrow's business concurrently. Firms experience pressure to realize short-term results while simultaneously creating opportunities for future development. The four strategic areas represent different combinations of orientation and temporal focus and therefore represent different challenges for management.

Hart and Milstein (2003) draw parallels from the multidimensional challenge of sustainable development to creating sustainable value for the firm, which requires performance on multiple dimensions. Accordingly, firms must perform well on all four quadrants in order to create sustainable value. The authors however conclude that this is a demanding endeavor. Few firms seem to recognize, let alone exploit, the opportunities inherent in all four strategies. Focus lies mainly on the bottom half of the matrix, showing that short-term solutions related to existing products and stakeholder groups are more easily addressed[70]. The upper part of the model has received much less attention. Naturally,

[70] Hart & Milstein (2003) note that pollution prevention and product stewardship programs are well institutionalized within MNCs thanks to their savings potential.

uncertainty about the future increases risks and makes pay-offs elusive, hampering investments in a clean technology strategy. Creating a vision for sustainable development that is tailored to the firm's value creation capacity seems equally difficult to manage.

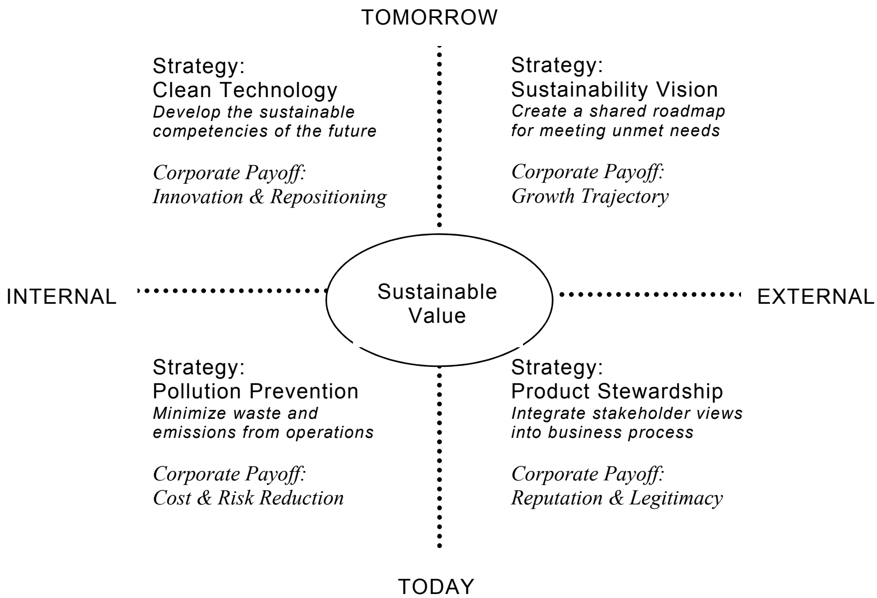


Figure 3.1: Sustainable Value Framework
Source: Adapted from Hart and Milstein (2003): 'Sustainable Value Framework' (p. 60).

However, Hart (1997) cautions that lacking engagement in the future-oriented strategies will result in that evolving needs cannot be addressed. This will make the firm more vulnerable in the future. To reconcile the complex challenges originating from the need to address sustainable development with sustainable value creation, firms should work simultaneously in the four strategic areas of the Sustainable Value Framework.

This framework has been influential when developing my thinking about strategies for environmental sustainability, which is why it forms the core of the model of analysis presented in the next chapter.

3.5.1 Ways forward to integrate the RBV and sustainable development

The RBV has been reconciled with sustainable development through the suggested link of corporate environmental or social performance with financial performance. Furthermore, the usefulness of valuable, rare and difficult to imitate intangible resources to create value for both the firm and social or environmental purposes has been acknowledged. Hart (1995) has integrated the natural environment into the RBV and opened up the theory for the views of external actors. However, the potential of the RBV to accommodate and leverage sustainability issues seems not yet fully utilized.

Several authors attempt to further connect the RBV with aspects of sustainable development. For instance, Litz (1996) acknowledges the need to respond to the social and ethical dimensions of corporate life and to integrate these into the RBV. Rather than seeing the social and environmental dimensions as hindrances, their potential to facilitate the development of necessary and enduring resources of strategic advantage should be recognized. Maurer et al. (2011) infuse the RBV with cultural aspects, arguing that economic value and social values are deeply interconnected. Accordingly, the economic value of a firm's strategy hinges not only on its VRIN/O resources and capabilities, but also on how well internal resources and capabilities can bridge contentious social issues and social values. This view gives stronger weight to the firm's context and highlights organizations' role in handling complex social challenges.

The above research addresses important blind spots of the RBV's capacity to deal with sustainable development issues, narrowing the gap between resource-based reasoning and sustainable development. Similar to Hart (1995), these contributions make firms more susceptible to issues arising from their environment. The integration of ethical and value dimensions into the realm of business is a first step towards a more receptive and unifying RBV. However, the basic premises of the RBV have so far been left intact. The 'Sustainable Value Framework', framing sustainable development as a multidimensional opportunity for companies to create sustainable firm value, may help to develop thoughts further. If sustainability is considered as an opportunity for companies to develop their business sustainably while creating societal welfare, the focus should be on how the RBV can promote the creation of such shared value. To harness the full potential of the RBV to contribute to sustainable development, the focus should shift away from proprietary value creation within the firm (e.g. Henneberg et al., 2005) to shared value creation between the firm and society.

This is addressed by Porter and Kramer (2006, 2011) who advocate an expanded view of value creation, one that creates economic value by creating societal benefits (rather than diminishing them). The authors introduce the principle of 'shared value creation', which refers to creating economic value in ways that also create value for society by addressing its needs and challenges (Porter & Kramer, 2011). This is based on the rationale that corporations and societies are mutually dependent. Companies affect the environment and society in various ways, and vice versa, the environment and society have an impact on firm competitiveness. If companies can contribute to mutually beneficial solutions, shared value will be created. For instance, by addressing and contributing to the solution of environmental problems[71], companies create value for society. A focus on creating shared value develops a symbiotic relationship where the success of the company and a flourishing community

[71] For example by contributing to the reduction of CO_2 emissions not only from own operations but society more broadly.

become mutually reinforcing. Creating shared value can thus be seen as a long-term investment in the future competitiveness of the firm (Porter & Kramer, 2011). Synthesizing this idea and the Sustainable Value Framework, shared value creation should be an integral part of the sustainability vision, guiding corporate activities and development in all four strategic areas.

The relevant question to ask for companies with such a vision is thus which issues at the intersection of business, the natural environment and society the company can address. The more closely a social issue is tied to the company's business, the greater the opportunity to leverage corporate resources and capabilities, and benefit society (Porter & Kramer, 2006). The unique resources and expertise of the company can be leveraged to create economic value through creating social value (Porter & Kramer, 2011). Creating shared value should thus be the underlying logic of the four strategic areas of the Sustainable Value Framework.

3.6 NRBV capabilities in prior literature

The purpose of this section is to take stock of the organizational capabilities advanced in the NRBV literature. This will allow reconnecting to earlier research when reflecting on the capabilities created in the case companies by pursuing a strategy for environmental sustainability.

The organizational capabilities advanced in the mainstream NRBV literature (e.g. Hart, 1995; Hart & Milstein, 2003; Sharma & Vredenburg, 1998; Hart & Dowell, 2011) are reviewed first. Large efforts are made in previous literature to discern capabilities created by proactive environmental strategies, or required to implement such strategies. However, there is diversity in the approaches used. While Aragón-Correa and Sharma (2003) consider a proactive environmental strategy to be a dynamic capability as such, most research (e.g. Sharma & Vredenburg, 1998; Hart, 1995) suggests that capabilities emerge from a corporate focus on environmental sustainability. Three key strategic capabilities are proposed by Hart (1995): pollution prevention, product stewardship and sustainable development. Later work (Hart, 1997; Hart & Milstein, 2003; Hart & Dowell, 2011) addresses clean technology as an additional strategic area where capabilities need to be developed. As argued in Section 3.4.2, a sustainability vision is instrumental in creating a shared roadmap and providing direction to corporate activities. Hence, it represents the fourth strategic area where sustainable capabilities are developed (containing elements of the original sustainable development capability). The review follows the four areas of the Sustainable Value Framework: pollution prevention, product stewardship, clean technology and sustainability vision.

3.6.1 Pollution Prevention

Following Hart (1995), pollution prevention focuses on new capability building in production and operations. A pollution prevention strategy is seen as people-intensive and dependent on tacit skill development through employee involvement and work in 'green' teams. The decentralized and tacit nature of a pollution prevention capability makes it difficult to observe in practice and, therefore, challenging to imitate quickly. The central capabilities mentioned by Hart (1995) under a pollution prevention strategy are *extensive employee involvement* and *continuous improvement of emissions reduction*. The latter can be achieved through well-defined environmental objectives. Hart and Dowell (2011) address strong innovative capabilities and a commitment to pollution prevention as complementary assets[72] (Teece, 1986; Christmann, 2000) that facilitate continuous improvement and enable the firm to capture the value created from a pollution prevention strategy. Sharma and Vredenburg (1998) conclude that a proactive environmental strategy leads to the development of a capability for *continuous innovation*. They observe that this capability is embedded in the organizational culture, rather than resting with a specific operation or functional area.

3.6.2 Product Stewardship

According to Hart (1995), it is important that environmental staff, marketing staff and customers work closely together to realize a successful product stewardship strategy. Moreover, *stakeholder integration* is a capability arising from a product stewardship strategy, requiring that the perspectives of key external stakeholders are integrated into product design and development (Hart, 1995). This entails extensive interaction with external parties such as suppliers, customers, regulators, communities, non-governmental organizations, and the media (Hart & Milstein, 2003). A capability for stakeholder integration relies on coordination and communication, both internal to the firm and across organizational boundaries (Hart, 1995).

Involving stakeholders in the conduct of on-going operations is a way to lower environmental impacts across the value chain and enhance reputation. However, Sharma and Vredenburg (1998) find that stakeholder integration also enables firms to better manage resources, reduce waste and conserve energy, making this capability valuable for pollution prevention as well. In addition, stakeholder groups were engaged in a dialogue over new explorations, site locations and plant designs, making this capability useful in many aspects. As shown by Sharma and Vredenburg (1998), the capability is deployed in different contexts, depending on the industry impact on its stakeholders.

Menguc and Ozanne (2005) add *entrepreneurship* to the list of capabilities required for successful product stewardship strategies. Entrepreneurship is “a set of actions that may enable a firm to address natural environmental issues” (Menguc & Ozanne, 2005:432), capturing three dimensions: innovativeness, risk taking, and proactiveness (Covin & Slevin, 1991). Innovativeness relates to the development and introduction of environmentally-friendly products. Proactiveness may enable the company to identify environmental market opportunities and take preemptive actions (Menguc & Ozanne, 2005). Hart and Dowell (2011) agree that capabilities created under a product stewardship strategy are likely to lead

[72] Complementary assets are resources required to capture the benefits associated with a strategy, a technology, or an innovation (Christmann, 2000).

to a competitive advantage through strategic preemption. In their view, entrepreneurial skills such as securing exclusive access to a variety of resources, for instance green raw materials, may be required. Preempting competitors may also be possible by establishing new standards beneficial to the firm (Hart, 1995; Hart & Dowell, 2011). An entrepreneurial approach is dependent on tacit skills and knowledge disseminated throughout a firm, thus representing a valuable intangible resource that is difficult to imitate (Menguc & Ozanne, 2005).

3.6.3 Clean Technology

Clean technology strategies result in reduced material and energy consumption, providing for human needs without putting strain on the planet's resources. Hart and Milstein (2003) consider the sustainable competencies emerging from the search for clean technologies to be central to corporate efforts to reposition the firm and its internal skills for the development and exploitation of future markets. These efforts are seen as more risky compared to strategies focusing on emission reductions and product stewardship. However, as future economic growth is driven by disruptive technologies that address society's needs, taking such risks is necessary to form part of tomorrow's economy (Hart & Milstein, 2003). To create sustainable value, firms thus require a capability to *reposition their internal competencies around more sustainable technologies.* Furthermore, the pursuit of a proactive clean technology strategy is more likely to occur in firms with a strong *capability for research and development* (Hart & Dowell, 2011). According to the authors, a capability for *clean technology commercialization* is needed, which requires "developing abilities to deal with areas of knowledge that are uncertain, constantly evolving, and dynamically complex" (Hart & Dowell, 2011:1471). In parallel, firms need to develop a capability to *protect and nurture disruptive and leapfrog green technologies.* The development of such capabilities is seen to be similar to second order (double-loop) learning (Hart & Dowell, 2011). Furthermore, the expansion to novel markets and the creation of entirely new markets requires capabilities, especially when moving to markets with a different underlying dominant logic (Prahalad & Bettis, 1986) than the one the firm is accustomed to.

3.6.4 Sustainability Vision

According to Hart and Milstein (2003:64), firms that manage "to create a compelling sustainability vision have the potential to unlock future markets of immense scale and scope". A sustainability vision facilitates competitive imagination by creating a shared roadmap. It is seen to guide employees in terms of organizational priorities, technology development, resource allocation, and business model design (Hart & Milstein, 2003). Several authors consider a *shared sustainability vision* to be a valuable organizational capability (Hart, 1995; Aragón-Correa et al., 2008; Walls et al., 2011). A managerial vision that is effectively communicated empowers followers to enact that vision (Walls et al., 2011). A vision is particularly important when uncertainty is high, making actions difficult to contract. Visionary leadership has several advantages following Groves (2006): it benefits corporate performance and followers' attitudes, it creates cohesion among top management, and it positively affects corporate citizenship. Visionary leadership is particularly important for environmental strategies because their success depends on long-term commitment and investments (Hart, 1995).

3.6.5 Overarching capabilities

Some of the capabilities seen to arise from a strong environmental focus cannot be directly allocated to one of the four strategic areas. Among these capabilities, *higher-order learning* (Sharma & Vredenburg, 1998; Sellers, 2010) seems the most interesting one. Sharma and Vredenburg (1998) observe that changes in the business environment may motivate the exploration of alternative organizational routines, technologies and objectives, potentially leading to higher-order learning. Triggered by environmental responsiveness strategies, higher-order learning processes lead to "a changing experiential base of organizational activities, routines, and goals" (Sharma & Vredenburg, 1998:741). Furthermore, the authors address the importance of *knowledge-based invisible resources* (Itami, 1987), whose build-up is stimulated by changes in technologies, processes, inputs and products. A valuable organizational capability addressed by Judge and Douglas (1998) is the capability to *integrate the natural environment into the strategic planning process.*

Walls et al. (2011), identify six valuable capabilities that jointly form a firm's environmental strategy. First, a *historical orientation* is a capability forming part of a proactive environmental firm strategy as "firms with a strong history in environmental strategy are more likely to consider the environmental impact of new strategies, products, and processes" (Walls et al., 2011:88). As a result, the longer the firm's history with an environmental strategy, the more likely it is that environmental capabilities have been built.

Second, *network embeddedness* is recognized as an environmental capability since an organization's ability to generate resources is influenced by its networks. Networks become a capability of the firm because they evolve over time and are path dependent. Since environmental issues are very complex and require interdisciplinary skills and coordination with others (Roome, 1992), access to networks is critical for corporate environmental strategy. Networks are a source of environmental capability acquisition, be it through information sharing, trust, or joint problem solving (McEvily & Marcus, 2005). Networking is thus a socially complex environmental skill, forming a competitive advantage from environmental strategy.

The third capability identified by Walls et al., (2011), *endowments*, refers to the firm's ability to build competitive advantage through accumulating assets over time. The possession of long-term endowments facilitates for firms to invest in technological leadership and exploit opportunities, allowing for environmental capabilities to be built (Arragón-Correa, 1998). This reflects that effective environmental strategies require continual and considerable investments, e.g. in environmental research and development and supporting structures such as an environmental management system, creating the necessary slack to optimize endowments (Walls et al., 2011).

The logic of the fourth capabilitiy, managerial vision, has been outlined earlier, whereas the fifth environmental capability, *top management skills*, is seen as firm-specific and difficult to imitate (Barney, 1991). The successful implementation of an environmental strategy requires a combination of managerial competencies and other firm-specific capabilities (Russo & Fouts, 1997). A talented top management team capable of managing strategic environmental initiatives that build on tight internal coordination and integration as well as established external partnerships is required. Managers' role in environmental strategy is one of coordination, integration, and external connections in search for talent, ideas, and technologies (Marcus & Geffen, 1998). *Human resources* are the sixth firm-specific environmental capability that can provide a firm with a competitive advantage (Walls et al., 2011). Human resources represent an important capability for developing environmental strategies since dealing with environmental issues requires expert knowledge and specific incentives. Furthermore, firms are more likely to develop environmental capabilities if they evaluate managers on environmental performance criteria (Sharma, 2000). The two firm processes that are most relevant to human resources skills for environmental strategy are environmental training as well as formal reporting systems for environmental performance.

Table 3.1 summarizes the environmental capabilities found in prior NRBV literature.

Table 3.1: Summary of environmental capabilities in the NRBV literature

Strategic area	**Capabilities**
Pollution prevention (Emissions reduction)	• extensive employee involvement (Hart, 1995) • continuous improvement of emissions reduction (Hart, 1995; Hart & Dowell, 2011) • continuous innovation (Sharma & Vredenburg, 1998)
Product Stewardship	• stakeholder integration (Hart, 1995; Hart & Milstein, 2003; Sharma & Vredenburg, 1998) • entrepreneurship (Menguc & Ozanne, 2005)
Clean Technology	• reposition internal competencies around more sustainable technologies (Hart & Milstein, 2003) • capability for research and development (Hart & Dowell, 2011) • clean technology commercialization (Hart & Dowell, 2011) • protect and nurture disruptive and leapfrog green technologies (Hart & Milstein, 2003; Hart & Dowell, 2011)
Sustainability Vision	• shared sustainability vision (Hart, 1995; Aragón-Correa et al., 2008; Walls et al., 2011)
Overarching	• higher-order learning (Sharma & Vredenburg, 1998; Sellers, 2010)

	• knowledge-based invisible resources (Sharma & Vredenburg, 1998) • integrate the natural environment into the strategic planning process (Judge & Douglas, 1998) • historical orientation (Walls et al., 2011) • network embeddedness (Walls et al., 2011) • endowments (Walls et al., 2011) • top management skills (Walls et al., 2011) • human resources (Walls et al., 2011)

4 Model of analysis

4.1 Introduction

This chapter aims at building up a model of analysis that is the key for finding answers to the research questions. The model consists of three main parts that are addressed in separate sections, successively building up the model.

Building on the method chapter, the *first part* (Section 4.2), provides an *operationalization* of strategies for environmental sustainability relevant to the chosen research context. This allows for a structured analysis of the first research question: *"What do strategies for environmental sustainability entail in municipal energy companies with a high environmental commitment?"*

An analysis framework is presented that conceptualizes strategies for environmental sustainability as consisting of four qualitatively distinctive areas of engagement. These represent differing degrees of organizational commitment and have varying potential to contribute to environmental sustainability. The conceptual areas represent the building blocks of a strategy for environmental sustainability. Based on the notion that a strategy can be seen as a 'pattern of actions' (Mintzberg & Waters, 1985), the method chapter established corporate activities and practices for environmental sustainability as the basic units of analysis of this study. It follows that strategies for environmental sustainability are conceptualized as the aggregate of such activities and practices conducted in the individual areas. Apart from providing an operationalization of such strategies, the framework serves as a tool to structure and analyze corporate activities and practices for environmental sustainability.

Whereas the first part presenting the analysis model is mainly concerned with the content of strategies for environmental sustainability, the *second part* of the model is of a more dynamic nature. Its focus lies on features that facilitate the implementation of such strategies in the empirical field of study. These are addressed as 'greening mechanisms', which relates to research question two: *"What are the mechanisms that facilitate the implementation of a strategy for environmental sustainability in municipal energy companies with a high environmental commitment?"*

As outlined in Section 2.7 of the method chapter, five greening mechanisms were empirically derived from the case studies. Sections 4.3.1 to 4.3.5 provide their theoretical foundation in view of creating a framework to analyze value creation from engaging in a strategy for environmental sustainability. The mechanisms are seen to provide a link between the activities and practices constituting such a strategy, and capabilities and resources as sources of value creation.

In the *third part* of the model, the focus lies on how strategies for environmental sustainability can create value. It is further of interest what kind of value that is created. Earlier research maintains that companies pursuing a proactive environmental strategy can create valuable organizational capabilities (e.g. Hart, 1995; Sharma & Vredenburg, 1998; Aragón-Correa et al., 2008; Walls et al., 2011). It is suggested that companies with a high environmental commitment are able to build similar organizational capabilities by pursuing a strategy for environmental sustainability. It is further assumed that the greening mechanisms play a pivotal role in the creation of such capabilities. As a consequence, the intention is to assess the generative potential of each greening mechanism to aid in the creation of valuable capabilities and resources within the different conceptual areas of an environmentally sustainable strategy. This analysis ('Analysis 3') results in an inventory of capabilities and resources created by virtue of engaging in such a strategy. In a further step, the capabilities' potential to create value for the firm and for society is examined. As a whole, the third part of this chapter provides a toolbox that allows answering the third research question: *"How can strategies for environmental sustainability contribute to the sustainable development of municipal energy companies and society?"*

4.2 Operationalizing strategies for environmental sustainability

How can the challenges from the degradation of the natural environment be reconciled with the organizational perspective, and how can the transition towards environmentally sustainable business be managed? These are both theoretical and empirical questions. In order to connect environmental sustainability with corporate strategy, this thesis explores strategies for environmental sustainability of municipal energy companies with a high environmental commitment. Just as with any other corporate strategy, the aim of a strategy for environmental sustainability is to create value. As discussed in the theory chapter, the notion of value creation can have different meanings and has seen a shift in recent years. Increasingly, the need for creating value in a social, ecological and economic sense is acknowledged (e.g. Stead & Stead, 2008; Porter & Kramer, 2006, 2011; Lee, 2008).

To enable drawing conclusions from this study, an analytical framework is designed that can give guidance as to how a firm can move towards environmental sustainability and what this involves for management. This framework captures both the sustainability dimension and the organizational dimension of working towards a reduced environmental impact. To catch these aspects, the framework was constructed along the dimensions of *environmental sustainability* and corporate *environmental commitment*. The framework serves both to operationalize what is meant by a strategy for environmental sustainability, and as a tool to analyze activities and practices performed under such a strategy.

4.2.1 Framework dimensions

As discussed in Section 3.1.1, advancing towards *environmental sustainability* requires solving problems of emerging complexity. While the general aim is the maintenance of natural capital (Goodland, 1995; Bartelmus, 2003) in terms of its source and sink functions, the particular challenge for the energy sector is to reduce carbon dioxide emissions to effectively mitigate its impact on global warming. This involves multiple challenges such as inducing lifestyle changes and working with energy efficiency and conservation. However, the most urgent endeavor for moving towards environmental sustainability is the transformation of the energy system towards highly efficient low-carbon alternatives. The diversity of those challenges requires energy companies to be able to find solutions to problems of widely differing nature.

The second framework dimension, *environmental commitment,* can be defined as "an organization-wide recognition of the importance of the natural environment that influences organizations to act in ways consistent with the interests of the natural environment" (Menguc & Ozanne, 2005:433). Environmental commitment has previously been used to categorize firms according to their approach to the natural environment (e.g. Henriques & Sadorsky, 1999). Typically, these classifications range from non-compliance to *proactivity* (e.g. Roome, 1992; Hunt & Auster, 1990). Following Henriques and Sadorsky (1999), a company's commitment to the natural environment is evidenced by what it is doing or has done in relation to environmental issues, i.e. its current and past activities. Accordingly, corporate activities and practices are indicators of a company's environmental commitment. For instance, committed organizations utilize policies and allocate resources to support their environmental commitment. Environmental commitment can thus be seen to produce activity and change at the interface of companies and the natural environment. As companies move across environmental commitment profiles, their management of environmental issues improves (Henriques & Sadorski, 1999). This entails that environmental concerns more broadly affect corporate decisions, and environmental aspects are increasingly taken into account in corporate activities and practices, leading to positive effects for environmental sustainability. If this thinking is connected with the work of Hart (1995, 1997) and Hart and Milstein (2003), we arrive at a framework that depicts growing environmental commitment as encompassing successively more conceptual areas of engagement with environmental issues, which jointly form a firm's strategy for environmental sustainability.

4.2.2 Conceptual areas of strategies for environmental sustainability

The 'Sustainable Value Framework' (Hart & Milstein, 2003; Hart, 1997) presented in Section 3.5 represents the intellectual basis of the analysis framework of this study. It has, however, been adapted to better reflect the energy business setting[73].

In line with the original framework (Hart & Milstein, 2003; Hart, 1997) the '*framework of conceptual areas of strategies for environmental sustainability*' (Figure 4.1) features four distinct domains of environmentally sustainable strategies:

- *Emissions Reduction* focuses on activities that minimize the emissions resulting from conducting business or opt at increasing resource efficiency.
- *Product Stewardship* encompasses developing new sustainable products and services or enhancing the sustainability of existing ones.
- *Clean Technology* relates to activities in connection with investments in and research and development on renewable and bridging technologies.
- *Sustainability Vision* aims at creating a shared roadmap for sustainability within the firm and with its stakeholders, reconciling value creation for the company with wider goals for a sustainable society.

These conceptual areas represent multiple dimensions of engagement with environmental issues. As discussed by Hart and Milstein (2003), these areas are qualitatively different as each of them has distinct drivers and future prospects. As a consequence, different logics apply when working within each area. Furthermore, when managing the different areas, companies are confronted with diverse challenges that are more or less difficult to handle. In addition, quite naturally, also the areas' potential to contribute to environmental sustainability differs. Since the fundamental logic of each conceptual area was already presented in the theory chapter, reference is made to Sections 3.3.1 to 3.4.2 for further details.

As illustrated in Figure 4.1, the conceptual areas form a 'ladder' along the two dimensions of *environmental commitment* and *environmental sustainability*. The level of *environmental commitment* embodied in a conceptual area is indicated on the horizontal axis, whereas the vertical axis refers to the area's potential to contribute to *environmental sustainability*.

[73] In contrast to Hart and Milstein's (2003) framework, the term 'emissions reduction' was used instead of 'pollution prevention' which aims at reducing pollution at the source. The basic meaning is however the same; reducing emissions and waste are the primary aims of pollution prevention (Hart, 1995).

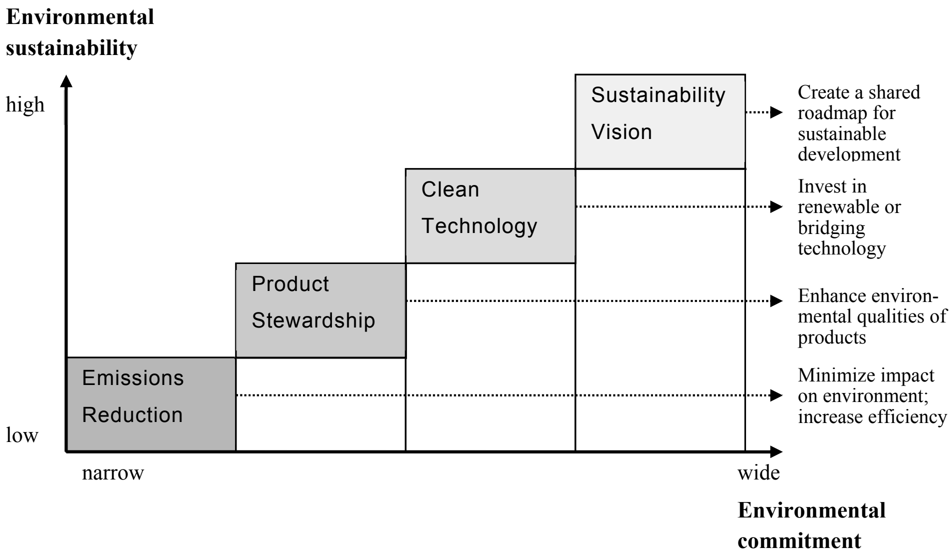


Figure 4.1: Framework of conceptual areas of strategies for environmental sustainability
Source: Adapted from Hart (1995, 1997) and Hart and Milstein (2003).

In line with Hart (1995) and Hart and Milstein (2003), a narrow environmental commitment involves activities that focus on internal aspects in the short term (today's business). Due to the incremental nature of these activities, the effect on environmental sustainability is rather low. Activities that involve a wide environmental commitment are more far-reaching in time and scope and their effect on environmental sustainability is therefore more significant. According to the framework, moving up the 'ladder' of an environmentally sustainable strategy requires wider *environmental commitment*, which leads to improved *environmental sustainability*. Although the framework is designed to analyze individual firms, its principles hold true also in a broader perspective: the wider the environmental commitment of corporations in an industry, the smoother will be the transition towards environmental sustainability and a sustainable society. In other words, the speed and scope of the transition is considered to rests upon the level of commitment of corporations to contribute to a sustainable society.

There obviously exist some tensions between the whole and its parts, i.e. the overall strategy and the conceptual areas into which it is divided in the framework. The interconnectedness of the strategic domains within the NRBV from the point of view of Hart (1995) has already been discussed in 3.3.4. His reflections are also valid for the framework presented here. To this can be added that, although strategies for environmental sustainability are conceptualized as consisting of different areas of engagement, there is an evident need to coordinate and integrate the activities and practices performed under the individual areas.

According to Porter (1996), activities should be consistent to achieve a coherent overall strategy, i.e. there has to be a fit between the individual activities and corporate strategy. Consistency in the activities makes the strategy both smoother to implement in the corporation and easier to communicate to corporate stakeholders. Due to the connectedness and interaction of activities and practices across conceptual areas, synergies can emerge between them. This observation goes back to Aristotle (1961) who noted that the whole is greater than the sum of its parts. Clearly, a coherent and aligned strategy for environmental sustainability stands greater chances of effectively leading to a transition towards sustainable business with positive effects on society. Although this aspect is not the core interest of this thesis, it deserves further analysis and discussion.

In the empirical part of the thesis, the framework displayed in Figure 4.1 will be used to analyze the activities and practices presented through the lens of the five greening mechanisms ('Analysis 2'). The analysis is performed for each of the four conceptual areas after presenting the empirical material for the respective mechanism. The aim is to study the interaction at the interface of the greening mechanisms and the conceptual areas of a strategy for environmental sustainability.

4.3 The five greening mechanisms

A further aim of this research is to catch the dynamic ways in which highly committed municipal energy companies work with sustainability issues. How can the environmental commitment manifested in activities and practices aiming at better environmental performance or the transition to a sustainable energy system be captured at a more abstract level? What are the prominent features characterizing how companies work with their strategy for environmental sustainability? These issues are addressed in the second research question: *"What are the mechanisms that facilitate the implementation of a strategy for environmental sustainability in municipal energy companies with a high environmental commitment?"* Expressed differently, interest lies in examining by what means a certain effect could be produced, i.e. moving towards higher environmental sustainability. Mechanisms provide a way to create understanding of a specific phenomenon (Hedström & Ylikoski, 2010), in the present case 'strategies for environmental sustainability'. Factors that promote the pursuit of a strategy for environmental sustainability are addressed as 'greening mechanisms'.

An implication of this view is that the greening mechanisms play a pivotal role in creating valuable organizational capabilities from pursuing a strategy for environmental sustainability. This is comparable to earlier resource-based research, explaining value creation from proactive environmental strategies based on the creation of valuable organizational capabilities (e.g. Hart, 1995; Sharma & Vredenburg, 1998). The greening mechanisms are seen to provide a link between corporate activities and practices aiming at higher environmental sustainability, and capabilities and resources generating value for the firm and society.

As outlined in the method chapter, five greening mechanisms were empirically derived from continuous reflection on the empirical material. These are *environmental integration, communication and learning, innovation, cooperation* and *local embeddedenss.* These mechanisms represent characteristic regularities in the way of working with strategies for environmental sustainability. This adds an additional layer to the model of analysis, which has been incorporated in Figure 4.2 below.

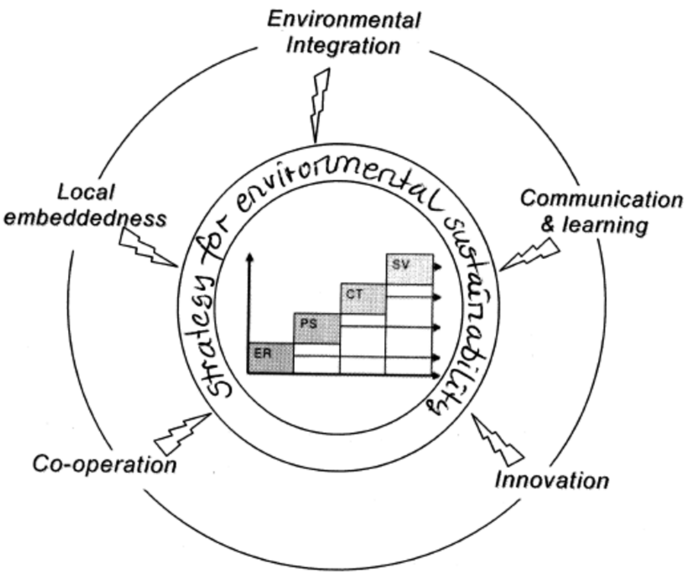


Figure 4.2: Five greening mechanisms facilitating the strategy for environmental sustainability

In Figure 4.2, the model of analysis consists of two components: The '*framework of conceptual areas of strategies for environmental sustainability'* lies at the centre of the model, capturing activities and practices performed under such a strategy. The circle surrounding the analysis framework, labeled 'Strategy for environmental sustainability', illustrates that a strategy for environmental sustainability is operationalized as activities and practices performed in the conceptual areas that constitute such a strategy. The greening mechanisms circling the strategy for environmental sustainability add a dynamic component to the model of analysis (as illustrated by the flashes).

In the following Sections (4.3.1 to 4.3.5), the greening mechanisms are theoretically grounded with respect to relevant literature. Thereby, a theoretical platform is developed before the greening mechanisms are empirically illustrated in the subsequent chapter. Combined with the empirical illustration in Chapter 5, this theoretical section aims at answering the second research question. In light of the view that the mechanisms are instrumental to the formation of valuable organizational capabilities, they provide a screening device to detect capabilities created from engaging in a strategy for environmental sustainability. In order to arrive at those capabilities, the greening mechanisms will be used in Analysis 3.

4.3.1 Environmental integration

The greening mechanism *environmental integration* sheds light on the approaches firms use to systematically reduce the environmental impact of their business. Both technical and managerial aspects are touched upon, acknowledging the fact that companies are complex socio-technical systems. The general idea is to first give a brief insight into the options for technical integration available to energy companies and subsequently review generic management tools and approaches to reduce negative environmental impacts.

Technical integration

Lund (2007) describes the technical challenge for developing the energy system in a sustainable way as three-fold. Firstly, the efficiency of energy production has to be improved. Secondly, fossil fuels should be replaced by renewable energy sources, and thirdly, energy savings on the demand-side have to be achieved.

The improvement of energy efficiency is obviously not new to management. It was initially triggered by the oil crises in the early 1970s, but came into focus more recently because of increasing energy prices (Wagner, 2008) and new policy instruments such as the EU ETS. Increasing energy efficiency in the energy production system is advantageous not only from an environmental perspective but also from an economic point of view. Evidently, if resources are used in a more efficient way, the costs for input fuels can be reduced. However, energy efficiency improvements using direct measures at plants have often already been implemented to a large extent, leaving limited scope for further cost-efficient measures (Wagner, 2008). Moreover, increasing the flexibility of the energy system is an important enabler of energy efficiency. A further option for improving energy efficiency is the upgrading of power plants. This involves investments in better components or technology, often yielding productivity gains and extending the life time of plants. Economic, environmental and safety motives lie behind these measures.

Replacing fossil fuels with renewable sources is the second important technical measure mentioned by Lund (2007). Wagner (2008) sees a high long-term potential for fuel switching and the increased use of renewable energy sources and technologies, especially for countries with a fossil-fuel intense production mix[74]. Fuel switching by either replacing entire fossil-fuel based production facilities, or replacing part of the fossil fuels used with biomass in existing facilities, is an important option for energy companies depending on fossil fuels for their energy production. Using the second option often requires technical alterations since

[74] As indicated, the share of fossil fuel based power production in Sweden (from condensing or gas turbines) amounted to 0.3 % in 2009. In district heating, 17 % of fuels used were fossil in 2008, including 6 % peat (SEA, 2010a).

combustion plants normally are designed for a particular fuel, allowing only slight deviations in for example moisture content.

Processual integration - Environmental management system (EMS)

The EMS has an important role in making complex environmental issues manageable (Kirkland & Thompson, 1999). The following definition illustrates the general idea of an EMS and how it relates to the rest of the organization:

> An environmental management system (EMS) is that facet of your organization's overall management structure that addresses the immediate and long-term impact of your company's products, services, and processes on the environment. An EMS provides order and consistency in organizational methodologies by allocating resources, assigning responsibilities, and continually evaluating your practices, procedures, and processes. (Cascio, 1996:8)

This definition is in line with the general view that an EMS is the single most important management tool for mitigating the environmental impact of any organization. An important fact is that the EMS is firmly embedded in the company. It consists of a managing structure for environmental issues developed internally by the organization as opposed to government regulations imposing requirements from the outside (Coglianese & Nash, 2001). An EMS is essentially a collection of internal efforts comprising an environmental policy and objectives, procedures and audit protocols for operations that create waste materials or emissions (Matthews, 2003). Based on the notion of continuous improvement (Deming, 1986), EMSs are "systems of management processes that enable organizations to continually reduce their impact to the natural environment" (Darnall & Edwards, 2006:302). Development and operation of an EMS follows a general four-step process of 'PLAN, DO, CHECK, ACT', often mentioned as the generic framework for initiating and maintaining an EMS (Matthews, 2003).

In 1996, the International Organization for Standardization (ISO) designed an environmental management system standard, ISO 14001, creating the possibility for organizations to certify their EMS. A similar arrangement is the EMAS scheme[75] which is the European counterpart of ISO 14001. Although costly and labour-intensive (Darnall & Edwards, 2006), certification is increasingly popular since it enables organizations to establish external legitimacy for their EMS (Bansal & Hunter, 2003). ISO (1998) sees the main benefits of a certified EMS to lie in reduced costs of waste management, as well as savings from reduced energy and material consumption. Companies themselves consider the introduction of an EMS also as a way to increase legal certainty and to motivate employees (Morrow & Rondinelli, 2002). It should, however, be noted that there are large variations in what an EMS looks like, very much depending on the nature of the organization's operations, its environmental impact, and the ambitions held by the organization.

---

[75] Eco Management and Audit Scheme (EMAS, 2011).

To form an understanding of what an EMS is about in practical terms it is worthwhile to take a closer look at the four steps of implementation. In the PLAN stage, the environmental policy, the central component of an EMS, is set up. Environmental policies typically outline how the organization's environmental burden is to be tackled and states its commitment to continuous environmental improvements. Thereby, it also provides guiding values for all organizational members. A further important part of the planning stage is to determine environmental impacts and compliance requirements, ranging from emissions and wastes to material and energy use, as well as potential hazards from environmental incidents (Matthews, 2003). Subsequently, environmental goals for the reduction of the impact are outlined. These are arbitrary and range from highly specific goals to more general targets. Nevertheless, the intention is that goals are tightened from year to year. Generally, the planning stage of the EMS sets the groundwork for later steps and provides a framework that gives guidance to the environmental managers' work (Matthews, 2003).

In the second stage, the DO phase, the organization outlines a structure for the activities that fall under the EMS. Work practices and operating instructions are established that define the procedure for each task, making sure that the environmental impact is minimized and environmental regulations followed. Typically, all impacting activities are defined in the EMS documentation. The documentation of the EMS, providing the structure for its operation, is the main task for many organizations (Godfrey, 1996). It includes the environmental policy, procedures and protocols for activities, records of monitoring and measurement, and the regulations the organizations is subject to (Matthews, 2003). Outlining the activities of the EMS and how employees should act to live up to the responsibilities under the system should thus lead to that set targets are met. An important component of EMS adoption is also employee training and enhancing communication structures inside as well as outside of the organization (Darnall & Edwards, 2006). Training should ensure that employees are prepared for their specific job tasks and aware of the environmental impacts that could result from malperformance. Communication entails informing employees about the EMS and environmental policy, as well as their specific role in environmental matters. Ideally, communication should address all levels of the organization to improve employee awareness and the organization's commitment to environmental issues (Matthews, 2003).

In the CHECK stage, the operation of the EMS is assessed through environmental auditing and environmental performance evaluation. Audits are usually performed both by internal personnel and external auditors. The audit includes evaluating EMS components and examining problems that have occurred, and which had caused an environmental incident. The causes of the incident would be investigated and changes to the EMS documentation suggested in order to prevent future impacts. The 'checking and corrective action' part of the system is seen as extremely important since "what gets measured and checked (i.e. audited) typically gets appropriate management focus, and what does not get measured and checked easily gets forgotten" (Woodside, & Aurrichio, 2000:23). Environmental performance metrics are obviously important to follow-up in the CHECK stage (Matthews, 2003).

Finally, in the ACT phase corrective action is taken to improve the plans and how they are put into practice (ISO, 2009). One way of doing so is conducting a management review, based on the results and insights gained from the audits (EPA, 2009). The program should be reviewed and evaluated by management at specified intervals to make sure it continues to be suitable, adequate and effective in relation to general business purposes (Woodside, & Aurrichio, 2000). It is vital that management considers the need for any changes to the EMS, and makes assignments to employees in charge as required (EPA, 2009). This entails a decision-making process for management that may result in outputs such as new programs, renewal of the policy or further environmental investments (Cascio, 1996). Important is also that the results of the management review are communicated to employees and other stakeholders, fostering confidence that the management is committed to ‘walking the talk’ (Cascio. 1996). Following the management review, the tasks performed in the PLAN stage should be revisited, ensuring that the circle is closed (EPA, 2009).

An essential feature of an EMS is “the implementation of policies and practices in all corporate activities” (Kirkland & Thompson, 1999:137). An advice from practitioners is that integrating the EMS with other system within the organization is preferable since “[e]nvironmental issues are related to other organizational issues, such as finances, profitability and overall management” (Kirkland & Thompson, 1999:137). Hence, companies should think of their EMS in terms of company objectives instead of treating it solely as a management system (Cascio, 1996). If the EMS interacts with other appropriate areas of the organization, it will be more powerful, preventing it from becoming an ineffective ‘paper exercise’. Long-term commitment to environmental issues also seems an essential requirement, given that changes can require a number of years to take hold within an organization (Kirkland & Thompson, 1999). Environmental policies thus need appropriate incentives. Young and Post (1993:39) hold that policies “need to be bolstered with communication, training, coaching, goal-setting, evaluation, and reward, if they are to take root in the organization’s day-to-day life”.

Supply-chain measures

Sustainability challenges are prominent in the supply chain since many environmental problems are ‘imported’ through the supply chain (Elkington, 1994). Kolk and Pinkse (2004), reviewing corporate actions on climate change, observe that many companies have started to consider emissions throughout their supply chain. Some companies may select their suppliers based on their environmental programs or even require ISO 14001 certifications, while others may expect their suppliers to have similar environmental standards to their own. Supply-chain measures are of growing importance (Kolk & Pinkse, 2004), widening the scope of integration of environmental concerns.

4.3.2 Communication and learning

According to James et al. (2007) organizations aiming at a change toward environmental sustainability require feedback and learning mechanisms in order to develop and share expertise and skills for the cognition of sustainability opportunities, as well as for planning and implementing selected initiatives. Communication and learning can be viewed from a multitude of perspectives, and the literature is extensive. This review sheds light on communication as an organizational phenomenon and especially the usefulness of dialogue in creating shared meaning. Furthermore, an open communication climate seems to facilitate the promotion of the environmental agenda. From the literature on organizational learning a few key concepts were picked, such as how organizations learn, the relationship between learning and change, as well as learning types. The need for organizational learning has been addressed by prominent researchers such as Schein (1993), who emphasizes that the rate of change in the environment requires organizations to learn rapidly. Senge (1995) argues that organisations must continuously adapt and transform through a process of learning in order to meet the challenges from continual and disruptive change, and maintain relevance and competitiveness. In other words, learning is crucial for corporations to maintain a strategic fit with their environment.

Internal communication

Young and Post (1993) hold that effective communication, in particular with employees, is vital to organizations undergoing major changes. Without effective and consistent exchange of information, progress will stall (James et al., 2007). Communicating the importance of the natural environment to employees contributes to forming an orientation towards the natural environment throughout the organization (Menguc & Ozanne, 2005). Communication is a critical management process involving face-to-face meetings, company publications and other means of communication, used strategically to manage organizational learning and change (Young & Post, 1993). Practitioners emphasize that managers should be champions at communication-oriented problem-solving. While top management should take responsibility for conveying the ‘big picture’, effective communication, however, only occurs when the supervisor links the big picture to the work group and the individual employee, translating how the changes affects them in their work (Young & Post, 1993). This is also true for environmental initiatives. Sustainable change initiatives towards the environment require constant exchange of information by all employees, top-down, bottom-up as well as laterally in the organization to communicate the environmental initiative’s needs, purpose and benefits. Organizations that successfully manage change provide frequent, accurate and timely information on progress and obstacles towards goals and vision (James et al., 2007).

External environmental communication

Supplying environmental information in external communications is a way to signal corporate commitment to the natural environment (Menguc & Ozanne, 2005). Following Cox

(2010), environmental communication can aim at improving the identity of the corporation so to reflect its environmental concerns and performance. Nowadays, many businesses appreciate the environmental values held by the general public, consumers, and the media. As a consequence, much of corporate communication illustrates a “skilful dance of corporate identity” (Cox, 2010:359), whereas corporations attempt to associate their products and identity with ‘green’ values. Such communication takes two important forms: image advertising and corporate environmental reports (Cox, 2010). The intention is to link corporate identities and behavior with “images of environmentally responsible corporate citizens” (Schumann et al., 1991:35).

Effective stakeholder communication about the environment or other issues is a powerful way to build trust and loyalty, which contributes to business performance (Wheeler & Sillanpää, 1998). Such communication should ideally be regular, open, honest, and based on shared values (Wheeler & Elkington, 2001).

Environmental communication also plays an important role in alerting the public to the risks from climate change (Moser & Dilling, 2007). Likewise, the commitment to combat climate change demonstrated by corporations influences the public’s perception of the issue. Companies publicly addressing how climate change is integrated into their bottom lines send powerful messages about the realities of climate change and how it can be addressed (Arroyo & Preston, 2007).

Open communication climate

Buchholz (2001:1) points at the importance of an open communication climate since

> [a]t the center of every organization are people held together by slender threads of cooperation. These threads are maintained by people sharing information with each other. The result is a delicate network of human relationships linked through communication.

An open communication climate facilitates for employees to freely express their opinions, voice complaints, and offer suggestions to their superiors. According to Buchholz (2001), research shows that such open climate for communication is characterized by a supportive environment where employees are encouraged to take part in decision making. Trust is an essential component of an open communication climate. Buchholz (2001) further argues that, in participative environments, employees share information about customer preferences and problems freely with decision makers. This is further encouraged by flat organizations as opposed to highly formalized, bureaucratic organizations.

Dialogue

Smircich (1983b) argues that shared meanings and conceptions of the world can be considered as prerequisites for collective action. Communication failures and cultural misunderstandings frequently prevent parties from framing a problem in a common way. This makes it difficult to deal with problems constructively (Schein, 1993). The author argues that problem solving and conflict resolution in groups has become increasingly important in a complex world, which makes dialogue one of the most important human skills. According to Isaacs (1993), dialogue came to be seen as a major breakthrough in a number of emergent fields of human activity, amongst others in organizational learning. The word dialogue comes from the Greek roots *dia* and *logos*, suggesting 'meaning flowing through' (Isaacs, 1993). While it is not necessary for people to agree, dialogue encourages people "to participate in a pool of shared meaning that leads to aligned action" (Isaacs, 1993:111). Regan (2007:213) sees dialogue as "a genuinely creative and generative act". It involves the exchange of perspectives, beliefs, and experiences with people listening openly and respectfully. Schein (1993) holds that dialogue has considerable potential as a philosophy and technique for formulating and solving problems. It is a necessity for understanding cultures and sub-cultures in an organization, taking a step towards developing an overarching common language and shared mental models. This, in turn, is seen as a necessity for organizational learning. Increasingly, dialogue has also been addressed as a means to create shared understanding between companies and stakeholders (e.g. Wheeler & Sillanpää, 1998; Bendell, 2003). At a higher level, dialogue seems uniquely suited to address questions of fairness, participation, roles and values. Regan (2007) thus sees dialogue to hold potential to result in more generative conversations about climate change.

LEARNING

While communication can be considered a prerequisite for learning, learning as such attracts far wider scholarly attention. Thomas and Allen (2006) contend that, given the rate of change in the environment and the changing nature of work, organizations have come to view learning as more critical than in the past. With regard to the natural environment, Sharma and Vredenburg (1998) argue that when managers deal with the uncertain outcomes of incorporating environmental considerations into their decision processes, business paradigms may change and fundamental shifts in philosophy are likely to occur. The capacity of a corporation to learn about the interface between business and the natural environment and manage this knowledge is crucial as it can fundamentally influence the development of sustainable solutions towards a better environment (Marcus & Nichols, 1999).

Organizational learning

From an academic standpoint, two terms seem relevant: the learning organisation concept and the concept of organizational learning. According to Thomas and Allen (2006:126) the learning organization is about "building learning and knowledge creating capacity in individuals and enabling the effective dissemination of this knowledge through the organization". Organizational learning, on the other hand, designates "the process of improving actions through better knowledge and understanding" (Fiol & Lyles, 1985: 803).

An interesting question is *how* organizations actually learn. Argyris and Schon (1978) state that individuals are the agents for organizational learning. However, organizational learning is not the cumulative result of individual learning (Hedberg, 1981, in Fiol & Lyles, 1985). "For *organizational* learning to occur, learning agents' discoveries, inventions, and evaluations must be embedded in organizational memory", as argued by Argyris and Schon (1978:19, italics in original). This can only be achieved if the knowledge is encoded in shared maps which form the basis of other organizational members' subsequent actions (Argyris & Schon, 1978). For new individual knowledge to become organizational knowledge, it needs to be exchanged and accepted by other organizational members and considered relevant for organizational activities (Duncan & Weiss, 1979). Bood (1998) emphasizes that frequent dialogue between individuals or groups within the organization is crucial in the process of organizational learning. Nonaka (1994) considers learning in organizations to be, above all, a social process with individual members learning and developing knowledge together.

Cognitive and behavioural development

Fiol and Lyles (1985) find it crucial to distinguish between cognitive development and behavioural development in the context of organizational learning since "not only do they represent two different phenomena, but also, one is not necessarily an accurate reflection of the other" (Fiol & Lyles, 1985:806). It is argued that changes in behaviour can take place without gaining new knowledge. Likewise, cognitive development can occur without simultaneously altering behaviour. Cognitive development refers to "change in the interpretation of events and the development of in-depth understanding of past actions in the light of future behaviour" (Bood, 1998:212). Behavioural development encompasses new responses and actions that are based on these existing interpretations and understandings. Organizational learning is thus associated with cognitive development, whereas behavioural development reveals only the level of change, as illustrated in Figure 4.3.

While different strategic implications may be conceived depending on a firm's position in Figure 4.3 below, in the context of this study the upper right circle where both learning an change occur is of greatest interest as it represents a well-founded, reflective type of change. In the upper left circle the firm disposes of relevant knowledge but is unable to act upon it, resulting in inertia. The lower right circle involves implementing changes that are not well-thought through, which may create lock-in effects or lead to sub-optimization on a system level.

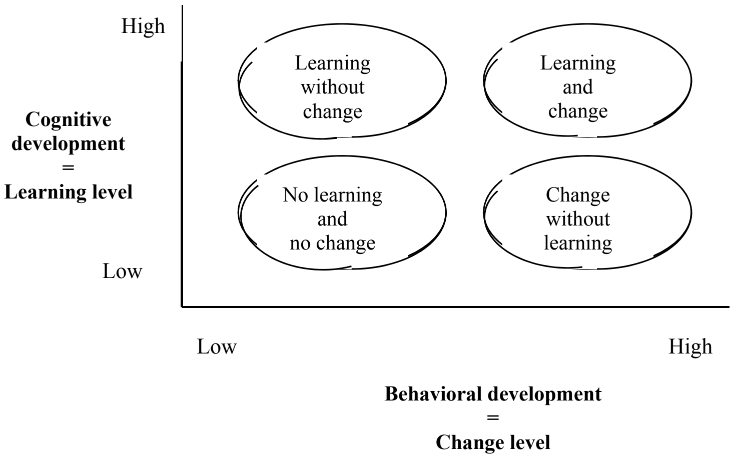


Figure 4.3: Organizational learning and change
Source: Adapted from Bood (1998, based on Fiol & Lyles, 1985, p. 807).

Learning types

An important contribution to the literature on organizational learning was made by Argyris and Schon (1978) by introducing the idea of single-loop and double-loop learning, also known as lower order and higher order learning (Fiol & Lyles, 1985) or adaptive and generative learning (Senge, 1990). Single-loop learning refers to error detection and correction in order to respond to changes in the organization's internal or external environment and preserve constancy. This type of learning is mainly concerned with effectiveness, i.e. to find the best possible way to achieve existing goals and maintain performance within the dominant management logic and existing norms. A potential drawback of this learning approach is that the prevailing logic may turn into a rigidity, thereby stifling creativity (Sadler-Smith & Badger, 1998). Instead, in some instances, a learning cycle that involves modifying organizational norms as such is required. This is the case with double-loop learning. Double-loop learning "connects the detection of error not only to strategies and assumptions for effective performance, but to the very norms which define effective performance" (Argyris & Schon, 1978:22). Hence, current operating assumptions and existing practices and norms are challenged.

Fiol and Lyles (1985) argue that double-loop learning is a more cognitive process than single-loop learning, which frequently results from repetitive behaviour. Nelson and Winter (1982) see single-loop learning as a learning-by-repetition approach which eventually results in a distinct set of organizational routines. Fiol and Lyles (1985) further associate single-loop learning with problem solving skills and double-loop learning with problem-defining skills. Accordingly, double-loop learning is linked with changes in values and unlearning of prevailing behavioural patterns (McGill & Slocum, 1993). According to Fiol (1994), higher-order learning involves the development of different interpretations of existing and new information, resulting from developing a new understanding of surrounding events. In relation to learning and the natural environment, higher order learning is likely to occur within an organization as a result of fundamental shifts in philosophy associated with a proactive environmental strategy and the experimental base of activities lying at its base (Sharma & Vredenburg, 1998).

Argyris and Schon (1974) suggest that most organizational learning is single-loop, whereas double-loop learning is only rarely found. However, rather than seeing one of the styles as superior to the other, Sadler-Smith and Badger (1998) see them as qualitatively different types of learning. Versatile and adaptable organizations can switch between learning styles depending on the set of demands they are facing. Sharma and Vredenburg (1998:740) hold that “environmental strategies can lead to different paths of learning and knowledge creation on the business/natural environment interface for each firm”.

Interfirm learning

Although most of the literature is concerned with aspects related to internal organizational learning, learning cannot be assumed to stop at the corporate boundary. Given the systemic character of many of the changes required when aiming at a transition towards a more sustainable organization of industrial activities, research on *interfirm learning* is relevant to address. This body of research reflects that firms have different strategic options how to organize their learning and production on a market with increasingly green concerns. It also reflects that organizational learning is an antecedent of innovation (Sadler-Smith & Badger, 1998). Firms learn form inter-organizational ties (e.g. Marcus, 2005), exploiting external knowledge by using their absorptive capacity (Cohen & Levinthal, 1990), which is discussed more in-depth in Section 4.3.3.

Andersen (2002), attempting to identify different types of interfirm learning modes related to the greening process, proposes a framework consisting of three learning types. *Capability accessing* relates to knowledge exchange or collaborative knowledge generation between firms, aiming at building capabilities. *Learning through adaptation* refers to “the information exchange, in the form of communication, persuasion and teaching associated with the coordination of productive activities” (Andersen, 2002:109). Under this topic, two qualitatively different coordination processes are seen to lead to interfirm adaptation: *ex ante coordination* and *ex post coordination,* reflecting the point in time when firms coordinate their innovative activities. Ex-ante coordination aims at securing coordinated adaptation between firms with complementary activities in order to ensure that market capabilities are compatible and competitiveness maintained. “Ex-ante coordination emphasizes thus the ongoing but conscious adaptation attempts between producers and users, involving either co-operative or coercive communication of information on user demands and product properties” (Andersen, 2002:112). Ex-post coordination involves efforts to solve conflicts from incompatible products and activities which render market capabilities obsolete. It is of a more adversarial nature than ex-ante coordination which relies more strongly on cooperation. In any case, interfirm collaborative learning efforts are seen to influence the rate and direction of innovation by shaping "the firms' knowledge bases, their heuristics and their entrepreneurial expectations" (Andersen, 2002:116). Andersen (2002) concludes that interfirm dynamics play an important role for the occurrence and diffusion of new market trends such as greening.

4.3.3 Innovation

Von Malmborg (2007:1731) sees innovation to be "closely related with organizational learning (and unlearning) and the exploration or exploitation of knowledge in a company or a larger socio-technical system". After broadly defining innovation, this review elaborates on a narrow set of concepts from the innovation literature that seem most relevant for this study. The aspects addressed facilitate an understanding of innovations as (tacit) organizational phenomena (dependent on learning) with potential effects on a system level.

Johansson et al. (2005) argue that the sustainability challenge for industrial systems lies not merely in managing technical innovations. They see a need for innovative ways of organizing production-consumption systems, calling for a change in lifestyle and technology. Similarly, Van de Ven (1986) criticizes research on organizational innovations for being mostly technically-oriented and not defined widely enough. He sees the need to find a more general definition that can be applied to a broad range of technical, product, process and administrative types of innovations. Consequently, he advocates the following definition of the process of innovation: "the development and implementation of new ideas by people who over time engage in transactions with others within an institutional context" (Van de Ven, 1986:591). Such a wide definition of innovations is preferable in the context of this study in order to capture less evident ongoing changes in the organizations and the systems they are embedded in.

Management innovation

Management practices, processes, techniques, and organizational structures have been identified as different facets of rules and routines by which work gets done inside organizations. The identification of a novel problem that causes a perceived shortfall between the organization's current and potential performance may drive the demand for new management practices (Birkinshaw et al., 2008). Following established theory (e.g. Cyert & March, 1963), "(a) perceived shortfall can be caused by a problem that undermines current performance but also by opportunities that may exist and the anticipation of environmental changes" (Birkinshaw et al., 2008:833).

Management innovation can be defined as "the invention and implementation of a management practice, process, structure, or technique that is new to the state of the art and is intended to further organizational goals" (Birkinshaw et al., 2008:825). Viewed from a rational perspective, the focus lies on how management innovations bring about improvements in organizational effectiveness (e.g. Chandler, 1962). Typically, an innovative solution is put forward by an individual to address a specific problem faced by the organization, whereas he or she then champions its adoption and implementation (e.g. Howell & Higgins, 1990). At the same time, external change agents may play a major role in management innovations since they provide legitimacy and expertise to the different stages in the process (Birkinshaw et al., 2008). Regarding their novelty, management innovations do not necessarily need to be 'new to the state of the art' but 'new to the organization' (e.g. McCabe, 2002; Zbaracki, 1998), which includes the adoption of already existing initiatives or programs.

Seen from an intrafirm evolutionary perspective (Burgelman, 1991; Zbaracki, 1998), the adoption of a management innovation is a four-phase process: 1) changes perceived in the environment lead to 2) variations in management practices. Some of those inventions are then subject to 3) internal selection and 4) retention. Management innovations are often tacit in nature (Alänge et al, 1998), and some may offer the potential to create a competitive advantage (Birkinshaw et al., 2008). Management innovations aim to further organizational goals, which can refer to both traditional performance-oriented aspects and softer aspects, such as employee satisfaction. Such innovations are seen to have the potential to generate positive outcomes not only for the innovating firm, but also for society as a whole (Birkinshaw et al., 2008).

Open innovation

A relatively recent addition to the innovation literature is the concept of open innovation (Chesbrough, 2003, 2004, 2006). It is a new paradigm based on the assumption that "firms can and should use external ideas as well as internal ideas, and internal and external paths to market, as they look to advance their technology" (Chesbrough, 2006:1). While the possibility to adopt the concept depends on institutional underpinnings according to Chesbrough (2006), it seems of particular interest for the Swedish district heating industry since the competition between firms is low (Söderholm & Wårell, 2010), creating unique conditions for common innovation activities in the spirit of open innovation (Mansouri, 2009). Open innovation departs from the earlier premise that successful innovation requires control and hence companies must generate their own ideas. It is based on the insights that a firm with a closed innovation approach might miss opportunities that fall outside its current business or require the combination with external technologies to succeed (Chesbrough, 2003). The basic assumption is that valuable knowledge is widely distributed and, therefore, it is important that companies in their innovation process identify, connect to and leverage external knowledge.

Absorptive capacity

The idea that outside knowledge sources often are critical to the innovation process is also dominant in the seminal work on absorptive capacity by Cohen and Levinthal (1990). This perspective elegantly ties communication, learning and innovation together. Absorptive capacity refers to the ability of a firm to "recognize the value of new, external information, assimilate it, and apply it to commercial ends" (Cohen & Levinthal, 1990:128). Since learning is cumulative, the absorptive capacity of a firm is likewise seen as largely contingent on its level of earlier related knowledge, i.e. it develops in a cumulative fashion. Without a certain level of prior knowledge, the organization will not be able to exploit external knowledge. This points at that "the development of absorptive capacity, and, in turn, innovative performance are history- or path-dependent" (Cohen & Levinthal, 1990:128). As a consequence, investing in absorptive capacity in one period will permit a more efficient accumulation of absorptive capacity in later periods[76].

Well-designed structures for communication and knowledge transfer between the organization and its external environment as well as among internal subunits are seen to be of great importance for the accumulation of absorptive capacity. As highlighted by various authors in the previous section on communication and learning, also Cohen and Levinthal (1990) consider shared knowledge and expertise to be essential for communication. At the same time, even diversity of knowledge is seen as beneficial to leveraging the organization's capacity to innovate. A firm's absorptive capacity thus depends on "the links across a mosaic of individual capabilities" (Cohen & Levinthal, 1990:133) that allow for novel linkages and associations.

A last important aspect of absorptive capacity is expectation formation, especially in an uncertain environment. A high level of absorptive capacity allows the firm to more accurately predict the potential of technological novelties. Cohen and Levinthal (1990) further argue that:

> The greater the organization's expertise and associated absorptive capacity, the more sensitive it is likely to be to emerging technological opportunities and the more likely its aspiration level will be defined in terms of opportunities present in the technical environment rather than strictly in terms of performance measures. Thus, firms with higher absorptive capacity will tend to be more proactive, exploiting opportunities present in the environment. (Cohen & Levinthal, 1990:137)

The above findings from the literature on absorptive capacity highlight the tacit nature of firm capabilities that function as a search light for its development trajectory, both in terms of innovations and the direction and ambition of its future business development.

Type of innovation

When it comes to the type of innovation, a convincing distinction is made by Chesbrough and Teece (1996), who distinguish between *autonomous* and *systemic* innovations. The former can be pursued independently from other innovations, whereas the latter can only be beneficially realized in conjunction with similar complementary innovations. The type of innovation has important consequences for the choice of organizational design and strategy.

[76] Leiblein (2011) sees parallels between absorptive capacity and the RBV isolating mechanism of 'asset mass efficiencies' (Dierickx & Cool, 1989).

The key issue is the flow of information necessary for any innovation. Autonomous innovations, although also developing gradually as a result of experiments, research findings, customer feedback etc., can be more readily codified in industry standards. The information needed to integrate these innovations with existing systems is thus more easily understood. Systemic innovations, on the other hand, often rely on tacit knowledge that is deeply embedded in individuals or firms. It therefore diffuses more slowly, frequently requiring substantial efforts or even the transfer of people (Chesbrough & Teece, 1996). Hence, information exchange facilitating systemic innovations is very challenging for managers. Because systemic innovations require "information sharing and coordinated adjustment *throughout an entire product system"* (Chesbrough & Teece, 1996:68, italics in original), they are more easily achieved within organizations than across organizational boundaries. Hence, Chesbrough and Teece (1996) suggest that a market leader able to coordinate and knit systemic innovations together, might be required in order to establish and advance industry standards.

Degree of innovation

Tukker and de Bruijn (2002) consider the macro-level of production-consumption structures of society the most suitable level of analysis for innovation processes leading to sustainability. They thus address the degree of socio-technical change of an innovation as an important variable. Their scheme differentiates between mere *optimizations*, *singular innovations* and *system innovations*. These address the relative degree of innovation ranging from incremental to radical. Optimizations relate to technical system adjustments or end-of-pipe measures which leave the existing production-consumption structure widely untouched. Singular innovations are usually process-integrated, requiring the redesign of part of the production-consumption chain. They create changes in socio-technical arrangements, but touch only upon a limited number of actors. System innovations in turn affect the whole production-consumption configuration. Their main focus lies on societal functions and thereto connected systems. The alignment of activities of many actors in society is required during an extended time period. It is further argued that system innovations aiming at sustainability "are likely to require complex collaborative settings" (Tukker & de Bruijn, 2002:297).

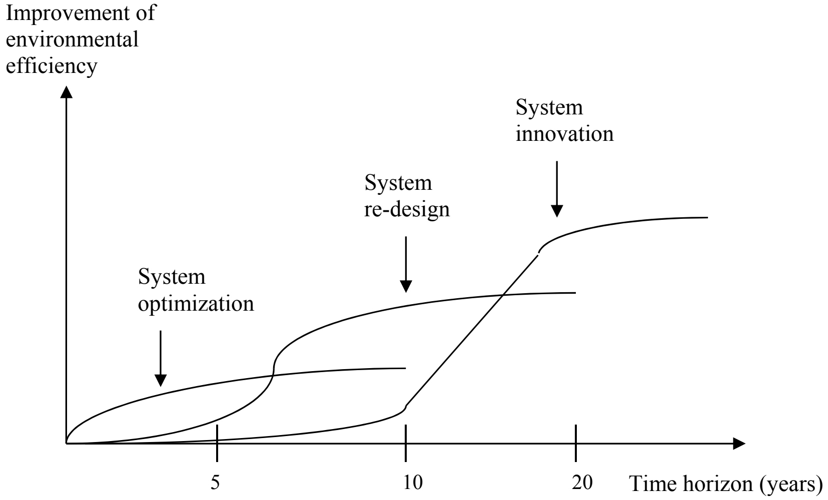


Figure 4.4: System optimization, re-design and innovation
Source: Adapted from Tucker & de Bruijn (2002, p. 298).

Figure 4.4 illustrates the three innovation levels. Similar to the widely known S-curve from innovation theory, the performance of a system can be significantly improved for some time using optimization and re-design. However, having reached a certain performance threshold, further progress can only be made once a new system is adopted (Tucker & Bruijn, 2002). Socio-technical change and innovation are seen as "an interactive process of variation (e.g. knowledge within single organizations or networks) and selection (e.g. social and institutional preferences) that lead to certain preferred technological trajectories or socio-technical regimes" (von Malmborg, 2007:1731).

4.3.4 Cooperation

Cooperation has been identified as a further important greening mechanism that facilitates both technical and systemic embedding of sustainability in the energy system. Cooperation in general terms is "the act of working or acting together to achieve a common goal" (Encarta, 2009). Worth noting is that cooperation and collaboration are often used interchangeably[77]. The intention here is to first put cooperation and similar endeavors in the larger context of sustainability and subsequently narrow it down to concepts and concrete arrangements that can be relevant for the studied setting.

[77] Collaboration can be defined as a "cooperative arrangement in which two or more parties work jointly towards a common goal" (BusinessDictionary, 2009).

Partnerships as a form of collaboration have been extensively discussed as a path to sustainability[78], and there is a call for collaborative leadership for sustainable development against the background of complex environmental problems which cannot be tackled by governments alone. It is claimed that “consensus-oriented policies require the consideration of social, economic and technological interests of various sectors of society through coordination and partnerships” (Hartman et al., 1999:257). Increasingly, attention is directed towards “stakeholder collaboration as a path towards sustainability and government’s role as a collaborative leader” (Hartman et al., 1999:263). It is suggested that collaboration can change the way how industry and society view their relationship with each other and the environment (De Groene & Wijen, 1998). These statements catch the essence of how cooperation is seen as a pathway to sustainability on a meta-level. However, this needs to be broken down to the level of analysis of this research, namely relating to organizations. Relevant terms investigated for this review, amongst others, are cooperative interorganizational relationships (cooperative IOrs), forms and determinants of cooperation as well as how interorganizational cooperation relates to the operational business of energy companies.

Shared understanding

Gray (1989) describes collaboration as a method for solving common problems and resolving conflicts. It enables organizations to join forces, pool information and reach mutually satisfactory long-term agreements. Gray (1989:5) views collaboration as “a process through which parties who see different aspects of a problem can constructively explore their differences and search for solutions that go beyond their own limited vision of what is possible”.

It is vital that the stakeholders to the collaboration build a shared understanding of how problems arise by exchanging their opinions. This shared understanding is seen as the basis for choosing a collective course of action (Gray, 1989). Furthermore, Gray (1989) argues that economic and technological solutions to promote sustainability through collaborating are not sufficient. Above all, attention should be paid to leadership, decision-making, fairness and relationship management. Gray (1989) further notes that one of the central factors influencing collaboration is the existence of a shared vision regarding the nature of the problem.

Cooperative IORs

According to Oliver (1990), a variety of starting conditions can lead to cooperative IORs, for example previous friendship ties, an institutional mandate, resource dependence or the search by an organization for a partner that holds desirable resources. Benefits of cooperation are typically framed in terms of performance and satisfaction. One of the most sought after outcomes of cooperation in an organizational setting is effective coordination which

[78] See special issue of Business Strategy and the Environment following the Conference of the Greening of the Industry Network (GIN) in 1998.

assumingly leads to higher performance. Contractor and Lorange (1988) support this notion, pointing out that cooperativeness among companies is positively related to strong levels of efficiency and profitability. Nevertheless, many of the benefits of cooperation to an organization can be defined in non-economic terms; benefits may include improved quality, high quality decision making and improved competitiveness (Smith et al., 1995).

Formal and informal cooperative relationship

Smith et al. (1995:10) distinguish between at least two cooperative relationships; the formal and the informal, whereas "[i]nformal cooperation involves adaptable arrangements in which behavioral norms rather than contractual obligations determine the contributions of parties". This type of cooperation is referred to as organic and voluntaristic by Astley (1984). Formal cooperative relationships, in contrast, are characterized by contractual obligations and formal structures of control (Smith et al., 1995). However, over time formal types of cooperation can change into informal types, in which rules and regulations become redundant (Ring & Van de Ven, 1994).

Determinants of cooperation

Although many determinants for cooperation have been identified by researchers, there has been wide-spread agreement that one particularly direct antecedent is trust (Smith et al., 1995). Trust is defined by Ring and Van de Ven (1994) as "an individual's confidence in the good will of the others in a given group and belief that the others will make efforts consistent with the group's goals" (Smith et al., 1995:11). Kleef and Roome (2007) conclude that the way trust is built is distinctive for each organization; it includes for instance frequent and rich communication, consistency between words and actions, fair and transparent decisions and establishing a shared vision and language.

Accumulation of trust between parties as a result of repeated prior interactions (that were perceived as efficient and equitable by the parties) are seen to increase the probability that future transaction may involve more significant and risky ventures (Ring & Van de Ven, 1994). As a consequence, it also seems that cooperative IORs among parties with earlier economic relationships or social ties develop more rapidly and efficiently than among parties who initially were strangers (Galaskiewicz & Shatin, 1981).

According to Murnighan (1994) it makes sense to discriminate between structural and psychological determinants of cooperation. Structural determinants include the number of parties in a relationship, the social context of the cooperation, and prior social ties as an indicator of reliability and predictability. Psychological determinants refer for instance to the similarity in partners' values, the perceived status and legitimacy of partners, and the perception that the shared procedures are just. From a practical point of view, Von Malmborg (2007) cautions that differences in national cultures (and presumably even corporate cultures) can present considerable challenges to achieving cooperation in organizations. For example, Cole (1989) reported that people tend to cooperate less in the US than in Sweden and Japan.

Cooperation related to the operational business of energy companies

How do these general considerations connect to the energy sector? Research in cooperation relating to energy companies has been rather sparse and tends to focus on technical and economic aspects[79]. Grönkvist and Sandberg (2006) see the main system benefits arising from cooperations between district heating companies and industries to be a lower total need for primary energy, yielding cost savings and environmental benefits. The two dominant forms of cooperation in the energy sector are industries selling waste heat to a district heating system, or two district heating companies interconnecting their energy systems. The latter implies that heat can flow in either direction depending on the prevailing situation at any given time (Gebremedhin & Carlson, 2002). Such cooperation can lead to a more effective use of plants, reduced use of fossil fuels, and a larger potential for producing electricity in combined heat-and-power plants (CHP).

Given that the possibilities to reduce emissions are better when plants are used more efficiently (including better flexibility to switch between fuels and taking advantage of price variations), this implies both economic benefits and a lower environmental impact. Gebremedhin (2003) identifies untapped potential for more efficient district heating systems and recommends that an enlarged system boundary should be applied when analyzing energy systems, taking the possibility of cooperation for integrated systems into account.

Research in cooperation among energy companies or between industry and energy companies shows that agreements concerning heat supply are quite common[80] (Holmgren & Gebremedhin, 2004). However, the authors caution that heat supply collaboration between two actors is not so easy to bring about. First, technical and economic aspects need to be resolved. Second, such a project is a long-term undertaking, demanding mutual commitment. Moreover, it is seen as a disadvantage that both parties are bound to a contract, which makes them less flexible (Grönkvist & Sandberg, 2006). They assert that good techno-economic circumstances, such as short geographical distance, are not enough to bring about cooperation. Often the ‘cultural distance’ between the management of an industry and the management of municipality-owned companies is large, which can lead to difficulties.

Experience indicates that openness and trust are vital for a successful cooperation; hence Grönkvist and Sandberg (2006) see it as crucial that all facts regarding the project are available to both parties. Furthermore, while both parts should win from cooperating, also the total benefits of the cooperation to society should be emphasized. Besides, agreeing upon a stable and long-sighted contract is essential. A further decisive factor for such cooperation to come about is people with an ambition to cooperate from both parties. Grönkvist and Sandberg (2006:1518) suggest that “[u]sually, these people share the view that cooperation is

[79] For a review see Gebremedhin (2003) and Grönkvist and Sandberg (2006).

[80] According to the Swedish District Heating Association (2002), around 30 % of its members have waste heat supply from industries.

something good for both the companies they represent and for the community, which includes the environment and the residents of the municipality".

4.3.5 Local embeddedness

This greening mechanism takes up aspects related to space or location in one form or another. Sayer (1992:146) is concerned about researchers' ignorance of space, claiming that "indeed most social scientists ignore space. Yet space would seem to make a difference to what happens in the world". He emphasizes that "[s]ocial processes do not take place on the head of a pin" (Sayer, 1992:148). The term 'embeddedness' as such goes back to Polanyi (1944) and Granovetter (1985) who, in a nutshell, point at the embeddedness of economic action in structures of social relations. Since then, different strands of social science have borrowed the concept, which resulted in an abundance of meanings linked to the term (Hess, 2004).

On a general level, Hess (2004) divides embeddedness in three fundamental categories. *Societal* embeddedness relates to the importance of where an actor stems from, emphasizing his cultural and political background. *Network* embeddedness describes the structure of relationships among a set of organizations (or individuals), regardless of their local anchoring in a particular place. *Territorial* embeddedness relates to "the extent to which an actor is 'anchored' in particular territories or places" (Hess, 2004:177). These three embeddedness categories should consider "developments over time and changes in the spatial configuration of networks on different scales" (Hess, 2004:178), pointing at that embeddedness is a dynamic rather than a static concept. The spatial aspects of embeddedness, mostly elaborated upon by economic geographers, is most relevant to address when defining what is meant by the 'local embeddedness' of municipal energy companies.

Territorial embeddedness

According to Hess (2004), economic actors become embedded spatially by absorbing the existing economic activities and social dynamics of those places. Hess (2004:178) concludes that, from a development perspective, "the mode of territorial embeddedness or the degree of an actor's commitment to a particular location is an important factor for value creation, enhancement and capture".

A central question is how the territorial dimension of embeddedness can connect to sustainable development. Orr (1995) argues that, although problems regarding development and sustainability are found around the globe, they are not necessarily global in nature. For many of the global problems there are, very likely, local solutions to be found. The local level has frequently been pointed out as the most adequate when it comes to finding solutions to environmental issues (Hägerhäll, 1988; UN, 1992). Kleef and Roome (2007:44) maintain that "what is sustainable is often determined by local circumstances and conditions", whereas Thellbro (2006) addresses the local level as an appropriate basis for positive societal development and healthy natural systems. A straightforward example can illustrate this point: In the food sector, for instance, quality is closely related to nature and the local embeddedness of supply chains. Accordingly, 'localness' of production has come to be seen as intrinsically linked to quality, in essence due to the embeddedness of the product in the local ecology of production (Murdoch et al., 2000). An interesting point is how the local embeddedness of an intangible product such as (green) electricity or heat could be exploited to promote green energy consumption[81].

Promotion of green energy at the community level

When it comes to the marketing of green electricity, Wiser (1998) presents some evidence that local and community-based programs do well. He advocates the use of a 'local' approach to enhance the marketing of green power[82]. Three recommendations are made based on the knowledge that "individuals who are less alienated from their social world and are more involved in community affairs are more likely to participate in environmentally responsible behavior" (Wiser, 1998:113). First, green power marketing is seen to be more successful when it appeals to a sense of community which is based on social values and norms. Second, it seems recommendable to use messages that stress the collective harm caused by environmental problems and, consequently, the need to work together in order to solve the community problem (Grazin & Olson, 1991). Third, community-based marketing and locally-sited and visible (clean technology) projects should help in the effort to increase customer demand for green energy (Wiser, 1998).

Local identity as a strategic asset

Local aspects are also of relevance in relation to branding strategies. Wiedman (2005) studied the impact of different factors on customer retention[83] of municipal energy companies. Survey results from commercial enterprise customers indicate that perceptions of price-worthiness, customer orientation and the perceived local importance of the local utility company for the city has the strongest impact on customer retention (Wiedman, 2005). This indicates that local relevance and customer orientation are important elements in an integrated branding approach, which can even compensate for slightly higher energy prices of local energy companies as compared to competitors from outside the region. The author concludes that "an integrated local branding approach will be the most favorable strategic opportunity. No competitor would be able to copy this strategy. Consequently, from the local utility company's perspective it is the strategic approach that has the greatest chance of

[81] From a production perspective, security of supply of power from Swedish resources naturally is an issue and the green electricity scheme promotes this kind of local initiatives.

[82] The dilemma with green power is that its demand is considered analogous to the voluntary provision of public goods, or, more accurately, the reduction of 'public bads'. There is a risk that customers do not want to pay a premium for green power, i.e. they have strong incentives to 'free-ride' (Wiser, 1998).

[83] The empirical study covered commercial enterprise customers only. The customer retention rate for commercial enterprise customers by municipal energy companies was slightly lower than for private household customers (which was between 90 and 98 per cent) after the liberalization of the German energy market.

uniqueness" (Wiedman, 2005:215/16). Hence, experience, tradition and a good local position are seen as strategic assets that can create value for customers (Wiedman, 2005).

Embeddedness at the municipal level

Ownership characteristics are a further central aspect of local embeddedness of municipal energy companies. Naturally, municipal ownership involves being influenced by local authorities and their values and goals in one way or another (Sandoff, 2006b). Collier and Löfstedt (1997) contend that local authority involvement in environmental issues has a long tradition in Sweden. At the same time, local authorities enjoy substantial autonomy in energy and environmental planning (SEA, 1988)[84]. This makes the local level a relevant dimension to study in addition to the commitments and policy measures taken at a national level. Evidently, the municipal energy company is a cornerstone of local energy planning. Since the owner has the possibility to influence investments and pricing, he has also great opportunities to impact emissions (Collier & Löfstedt, 1997).

As outlined earlier, important reasons for municipalities to own energy companies are the possibility to exert influence on the local environment and the development of the local energy system (Sandoff, 2006b). Rönnborg (2009) describes municipal energy companies as driven by contemporary norms such as an increased interest for the local society and green consumption, which are seen to strengthen their possibilities for business development. Being governed to act in the best interest of their owners (Collier & Löfstedt, 1997), which ultimately are the residents of the municipality, puts municipal energy companies in the favorable position to develop (or maintain) a deeply-rooted societal embeddedness in terms of cultural and political concerns. Moreover, given the infrastructural nature of the energy business (Sandoff, 2006b), the territorial embeddedness and commitment to the local dimension seem almost naturally warranted. Local energy generation is mainly represented by combined heat and power production, power produced in municipal wind farms as well as by local wind cooperatives (Rönnborg, 2009). The structures for energy provision are closely intertwined with the economic activities and social dynamics in the area, making the municipal company a key actor in the promotion of sustainable industrial and consumer activities.

Regional sustainable development

Von Malmborg (2007) takes up the aspect of regional innovation systems (Fisher, 2001) which can lead to regional welfare development. He highlights that in many regions, high environmental quality and sustainable development are considered important drivers of technological innovation as well as regional industrial change. According to Johansson et al.

[84] It should be pointed out that the municipalities have the monopoly for planning and land use under the Planning and Building Act. Furthermore, they are guided by the Environmental Code which promotes sustainable development. These Acts set the guidelines for the municipalities' actions and their role as supervising authorities (Collier & Löfstedt, 1997).

(2005), the sustainability of industrial regions, taking into account environmental performance of economic activities has been given limited attention. Johansson et al. (2005) take up the concept of distributed economies which involves that selected parts of economic activities are broken down to the regional level, where the various activities are organized as “small-scale, flexible units that are synergistically connected with each other and prioritize quality in their production” (Johansson et al., 2005:971). Regions can be regarded as jointly operating entities with the ability to create a ‘team spirit’ which can bring along collaboration and competitive benefits from alternative production systems. In contrast to centrally-planned large-scale projects that often fail to improve the local quality of life, distributed economies can bring fundamental issues of sustainable development closer to the individual, stimulating local efforts that foster the vitality of the region. Moreover, “[o]rganising regional activities mainly in the form of small-scale units will also allow for the local community to posses higher ownership and consequently gain more power in directing these systems in ways that add quality to their lives” (Johansson et al., 2005:975). This allows for more value to be added to local resources and the retention of the benefits in the region. The gains in quality of life made from this approach can be shared by a collective community with similar ambitions and values. Regional development is thus seen as a tool for testing new strategies to bring about the required changes for sustainability at a systemic level (Johansson et al., 2005).

4.3.6 Overview on the greening mechanisms

Table 4.1 below provides an overview on the greening mechanisms and their respective sub-themes. In Appendix 3, resulting from the next analysis step, the particular sub-theme giving rise to a valuable organizational capability or resource will be indicated. This allows tracing the analytical process and the conceptual origin of the capability. In addition, a more in-depth analysis of the bearing of certain sub-themes on the formation of capabilities and resources can be performed.

Table 4.1: Overview on greening mechanisms and sub-themes

Greening mechanism	Sub-themes
Environmental integration	• Technical integration • Processual integration • Supply-chain measures
Communication and learning	• Internal communication • External environmental communication • Open communication climate • Dialogue • Organizational learning • Cognitive and behavioral development • Learning types • Interfirm learning

Innovation	• Management Innovation • Open innovation • Absorptive capacity • Type of innovation • Degree of innovation
Cooperation	• Shared understanding • Cooperative IOrs • Formal and informal cooperative relationships • Determinants of cooperation • Cooperation related to the operational business of energy companies
Local embeddedness	• Territorial embeddedness • Promotion of green energy at the community level • Local identity as a strategic asset • Embeddedness at the municipal level • Regional sustainable development

4.4 Value creation

The third research question *"How can strategies for environmental sustainability contribute to the sustainable development of municipal energy companies and society?"* is fundamentally a question of value creation. Answering this research question requires additional analytical tools. With a point of departure in the resource-based view (RBV) as a theory for value creation, capabilities and resources represent suitable entities for the analysis of value creation, as argued in Section 2.12 of the method chapter. As outlined by Hart and Milstein (2003:62) "firms strive to solve social and environmental problems through the internal development or acquisition of new capabilities that address the sustainability challenge directly."

Based on this understanding, the next analytical step consists of establishing the capabilities and resources emanating from the greening mechanisms' dynamic features within each of the four strategic domains ('Analysis 3'). This is mainly done by synthesizing the analyses performed in the previous step ('Analysis 2'), and examining these in turn to establish capabilities and resources originating from working with strategies for environmental sustainability by virtue of the greening mechanisms. This adds an additional element to the main model as visualized in Figure 4.5.

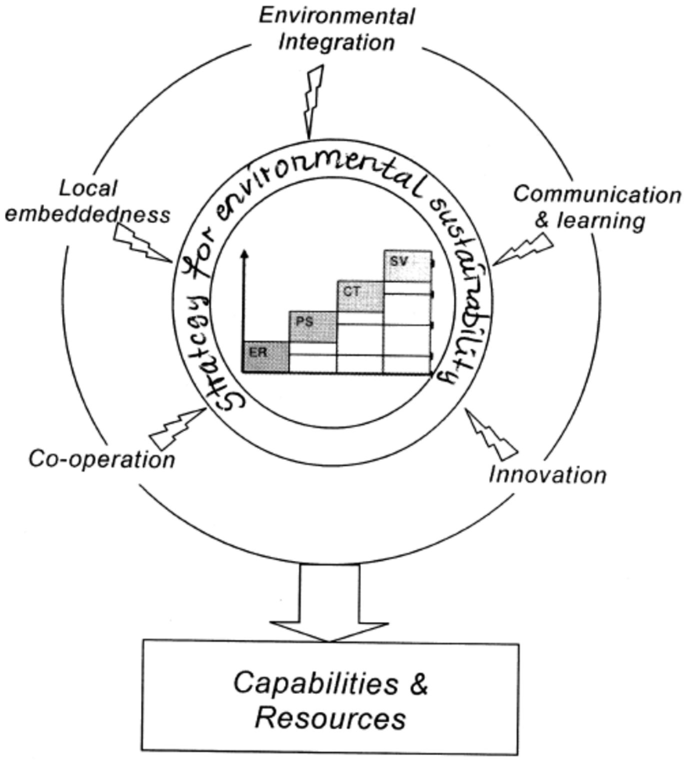


Figure 4.5: Five greening mechanisms and the formation of capabilities and resources

With the capabilities and resources enabling value creation at hand, the next question is what kind of value is created and for whom. As discussed in the previous chapter, the view on value creation within the RBV has traditionally been narrow. The notion of 'shared value creation' (Porter & Kramer, 2006, 2011), advocating the generation of economic value in ways that also create value for society by addressing its needs and challenges, emerged as a novel approach with a better capacity to integrate sustainable development concerns (see Section 3.5.1). With an interest in how the greening mechanisms elaborated can contribute to the sustainable development of municipal energy companies and society, the concept of 'shared value creation' is highly relevant. The fourth step of the analysis ('Analysis 4') therefore involves assessing the value creation potential of the capabilities in terms of value created for the firm and shared value created between the firm and society. Assessing this potential in the two dimensions, however, requires further operationalization. Relevant criteria for the analysis of *value creation for the firm* and *shared value creation* are elaborated in the next two sections.

4.4.1 Creating value for the firm

This section presents the tools that allow analyzing the capabilities originating from the case companies' environmentally sustainable strategies in terms of their capacity to create value for the firm ('Analysis 4'). Three value creation dimensions were considered relevant based on prior literature employing the RBV or the NRBV (Barney, 1991; Boyd et al., 2010; Hart, 1995; Hart & Dowell, 2011; Sharma & Vredenburg, 1998; Hastings, 1999). These three dimensions are *cost savings, corporate reputation, and future position*. Other potential value creation dimensions[85] were considered less prominent or inherent in one of the chosen dimensions. In the following, the rationales of the three dimensions are explained.

Cost savings

A prime catalyst for taking action on the environment are potential cost savings that arise from making business more efficient (Arroyo & Preston, 2007). As widely supported in the literature (e.g. Hart, 1995; Hart & Milstein, 2003; Hart & Dowell, 2011; Christmann, 2000; Marcus, 2005; Walls et al., 2011), an increased focus on corporate environmental sustainability can lead to a sustained competitive advantage due to lower costs. This value creation dimension refers to the efficiency properties of resources or capabilities, whereas efficiency is expressed in the ability to reduce costs (Kraaijenbrink et al., 2010). Technical fitness and/or productivity determine the efficiency of resources or capabilities (Leiblein, 2011).

Emitting harmful substances into the environment is considered to be a form of inefficiency or waste (Porter & van der Linde, 1995; Hart, 1995; Marcus, 2005). It is a sign of operational ineffectiveness, wasting resources and imposing unnecessary costs (Porter & Reinhardt, 2007). Frequently, emissions require a company to engage in non-value creating activities such as handling, storage and disposal (Porter & van der Linde, 1995). Consequently, within the scope of a strategy for environmental sustainability, cost savings can be made from reducing energy and resource consumption (e.g. Porter & van de Linde, 1995; Hart, 1995; Porter & Reinhardt, 2007), better utilization of raw materials and other inputs, and lower costs for waste disposal (Young, 1991; Hart & Milstein, 2003). Other benefits from a proactive environmental strategy are improved operations through increased process efficiency, increased productivity and process innovations (Sharma & Vredenburg, 1998).

Furthermore, cutting emissions can reduce the firm's compliance and liability costs (Rooney, 1993), including costs for emission allowances under the EU ETS (Hoffmann & Trautmann, 2008). Through the development of skills and capabilities in eco-efficiency and pollution prevention, firms can both lower costs and reduce risks (Hart & Milstein, 2003).

[85] For instance, employee morale, improved operations and management practices, and faster regulatory approvals are seen as other potential benefits of a proactive environmental strategy (Sharma & Vredenburg, 1998; see also Michalisin & Stinchfield, 2011).

Corporate reputation

Hart (1995:995) argues that there is a “vast amount of unclaimed reputation ‘space’ with respect to corporate environmental performance”. Reputation is considered a valuable intangible asset that can provide firms with a sustainable competitive advantage (Barney, 1991; Hall, 1992; Hart, 1995; Roberts & Dowling, 2002). Its value stems from its capacity to reduce the uncertainty stakeholders perceive when evaluating firms as potential suppliers of required products and services. Reputation is here defined as “stakeholders' perceptions about an organization's ability to create value relative to competitors” (Rindova et al., 2005:1033).

Reputation can be an important factor in achieving a competitive advantage through differentiation (Hall, 1992; Boyd et al., 2010) and competitive preemption in green product domains (Hart, 1995). Hart (1995) argues that the employment of pollution prevention and product stewardship strategies over time may lead to a differentiated reputation. In analogy with Hastings (1999) it is argued that differentiation by improved reputation may be important to achieve a competitive advantage in the energy business due to the limited opportunities for energy companies to achieve such an advantage from product or price differentiation (Summerton, 2004; Sandoff, 2006b).

Reputation can be considered as a strategic asset stock (Dierickx & Cool, 1989) that is non-tradable (Barney, 1991) and cannot be adjusted quickly. Following Dierickx & Cool (1989), a consistent pattern of resource flows (e.g. investments in sound environmental practices) is required to change a strategic assets stock (e.g. environmental reputation).
Rindova et al. (2005) posit that organizational reputation can be seen to consist of two dimensions. Firstly, a *perceived quality dimension* captures the degree to which stakeholders evaluate an organization positively on a specific attribute, for instance its ability to produce quality products. Secondly, the *prominence dimension* captures the degree to which a company receives broad collective recognition in its organizational field.

Viewed from the *perceived quality dimension*, reputation forms based on the actor’s past actions through which it signals its ‘true’ attributes to stakeholders (Clark & Montgomery, 1998). To evaluate the quality of a provider of goods or services, stakeholders rely on signals that disclose unobservable attributes which affect a firm’s ability to produce quality goods. When quality is difficult to evaluate prior to purchase, customers are likely to rely on strategic signals to form expectations about quality. Companies’ strategic choices with regard to the resources used to produce goods and services may influence perceptions of quality as these choices contain information about the companies’ underlying capabilities to produce quality goods (Rindova et al., 2005; Barney, 1991).

When it comes to the second dimension, choices and opinions of influential third parties vis-à-vis an organization may influence its *prominence*. Under conditions of uncertainty, individuals tend to base their decisions on others’ choices and opinions. Through the exchange of information among various actors in an organizational field, the uncertainty about the ‘true’ attributes of a firm is reduced. In addition, it is suggested that the two reputational dimensions are related; perceived quality also has an impact on prominence (Rindova et al., 2005). Hart (1995) adds that corporate reputation can be enhanced through transparency about corporate environmental impact, for instance by publishing voluntary environmental reports. Toms (2002) confirms that environmental disclosure contributes significantly to the creation of environmental reputation. Sharma and Vredenburg (1998) point out that companies develop trust and credibility by addressing stakeholder concerns, leading to a good corporate reputation.

The relationship between organizational reputation and economic payoffs is explained by several drivers. Firstly, a favorable reputation reduces stakeholder uncertainty about the value of the exchange, and hence can induce buyers to pay a price premium (Shapiro, 1983). A reputation for environmental leadership therefore increases sales to environmentally conscious customers (Russo & Fouts, 1997). A favorable corporate reputation is further seen to reduce the cost of capital, improve companies' attractiveness as an employer (Fombrun, 1996), and make them more attractive for strategic alliances with other firms (Dollinger et al., 1997). Sharma and Vredenburg (1998) argue that an improved corporate reputation due to a proactive environmental strategy may facilitate approval processes for new developments, leading to various financial savings. Hall (1992, 1993) further points at the fragility of corporate reputation. It takes years of demonstrated superior competence to build up, but it can easily be damaged. Once damaged, it takes a long time to replace. Hence, a firm's environmental reputation requires consistent actions and continued investments for it to be maintained (Russo & Fouts, 1997). Hall (1992) concludes that reputation should receive constant managerial attention.

Future position

Hamel and Prahalad (1989, 1994) see 'competing for the future' as a neglected dimension of competitive advantage. In addition to a concern for current performance and medium-term growth, the firm should be concerned with its future position and sources of competitive advantage. The importance of creating a favorable future position by focusing strongly on environmental sustainability is highlighted in the NRBV (Hart, 1995; Hart & Dowell, 2011) and the 'Sustainable Value Framework' (Hart & Milstein, 2003). For a proactive environmental strategy to result in competitive advantage, it must be future-oriented and go beyond regulatory compliance (Aragón-Correa, 1998).

The competitive advantage brought about by a sustainable development strategy lies in a favorable future position (Hart, 1995). The clean technology strategy refers to developing and acquiring skills, competencies and technologies that form the basis for future growth (Hart & Dowell, 2011). The aim is to generate crucial sustainable competencies required to reposition the firm for the development and exploitation of future markets (Hart & Milstein, 2003). Accordingly, the third value creation dimension refers to the effectiveness of resources and capabilities, i.e. to their capacity to increase future value (Kraaijenbrink et al., 2010).

Following the RBV, heterogeneous expectations about the future value of a strategic resource (or strategy) may affect future opportunities (Barney, 1986; Rumelt, 1987; Peteraf, 1993; Hart, 1995). Consequently, the value of a resource or capability resides in the complex options on future opportunities embedded in that resource that allow the firm to achieve a competitive position in the marketplace (Kogut & Kulatilaka, 1994). Capabilities can thus be framed as platforms that can create a generic set of resources and hence represent investments in future opportunities for the firm.

4.4.2 Creating shared value

Complex global environmental problems, stemming from multiple activities and interactions across social and natural systems (Auld et al., 2007), are profound challenges to sustainable development. The wickedness of these problems poses several major challenges to implementing sustainable solutions. Complexity and uncertainty as well as the long time horizons involved have been highlighted as key issues for sustainability (Voss & Kemp, 2006). In addition, wicked problems and social complexity represent forces of fragmentation, a condition in which information and knowledge are scattered, making collaboration difficult (Conklin, 2006). Members of academia (Gray, 1989; Hart, 1995) and other bodies (UNEP, 1992; Schmidheiny, 1992; Stern, 2006) emphasize that many societal actors need to get engaged if systemic changes towards sustainable development are to be achieved. Sustainability in the context of the energy business is a multidimensional concept, requiring thorough understanding and coordinated actions by many stakeholders (Schaad, 2011).

The objective here is to elaborate if the capabilities generated by pursuing strategies for environmental sustainability can help to alleviate or overcome obstacles regarding the transition to a more sustainable energy system in particular, and to improved environmental sustainability in general. This would lead to the creation of shared value between the firm and society. The potential of capabilities to create such value is examined with the help of three criteria: *transferability*, *coordination* and *far-sightedness,* which are outlined below.

Transferability

Transferability in the context of strategies for environmental sustainability refers to the capabilities' potential to *reduce* the imperfect imitability of valuable resources or capabilities. Under the resource-based view (RBV), imperfect imitability is a central tenet for maintaining a competitive advantage, whereas imitation is defined as "the diffusion of successful business models – defined in terms of resources deployed and/or activities performed – across the population of firms" (Ghemawat, 2001:84). Imitation is costly due to unique historical conditions, causal ambiguity and social complexity (Barney, 1991). The build-up of valuable resources and capabilities requires a long time-frame and evolves in a path dependent manner (e.g. Penrose, 1959).

So-called 'time compression diseconomies' pose a substantial barrier to imitation. The concept acknowledges that "some tasks simply take time to accomplish" (Nehrt, 1996:537).

These tasks are hard to accelerate by simply investing more money or manpower, resulting in diseconomies for firms that take late action (Dierickx & Cool, 1989). This also applies to environmental strategies: According to McGee (1998), 'green' strategies are developed over a long time-span and are hard to comprehend and imitate by other actors. It follows that firms that lag behind cannot catch up with early movers, since investing more in environmental management over a shorter period of time does not give the same effect as investing smaller amounts over a longer period of time. Learning curve effects also create an advantage when addressing environmental issues earlier than competitors. For instance, moving down the learning curve for environmental technologies results in lower costs for environmental strategies (Christmann, 2000).

The long time frame and complexity involved in managing the transition towards a sustainable energy system are notable obstacles to sustainable development. If companies are willing to share their capabilities built up under their strategy for environmental sustainability, the transition process could be accelerated (i.e. time compression diseconomies alleviated). This would involve sharing their expert knowledge with stakeholders (including competitors). If corporate capabilities promote the adoption of sustainable practices by stakeholders, the transition towards a sustainable energy system can be accelerated. This can for instance be achieved through spreading information or creating incentives for behavioral change. Furthermore, knowledge sharing is a prominent example of a capability that reduces the transferability problem, relieving time compression diseconomies. These thoughts are in line with Kraaijenbrink et al. (2010) arguing for a distinction between rivalrous and non-rivalrous resources within the RBV. While rivalrous resources are scarce, which involves that firms must compete to obtain them, there is no scarcity for non-rivalrous resources. To the contrary, deploying a non-rivalrous resource (such as knowledge) may increase it (Winter & Szulanski, 2001). Since deployment increases such a resource, it is advisable that this resource is deployed as widely and frequently as possible. The more it is deployed, the more advanced it will become (Kraaijenbrink et al., 2010). When a non-rivalrous resource increases after deployment, not only the firm, but also society can benefit. Shared value can be created when others apply that knowledge. Hence it is of interest to investigate whether capabilities originating from strategies for environmental sustainability are deployed in such a fashion, creating shared value.

Coordination

According to the resource-based view (Barney, 1991), social complexity represents a barrier to imitation. Simultaneously, it is an obstacle for the transition towards environmental sustainability. Social complexity is a property of the social network that engages with a problem or task, and a function of the number and diversity of actors who are involved (Conklin, 2006). A difficulty caused by social complexity is that it fragments meaning; terms and concepts are used in different ways by different stakeholders. Following Conklin (2006), given their social complexity, solving wicked problems such as climate change (Auld et al.,

2007) is primarily a social process. It is therefore important to build capacity to collaborate effectively on wicked problems.

From a resource-based perspective, social complexity refers to actions or resources that depend on a large number of people who engage in coordinated actions, be it in the firm or with stakeholders (Barney, 1991). This also implies that it is difficult for any individual to accumulate sufficient knowledge to grasp the entire phenomenon (Hart, 1995; Barney, 1991). Consequently, it is challenging for companies to systematically manage and influence socially complex resources. Internal to the firm, company culture and corporate reputation among customers are examples of socially complex resources (Barney, 1991). In the context of environmental strategies, emissions reduction necessitates socially complex skills as continuously improving environmental management requires the involvement of a large number of people. Product stewardship strategies are seen to involve socially complex skills such as communication across functions, organizational units and company boundaries (Hart, 1995). The exploitation of technology frequently requires the deployment of socially complex resources in order to fully exploit the technology (Barney, 1991). Hence, making full use of clean technology is challenging and depends on socially complex skills (due to the required changes in processes and the need for system knowledge). Similarly, establishing and operationalizing a sustainability vision is a process that requires rare skills (Hart, 1995) and is difficult to manage systematically.

It follows that handling social complexity is a key challenge when working with sustainability issues within the firm. However, working for a transition towards environmental sustainability and a sustainable energy system involves managing socially complex issues beyond corporate boundaries. If companies develop capabilities that allow them to effectively handle socially complex problems connected to managing sustainability issues within their wider organizational field, this would benefit society. Conklin (2001) mentions the creation of coherence as an antidote for fragmentation. Coherence refers to shared understanding and shared commitment, which are important prerequisites for moving forward in complex situations. If coherence can be increased, more collective intelligence will be available to cope with complexity. Consequently, capabilities that reduce coordination problems, slowing down the transition to more sustainable energy systems, can make a substantial contribution to environmental sustainability and would thus create shared value.

Far-sightedness

A widely addressed problem is that progress is slow when it comes to the transition towards low-carbon energy systems (e.g. Jacobsson & Johnson, 2000; Jacobsson & Bergek, 2004; IPCC, 2007b). Given the large uncertainties about the impact of climate change (Brewer, 2005) and the materialization of public policies (e.g. Kolk & Pinkse, 2007), companies often postpone decisions until more information is available (Rugman & Verbeke, 1998). This affects the pace and intensity of actions taken to mitigate climate change (Stern, 2006b). Ascher (2006) cautions that under uncertainty, more certain short-term benefits are often preferable to less certain long-term gains, even if the latter offer much greater potential benefits. Trapped in short-termism (e.g. Laverty, 1996), companies optimize operations in a short-term perspective rather than in the long term, which would be better suited in view of the infrastructural character of the energy business and the nature of the challenge. Enacting far-sighted strategies is a matter of tolerating short-term sacrifices to pursue longer-term gains (Ascher, 2006). Instead of looking backward and taking action based on past experience, forward reasoning is required (Auld et al, 2007).

The tragedy of the commons underlying global warming (e.g. Moser & Dilling, 2007) requires that the energy system is managed in a more responsible and sustainable manner. Certain actors need to assume responsibility for a limited portion of the energy system and act in a more far-sighted manner, promoting the transition towards a low carbon economy. This involves for instance taking the risks and costs of building up an infrastructure that allows for environmentally benign production and consumption. Facilitating for others to take greater responsibility for their actions, for instance by providing green products and services etc., would also reduce resistance to act in an environmentally-responsible way. Dilling and Farhar (2007) advocate the seamless embedding of efficiency and renewable energy into products and energy services to make it easy for customers to use sustainable energy products. Making the use of sustainable energy services and products easily accessible is seen as a critical element of a strategy towards greater sustainability (Dilling & Farhar, 2007).

Taking the responsibility to facilitate far-sighted systemic solutions would make a great contribution to the sustainable development of society. Corporate capabilities enabling others to make sustainable choices could create shared value between the company and society. An additional benefit of such far-sightedness would be that the local economy can develop in a sustainable way, both economically and environmentally. If companies take responsibility not only for their own bottom line, but also for the sustainable development of the municipality or region, shared value can be created.

4.4.3 Integrating value creation into the model

Adding the two sets of value creation dimensions to the main model results in Figure 4.6 below which now displays all the functional parts required for making a structured analysis of the empirical material. To sum up the last addition to the model, it is posited that the pursuit of a strategy for environmental sustainability results in the creation of valuable organizational capabilities and resources. These capabilities potentially generate value for the firm and shared value between the firm and society, as indicated by the arrow. The upper part of the oval shape catches the different dimensions of value creation. The left side of the figure focuses on the (traditional) value creation dimension, aiming at creating value for the firm (relating to Section 4.4.1). Accordingly, capabilities create firm value from *cost savings*, improved *reputation* and a favorable *future position*. On the right hand side, the creation of shared value is in focus (discussed in Section 4.4.2). Shared value can be created with the help of capabilities that facilitate the sustainable development of the energy system through *transferability*, *coordination* and *far-sightedness*.

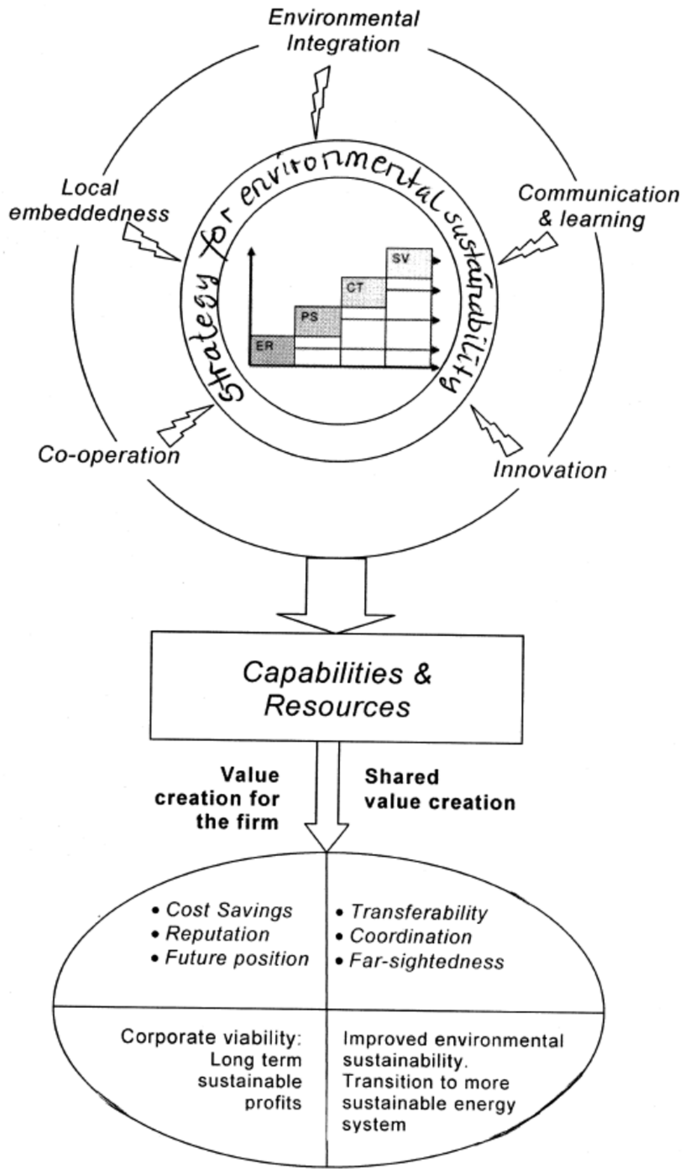


Figure 4.6: Value creation from pursuing a strategy for environmental sustainability

The lower part of the oval shape summarizes the main benefits of firm value creation and shared value creation. Value is created for the firm by enhancing corporate viability, which can be achieved through long-term sustainable profits. The foremost benefits provided to society and the firm jointly are the transition towards a more sustainable energy system and the contribution to environmental sustainability more generally.

4.4.4 Completing the main model of analysis

There are but a few additions necessary to complete the main model. These regard the inclusion of the organizational context as well as a feed-back loop indicating the reflexivity of the model, as outlined in Figure 4.7.

The organizational context at the top of the model is described in various parts of this thesis. Even if the context strongly influences corporate strategies for environmental sustainability, it is not as such the object of study.

Finally, the dotted arrow pointing back at the second part of the model represents an assumed feedback-loop that leads to the adaptation of the strategy for environmental sustainability and the mechanisms that aid its implementation. This is neither the object of study.

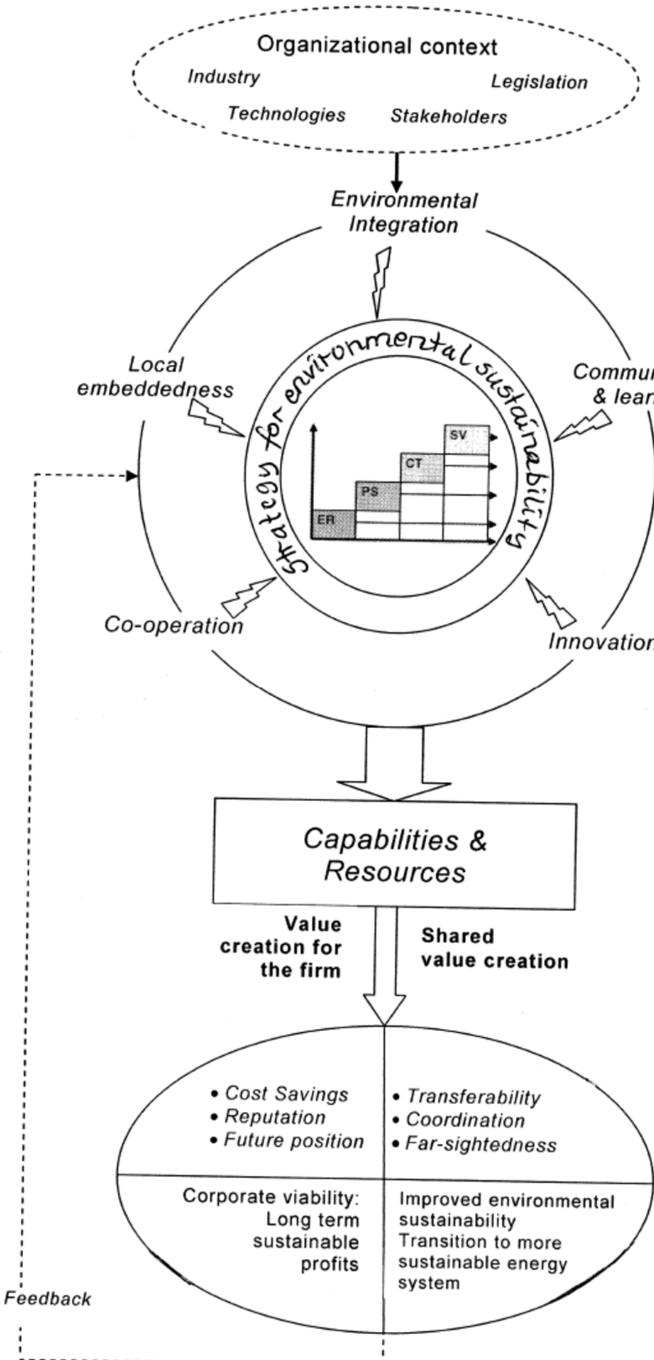


Figure 4.7: Main model of analysis

5 Empirical results

5.1 Introduction to the case studies

The following sections present the empirical findings of the three case studies. Each case consists of four parts. First an introduction of the company concerned is provided, including a brief review of the company history, its vision as well as information on its energy production system and environmental performance. Second, a short look is taken at corporate representatives' perception of the business–environment relationship. Third, the actual activities and practices that lead the companies towards improved environmental sustainability are reported upon, using the five greening mechanisms as a lens and structuring tool. Key topics under the greening mechanisms are written in bold and italics, while activities or practices categorized under the key topic are in italics. Fourth, an analysis of the activities and practices under each mechanism is made after every subsection ('Analysis 2'), using the '*Framework of conceptual areas of strategies for environmental sustainability*' (Figure 4.1) as an analysis tool. The analyses outline how the conceptual areas are manifested in the empirical context. Before proceeding to the case studies, which can be read in any order, a brief overview of the companies forming part of the study is given.

SouthEnGroup is a regional energy provider in Southern Sweden, acting as an umbrella for 19 smaller energy companies throughout the region. It has a total work force of about 450 employees. The group offers mainly electricity, district heating, cooling, and fuel gas. It has various windmill projects under investigation and plans to build a biomass-based cogeneration plant (150 MW), Gravel Site, which is its flag ship for the changeover to renewables. The group wants to be "the leading energy group with a strong local connection" (SouthEnGroup, 2007) and has recently set the long-term goal to become 'climate neutral'. It is jointly owned by four municipalities in Southern Sweden.

LocalEnCo is a local power and district heating provider in a metropolitan area. It currently has roughly 100 employees. The company is in the process of constructing Grove Hill, a biomass-based cogeneration plant (114 MW), which will enable it to expand and offer a wider product range. The corporate motto is to be “nearby and simple with a passion for the environment” (LocalEnCo, 2009). The local municipality owns 100 % of the company.

WestEnCo is the dominant player on the energy market in Western Sweden. The company employs approximately 1,000 people. WestEnCo mainly provides electricity, district heating and cooling, and is a forerunner in energy services and biogas development. Its district heating system is among the largest in Europe. The company operates a large-scale gas-powered cogeneration plant (555 MW) as well as Sweden’s largest biogas upgrading facility, besides various wind mills and district heating plants. Current plans involve building a large, cutting edge biomass gasification plant. The company is wholly owned by Western Municipality, and strives to actively contribute to ‘a sustainable Western society’ (WestEnCo, 2009).

5.2 SouthEnGroup

5.2.1 Introduction of SouthEnGroup and its energy system

SouthEnGroup is one of the larger regional actors in the Swedish energy landscape, active in electricity production, district heating and cooling, electricity sales, power network operations and natural gas, among other related activities. The group is headed by the parent company where strategy-making takes place[86], whereas its 18 subsidiaries operate under their local brand name in different municipalities across Southern Sweden. SouthEnGroup was formed in 2004 after the merger of two regional energy companies. It is jointly-owned by four municipalities within the region (one majority and three minority owners). The group supplies electricity to about 155,000 customers and has 7,200 district heating installations with customers spread across 20 municipalities. Currently, the group has roughly 450 employees. Its vision is stated as follows:

> We want to be the leading energy group with a strong local connection that, thanks to the support from common resources and a comprehensive and stable organization, can remain strong and competitive. (SouthEnGroup, 2007)

Hence, one of the building blocks of the group’s strategy is to safeguard its local roots. The business concept is defined as

> providing a good and comprehensive energy supply with high security of supply and low environmental impact. This should be done at a fair price and with a reasonable return. (SouthEnGroup, 2007)

The group strives for steady growth which allows for a broader resource base and economies of scale by streamlining operations. Acquisitions and collaboration agreements are an important element of this growth strategy. The group also sees its growth strategy as a way to safeguard the local energy business’ survival. One of its guiding principles is ‘continuous

[86] As a consequence, the parent company was the main focus of this study.

development'. The managing director stated that "change is a permanent state" in the group (SouthEnGroup, 2008). One aspect of change interesting to shed light on is how the energy production system evolved over time.

SouthEnGroup's predecessor company was founded in 1907 with the aim to electrify the town and in this way contribute to increased prosperity. In the 1950ies oil-based district heating was started up as a new enterprise. Fossil fuel based production dominated until 1984 when the company switched to producing district heating from geothermal wells as the first energy provider in Sweden. The company started its engagement in wind energy in 1990, followed by combined heat and power production based on natural gas in 1991. In 1995, a first natural gas fuel station was inaugurated, creating the base for the fuel gas business. The district cooling business took off in 1996, replacing smaller cooling units with customers. Through collaboration, the company gets hold of withdrawal rights for electricity in a Norwegian hydro power station in 1998. In 2002, a Deep Geothermal Energy Project is initiated with the prospect to secure extensive heat supplies for many years to come. The project however fails and is dropped in 2005.

Projects currently explored are all based on renewable energy. The group has approximately 25 small windmill projects in different stages under investigation, one near completion. Another project is test drilling for additional geothermal wells. Furthermore, a preliminary decision has been taken to install an additional turbine at the Norwegian hydro power station. The largest project that is yet in the planning stage is Gravel Site, a biomass-fired combined heat and power plant based on locally-produced straw and wood chips[87]. This project, costing approximately two billion Swedish Crowns, is the group's flag ship for the changeover to renewable energy. However, it has been delayed significantly due to litigation (SouthEnGroup, 2007). The Gravel Site project has been rejected by the Highest Environmental Court and this decision is now appealed against in the Supreme Court. At the time of writing, it is unknown if the group will obtain the concession to build the plant.

Table 5.1 below sets out the amount of energy produced in each production category and the amount of fuel gas distributed (in MWh) during the three-year period closest to the empirical study. Further the shares of production per energy source are indicated, whereas fossil fuel production is shaded dark (in % of the total MWh produced).

[87] 40 MW straw unit, 110 MW wood chips unit.

Table 5.1: SouthEnGroup's energy production

	Year	Total in MWh	Wind Power (%)	Natural gas & oil (%)	Waste Heat (%)	Geo-thermal/ heat pumps (%)	Hydro Power (%)	Biomass/ biofuel/ biogas (%)
Produced Power	2008 2007 2006	223 000 225 000 185 000	2.0 1.8 2.4	42.4 45.4 44.8	n/a	n/a	45.9 42.7 43.8	9.7 10.1 9.0
Produced Heat	2008 2007 2006	1 003 000 994 000 1 013 000	n/a	23.0 25.0 38.1	4.4 5.0 3.9	35.6 36.5 40.5	n/a	37.0 33.5 17.5
Produced Cooling	2008 2007 2006	65 000 56 000 61 000	n/a	 0.0 0.0	 0.0 0.0	100 100 100	n/a	 0.0 0.0
Fuel gas	2008 2007 2006	15 000 13 000 4 600	n/a	100 100 100	n/a	n/a	n/a	0.0 0.0 0.0

Source: SouthEnGroup (2007, 2008). Annual Reports; Environmental Reports.

Despite the fact that the use of renewable energy sources has grown over recent years, fossil-fuels remain the dominant source of the fuel gas and the electricity business. Nevertheless, looking at the emissions ratio per unit of energy produced, the impact has been reduced by roughly 40 percent over the same period[88].

Table 5.2: SouthEnGroup's CO_2 emissions

Year	Total in ton	Emissions ratio per unit of electricity, heat and cooling produced
2008	70 864	0.0549 ton CO_2/MWh
2007	80 975	0.0635 ton CO_2/MWh
2006	121 523	0.0965 ton CO_2/MWh

Source: SouthEnGroup (2008) Annual Report; Environmental Report.

5.2.2 The business – environment relationship

Before looking at the actual actions the group takes to manage the changeover to a sustainable energy system, it is of interest to give some insights in interviewees' perceptions of the relationship between the environment and corporate strategy. Are environmental goals and business performance perceived as conflicting or as going hand in hand?

The Business Development Manager, a member of the management team at SouthEnGroup, argues that it is challenging to reconcile the growth strategy with the environmental strategy:

> Looking more closely at the environmental aspects of our strategy, naturally, our strategic goal is to be a good example. We want our owners to be able to proudly proclaim that we follow all the rules and do all we can to safeguard the environment. This means that we have high aspirations to reduce our emissions etc. At the same time we have an expansion strategy – and here, there is a difficult balancing act – we want to grow since margins get smaller and smaller

88 The average emissions ratio for European power producers is ca. 0.4 ton CO2/MWh (Eurelectric, 2009)

> in a competitive market. This means you either grow or get taken over. Our aim is to grow through cooperations, acquisitions and new products. At the same time, we strive for being as environmentally-friendly as possible. (8)

When it comes to the question how environmental performance is related to financial performance, the views are quite uniform as the following statements illustrate

> In order to get good profitability, we need to be proficient in environmental issues. […] If we can solve the problem to get rid of fossil fuels, we are also going to manage finances. (9)

> Investing in environmentally beneficial measures, I believe, is a way to survive for us. (10)

> I believe there is a sound financial basis in this [changing to environmentally benign production], but at the same time I believe that having a very large share [of production] that is green strengthens our brands. I believe that this will become more and more important. (9)

These views witness that the environment has become a strong business driver. There is a widespread conviction that environmental and financial goals are interconnected. In the opinion of the Chief Financial Officer (CFO) it is beyond any doubt that environmental and financial goals go together.

> There is an established vision for the future that puts an equals sign (likhetstecken) between profitability and the environment, so that…everyone in this group has doubtlessly understood that, if we make environmentally smart investments, this will be a guarantee for those to be profitable as well. […] There very rarely is a conflict between the environment and profitability nowadays. (11)

To judge from these opinions, the relationship between environmental and financial performance is perceived as strongly positive. It seems thus reasonable to assume that strong importance is attached to directing corporate actions towards developing business along sustainable lines. The following section presents the actual activities performed by the group that are in accordance with sustainability goals.

5.2.3 Activities for environmental sustainability

Environmental integration

Integration into energy production system

Fuel switching at SouthEnGroup involved *replacing fossil fuel oils with palm acid oil*, a by-product of palm oil production, at most of its oil-based combustion plants. By purchasing palm acid oil exclusively from certified suppliers, it is made sure that the negative effects associated with palm oil production are limited. Switching to palm acid oil required some adjustments in the technical system, for instance replacing burners and pipes.

Energy efficiency measures included *installing economizers* that extract additional energy from the flue gases after combustion at one of the large combustion plants. The building of an additional pipeline, *linking two district heating systems* in different municipalities together, augments flexibility and thereby increases efficiency according to the CEO of the production company:

> This really makes sense! We can optimize production in a much better way now. In municipality A we have a fluidized bed [type of combustion plant] fuelled with wood chips. We can use this plant to its full capacity and send the heat to municipality B [with a less beneficial fuel mix] if not all heat is needed in A. This is definitely positive. (9)

The possibility to connect a further separate system to the main district heating system is under consideration. The group also investigates the possibilities to *connect two separate cooling networks* in order to increase efficiency.

Under ***upgrading of power plants****,* the *installation of an accumulator tank* for overnight hot water storage makes it possible to avoid peak-load production with fossil fuels. Instead, heat can be produced when environmentally beneficial production capacity is available and distributed when demand is high. The *replacement of environmentally degrading cooling media* in heat pumps with a sounder alternative is a further upgrading measure. An *investment in a smaller district heating plant*, one unit based on pellets and one unit based on palm acid oil upgraded the facility and replaced an older, fossil-fuel based unit.

The ***usage of waste*** at SouthEnGroup features two activities. One of its combustion plants uses local waste, mostly from construction work, as a fuel. In recent years, the fractions of plastic and paper have been removed and only wood is burned, making it more environmentally-friendly.

The burning of especially solid fuels in combustion plants results in fly ash and solid ash as residuals. In order to reduce the impact on nature from production, it is of interest to reuse these ashes instead of depositing them in landfills. SouthEnGroup *exports fly ash* to Norway where it is used as filling material, whereas *solid ashes* from wood chips and other biomass combustion are *spread in forests*.

Integration into management systems

SouthEnGroup has been working with an environmental policy since 1998 and has certified its environmental management system according to ISO 14001 the same year. This seemed to be an important step according to the CEO of the production company:

> The big changes happened already when we became ISO 14001 certified since this triggered our focus on the environment. […] So I believe that many employees clearly became more environmentally aware through the fact that we got ISO certified. (9)

The company has thus a long track record of environmental management. Since continuous improvements are the core of environmental management systems, it can be expected that such long experience with the system has led to high standards in environmental management. The Environmental Manager is a key actor in the development of the environmental management system since she has the task to improve and control the environmental performance of the group.

In 2008, ***environmental goals*** were sharpened considerably when the group decided to *become 'climate-neutral'*. The Environmental Manager explains the reason for this as follows:

> Well, actually we have been talking about becoming fossil-free for a long time, but then the focus was mostly on production, to get rid of oil and natural gas.... However, I take a more comprehensive look at this; I look at what we do internally, our business travels, company cars, our own energy consumption and all these aspects. So I wanted to take an all-embracing approach...there was a lot of focus to communicate externally: the environment is important for us now. In my view we need to do the same thing internally if we want to gain credibility! (7)

Launching the project climate-neutral company[89] meant that all greenhouse gas emissions of the group are to be mapped annually and measures are taken to reduce emissions as much as possible. The remaining balance is then compensated by way of emission reducing projects abroad[90].

When it comes to the actual routines for environmental goals, the production company is most interesting to study. There, *environmental goals are measured and followed up* on a monthly basis. Moreover, the follow-up of *environmental goals is a standing point on the management meeting agenda of the production company*, making sure that environmental issues are discussed on a regular basis. These discussions are an important node interconnecting the technical components associated with energy production with the social aspects of environmental management.

In order to achieve continuous improvements across the group, *environmental goals are revised on a yearly basis* at the company level, whereas the environmental coordinator and the CEO of each group company are responsible for revising their goals.

A sign of the ***integration of environmental criteria in management processes*** at SouthEnGroup is that environmental measures are part of its performance management tool *Balanced Scorecard (BSC[91])*. Environmental performance represents an important aspect of the 'internal business processes perspective', one out of five perspectives of the BSC. This implies that environmental performance also has been built into the *staff incentive system* that is based on BSC. A further activity is that *environmental goals are built into the business plans* at each of the various group companies. Earlier, business objectives and environmental objectives were treated as separate issues.

A further expression of the integration of environmental concerns is that the group takes responsibility for good environmental performance beyond its corporate borders. *Environmental performance is a criterion for the choice of suppliers and subcontractors;* hence suppliers are scrutinized for the environmental impact of their business and products. Routines have been established to form an opinion on how the product was manufactured and what the environmental impact will be when it is taken out of use.

Investment planning and implementation featured the following notable activities. Looking at the *calculation praxis* for new investments, SouthEnGroup uses the same hurdle

---

[89] An initiative brought forward by the Environmental Manager.

[90] For more information refer to Respect Europe: http://www.respecteurope.com/villkorf%c3%b6rklimatneutralitet.aspx

[91] The main purpose of a BSC is to act as a link between the organization's strategy and its actions, enabling the evaluation and control of internal processes and outcomes (Wikström, 2010).

rate for all production investments. However, the payback time varies and ranges between four and 25 years, depending on the type of investment[92]. Strategic investments are not judged according to pre-set principles, but examined on an individual basis. *Environmental concerns are integrated in investment proposals*; the environmental impact of an investment is described in the documentation and is one of the criteria for investment decisions, although financial considerations admittedly dominate. The Development Manager commented as follows on how the environment feeds into the business development process:

> I do believe that the environment is a strong business driver now, definitely. At the same time I wouldn't say that we focus on projects that are environmental projects, our business is to a great extent guided by return, risk and price, but naturally, environmental aspects are a part of this and a strong element in the discussions, but they are not the driver. (8)

To name but a few activities aiming at ***reducing internal non production-related environmental impact***, the group has for instance implemented *guidelines for company cars,* putting up environmental objectives such as increasing the share of fuel gas and gas driven vehicles. Also, *fuel-efficient driving* is promoted by providing eco-driving courses to employees. Moreover, guidelines have been established for business travels and meetings; whenever possible, *environmentally-friendly travel alternatives should be chosen*. In addition, the portion of *telephone and web-meetings* should be increased. Conferences organized by the group should be climate-neutral and held within the region. The CFO of the group highlights that this very much is about changing established behavioural patterns:

> […] there is a stronger drive to make clients change to Internet invoices and see to that we receive Internet invoices at the finance department now. We focus on sorting waste, reduce our electricity consumption, 'switch-off, close-down and remove', switch off the lights, turn off what you're not using, and remove what you can do without. The latest is that, in principle, no one has an own printer in his room anymore, there are only central printers now. (11)

A further area where environmental concerns were integrated was for the construction of a new office building in 2007; the site was built in an energy-efficient way with a low impact on the environment and equipped with solar panels[93].

Analysis: Environmental integration

Emissions reduction: As a result of its long-term systematic work with environmental issues, the company has come far with integrating environmental concerns into all aspects of the organization. Looking at the production system, carbon emissions were substantially reduced over the past two years. Routines are in place to reduce the environmental impact within the supply-chain. A multitude of small non-production related improvements are in the implementation stage. The recent decision to head towards climate neutrality ensures that

[92] Due to the strategic nature of such information, no further details could be revealed.

[93] Furthermore, the building is equipped with self-regulating lights that adapt to the intensity of outside sun light and motion detectors switching on the lights. The building frame, concrete frontage and isolation follow energy-efficient standards. All paint used is water soluble.

emission reductions are worked with systematically throughout the group once guidelines and routines have been established and implemented. Yet, to achieve substantial further improvements, the implementation of the Gravel Site project is a necessity.

Product stewardship: Changing from fossil oil to bio-oil as input fuel led to a more environmentally-friendly production of district heat. These changes are seen as interim solutions and, assumingly, are mainly cost driven. Thus the changes do currently not result in a more overarching product stewardship strategy.

Clean technology: Technical measures focused on incremental changes to the production system, leading to efficiency improvements that yield cost savings and environmental gains. For example, the investment in a connecting pipeline improved flexibility, leading to a better utilization rate of existing renewable production resources. However, many investments are held up due to uncertainty if and when the Gravel Site plant can be built. Moreover, a different set of investment criteria is applied for strategic investments compared to commercial investments, creating better conditions for a transition to clean technologies.

Sustainability vision: The commitment to climate neutrality is a major step that will lead to systematic efforts to mitigate the environmental impact from the entire business beyond ISO 14001 standards. It can be seen as a strong force to align the group's environmental efforts behind a common goal and create a roadmap for the future. Again, for the vision to be realized, it is crucial that Gravel Site can be built.

Communication and learning

Within ***environmental network activities***, e*nvironmental scanning* is an important activity of the Environmental Manager, enabling him to act upon relevant news or new rules and legislations not only at a regional or national level, but also at a EU level. The scanning is done with the help of news services but in addition, internal discussions with other departments are considered vital for making sense of new issues arising. Regarding the dissemination of environmental information, monthly g*roup level meetings* with all environmental coordinators make sure that important issues emerging from environmental scanning are communicated to the group companies and action plans are established to deal with these challenges. This procedure ensures that the environmental work centrally planned by the Environmental Manager permeates the whole group. It also makes sure that standards required by ISO 14001 are met throughout the group.

The Environmental Manager further sees *external environmental network gatherings* with environmental coordinators of the municipality, business associations, professional networks etc. to provide valuable input to her work. Such gatherings serve as an arena for discussing practical problems within a community of practice.

Further activities speeding up learning are the *employment of an external consultant* to launch the project climate-neutral company that involved mapping and computing of all greenhouse gas emissions by the group. Employment of external consultants in the start-up process has also previously been observed as a factor contributing significantly to achieving good results from environmental management (Welford, 1996; Andersen & Neergaard, 2005).

Environmental training at SouthEnGroup involved a full day of *environmental introduction* for new employees. Obviously, this is part of the group's efforts to socialize new employees into corporate culture and values. In order to increase environmental commitment among existing staff, *yearly refresher training* on a current environmental issue is given to all employees. Occasionally, employees are given *on-site environmental training,* this in order to increase acceptance for changes taking place. For example, changing to bio-oil led to resistance by employees due to odour, which made it necessary to inform and persuade the workers of the environmental benefits of the new fuel.

External environmental training is another activity of the group. Providing environmental training to the Board of Directors, consisting of local politicians, can be considered crucial for their understanding of the group's impact on the environment and how it can be mitigated. The Environmental Manager confirms that:

> The environment has become a prioritized issue for the owner and the board during the past couple of years. There is a strong focus on the environment and all members are very knowledgeable. […] It is just no longer possible to be a member of the board or the management team in the energy sector and not be well informed about environmental issues. This just doesn't work any longer since there is such a tight connection. (7)

A green mindset thus seems to be a prerequisite to setting priorities right. This is also the focus of the next topic.

Since ***green organizational culture*** is a complex phenomenon and requires substantial time to develop, this study can only catch immediate revelations of the phenomenon. One observation is that, according to respondents, there is strong environmental consciousness and a collaborative atmosphere among employees which leads to *suggestions for environmental improvements* at all levels. The CEO of the production company mentions that:

> […] there is no doubt that both I and the employees are more conscious about 'the little details'. When it comes to chemicals, we have lubricants and solvents, there is a much bigger interest to find alternatives. 'This one is recommended, it's less harmful, let's replace the old stuff'. I find this very strong! (9)

An *open communication climate* also seems to facilitate employee involvement. Several interviewees mentioned that anyone can contact the management and bring up new ideas ('Det är högt i taket'). This open climate makes employees feel free to express their opinions, allowing for information to flow freely.

An artefact of a green organizational culture is the *group-wide television network* in recreation areas broadcasting internal information and tips how to act climate-smart. Environmental concerns seem to have reached a 'taken for granted' status within the group and have become a natural part of its culture.

Interestingly, the environmental challenge also triggered *critical reflections* on the company purpose and, tentatively, also led to a mission re-definition as the following statement of the Head of Market Analysis illustrates:

> Up here [at the head office] we discuss: 'Are we an energy provider or a provider of environmental services, what is it we are?', so to speak.[…] I believe that, as an energy company, you have to change your way of thinking. You are no longer an energy company but an environmental company, since energy companies are those that can do most to improve the environment. (10)

Regarding ***environmental communication*** at SouthEnGroup*,* naturally the home page with well-developed environmental information is the most common instrument for communicating what the group stands for. However, the company also has a pronounced *communication strategy* according to the Environmental Manager:

> […] we have a strategy for being visible; we want to tell people what we do, even so about our environmental work. […] We want to be perceived as an environmentally-friendly company, so it's important that we give information about this but also get information in from customers about what they want to know. […] However, it is important to put the resources where they come to use. There has to be a balance between putting resources on environmental initiatives and putting resources on communication, otherwise it is just publicity. (7)

Another way of communicating about environmental issues is the *publication of environmental information* by way of separate environmental reports[94]. A further activity was the *publication of a book on energy and the environment* that can be ordered for free. The group has also held a *seminary related to the environment* following its annual meeting for the second year in a row.

Internal competency building refers to the competencies the interviewees at SouthEnGroup perceived as vital in order to implement investments in new production facilities. Three competence areas were named, *technical competences* which include environmental aspects, *financial competence* which mainly refer to financing and *legal competence*, associated with obtaining permits. Expert competence within these areas is needed to make a valid risk assessment of a project in all three dimensions. A conclusion from the combined heat and power project that was temporarily stopped up is that the strengths and weaknesses of a project have to be thoroughly assessed before further developing a project. In addition, these three areas have to be developed in parallel and coordinated internally. Furthermore, the *maintenance of a good credit rating* is a vital endeavor to ensure that planned projects also can be realized. Given the long-term nature and large investments such projects involve, it is particularly important to obtain financing at beneficial conditions. Despite being publicly-owned, the group can not get loans with the municipality as a guarantor, which would allow for far better financing terms. Instead it has

[94] The establishment of a separate environmental report is voluntary.

to prove its creditworthiness based on own qualifications[95]. The group thus requested to get rated by Standard & Poors and a Nordic rating agency[96].

SouthEnCo's activities demonstrate ***that stakeholder involvement and negotiations*** are a prerequisite to managing investments in new production capacity. The group held *consultation meetings with nearby residents* regarding the Gravel Site project, which is a mandatory activity according to the Swedish Environmental Code. The purpose is to inform about the project's location, scope, design and its environmental impact (Government Offices of Sweden, 1999). Viewpoints from citizens gathered at the meetings should be taken into account in the formal application to the authorities. A further activity undertaken by the group to create trust was to issue a *monthly leaflet to nearby residents* informing not only about current issues related to the planned project, but also on other local events and phenomena of interest. Furthermore, in order to increase acceptance for the project, *concessions for municipality development* were made. A contract was signed in which the group agreed to build a bicycle track, to renovate the town hall and to pay for improving a street crossing. This reflects that creating political and public acceptance is a negotiation process of which the creation of trust is an essential part in addition to compliance with statutory rules.

Business development refers to activities connected to developing SouthEnGroup in different aspects. Plans for the expansion of the group by way of cooperations, alliances, new business areas etc. are dealt with at a central development department. Evidently, continuous environmental scanning and external contacts with trade association and other stakeholders are important even here in order to catch and take a position to new relevant issues. From the interviews it became obvious that the only acceptable direction for business development was towards renewable technologies since this was perceived as both profitable and the right thing to do. Business development goes thus hand in hand with sustainable development. At a business unit level, there are *development managers* who are responsible for the respective business. These are connected laterally by way of network activities to enable better communication and coordination. Finally, a *reference group* with young professionals from different business areas is tied to the management team, providing input and viewpoints from the different business units. The rationale for this is that the management team often is involved in political considerations and needs to reconnect with business reality. These last two activities point to that the interconnectedness between business units and low and high level staff within the group is vital for a sound business development. Communication across corporate and functional boundaries helps to create a shared and reflexive understanding about company goals and pathways of development.

---

95 According to Lombardo and D'orio (2012), a firm that performs well on the environmental dimension, all other things equal, obtains higher credit ratings and has larger possibilities to attract funds from green investors at favorable conditions.

96 The situation on financial markets was very strained during the later part of this study. As a consequence the group was down-rated slightly (S&P rating BBB, Nordic Rating K2), however maintaining an investment grade. From the interviews it became clear that financing environmentally beneficial projects (that usually have a long pay-back time) currently was extremely difficult.

Analysis: communication and learning

Emissions reduction: Communication and learning facilitate emissions reductions for example through knowledge exchange within a community of practice. Inputs from other professionals facing similar challenges allow the Environmental Manager to develop the environmental work of the group further. Regular face to face meetings with environmental coordinators ensure that central knowledge is disseminated and environmental standards implemented throughout the group. Considering that learning is a necessity to accomplish change, regular environmental training is essential to support the green culture, engage employees in the task to cut emissions and activate their creativity to find ways to conduct business in a more environmentally-friendly way. In sum, the group seems to have created a good environment for employee involvement in environmental improvements.

Product stewardship: Learning related to product stewardship is in its initial phase. Here accepted norms are challenged by asking oneself if the mission of energy companies has changed from energy provider to a provider of environmental services. This thinking needs to be developed further before a full-fledged concept can be advanced as to how these insights impact the current business model (comparable to the cognitive process of double-loop learning, where problem-defining skills are required). Frequent communication about corporate environmental performance and projects as well as publications and events related to the environment potentially improves the relation with stakeholders and contributes to creating a green profile.

Clean technology: Interviewees emphasize that competencies in different areas are required to make a valid risk assessment for the large CHP investment project, making learning-by-doing a risky approach. Failure to thoroughly assess the risks of such investment can result in sunk costs and delay the planned transition to cleaner production technology substantially. Communication is a necessity for creating acceptance for new projects, be it with the owners of the group or with other parties involved. Large investment projects such as the Gravel Site plant are often perceived as a threat by the local community. Informing and communicating on the benefits of such clean technology investment can at the very least open up for a constructive dialogue with opponents. The issuance of a leaflet to locals shows that resources have been allocated to mitigate the risk of litigation. However, it did little to appease the local opposition. In connection with the financing of clean technology, it is particularly important that the group can convey a favorable picture of themselves to financial market players, resulting in a good credit rating and consequently beneficial financing conditions. This can also be seen as a negotiating and learning process.

Sustainability vision: Communication is essential to making employees and external stakeholders understand the challenges the group faces and connect them to the related goals and vision. Communicating a development trajectory leading towards this vision may lead to committed employees, loyal customers and more collaborative stakeholders.

Innovation

The environmental challenge as formulated by the Head of Market Analysis makes it seem beyond any doubt that radical changes will be required for the company to stay competitive:

> I also believe that the environmental focus [of customers] is going to grow stronger, definitely, and this means that… 2013, we have to be climate-neutral. We have to be able to offer climate-neutral power supplies as this is going to be an important hygiene factor. […] Our gas [in fuel sales] has to become biogas and our district heat has to become entirely climate-neutral, otherwise we will be losing customers such as building societies. (10)

The perceived change in customer preferences will require firm action by the company to change its resource base and products in order to comply with market demands. Innovations can be thought of as playing an important part in this.

Green product offers at SouthEnGroup relate to electricity, district heating and energy services. For *green electricity*, a number of choices additional to the standard agreement are available to customers; Ordinary green electricity, wind power electricity and environmentally-certified green electricity ('Good environmental choice') can be purchased for a small premium. Within district heating, *climate-neutral district heat* is sold to business customers on request. It is seen as probable that this could become a new product in the long run. Furthermore, the group aims at establishing *energy services as a new business line*. Hence the possibilities of selling energy consultancy services for district heating or energy efficiency abroad are investigated. Another potential new energy service that is under investigation is to offer energy efficiency inspections for residential buildings.
SouthEnGroup maintains a *close dialogue with its business customers*. It is seen as important to be sensitive to customer views. This sometimes generates suggestions for improvements and ideas for new products. Coupled to this, a product development group works with designing new products or services that are then tested with a customer focus group.

A first step in the ***phase-in of green products*** was taken by *providing green electricity automatically to customers that do not make an active tariff choice*. Other desirable activities are so far only formulated as goals. SouthEnGroup sees it as a necessity to phase in green electricity to all customers without charging extra in the longer term. However, due to the higher cost this incurs, other sources of income will have to be found to compensate, for example offering chargeable energy services. For the fuel gas business, the goal is to *phase in biogas in the distributed fuel gas* and gradually increase the renewable share. One way to reach this objective is the ***phase-in of green technology***. Currently, a *biogas recovery and upgrading plant* is being built in cooperation with the public water treatment company[97] supporting the aim to increase the share of renewables in the distributed fuel. The group also *closely follows the development regarding solar panels* and emerging business opportunities. A venture in this area is however not considered economically feasible yet.

[97] With a capacity of 7 GWh upgraded biogas per year. About 15 % of the investment will be subsidized.

Demand-side management at the group entails a number of activities. Targeting the consumer market[98], the group has the goal to *mobilize customers to save energy* by raising awareness on their energy consumption. This new strategy for energy services is built upon several pillars. Firstly, *energy saving advice* is provided on the home page. Secondly, a free *CO_2 calculator program* for mobile phones is provided, allowing customers to track their CO_2 footprint. Furthermore, *energy measurement displays* are sold to customers (at a reduced rate), enabling them to track their energy consumption and costs. Finally, a free *statistics service* will be launched allowing every customer to check his energy consumption on a continuous basis. Further projects creating incentives to save energy are in the development phase. At the base of this strategy lies the *installation of remote meter reading* with all customers[99]. By enabling continuous reading of customers' energy consumption, the new system creates a basis for an improved dialogue with customers and builds the foundation for new energy services.

When it comes to ***research and development***, SouthEnGroup conducts no cutting edge research activities in-house. Instead it relies on a relatively small technology and development unit under the energy production company. In addition, the group participates in some *external research and development* programs, either by financing such activities or through active involvement. For example it participates in a *joint research project with a university for ash re-use*. Further, it makes a *financial contribution to a joint wind farm research project*[100] and *participates in a research project for electric cars* through Elforsk[101].

Analysis: Innovation

Emissions reduction: Innovations related to demand-side management could have a large impact on the amount of emissions if they effectively lead to lower consumption. Such innovations potentially influence the design of the production-consumption system. Here, open system innovation in an industry forum would seem particularly adequate to join resources and create common platforms. Regarding the environmental impact of operations, innovations are mostly of the autonomous type, aiming at system optimization. Innovations at the production company can lead to further emission reductions through system redesign.

Product stewardship: The innovation to build renewable power into the pricing model by default for those customers who failed to make an active choice seems a good way to increase the volume of renewable electricity consumed. This way, customers have to make an active choice to reject renewable power, which might be a bigger step than taking the decision to pay extra for renewable power under other pricing schemes. Generally, the small

[98] Consumer market refers to the sale of products and services to individuals or households, whereas the industrial market involves selling goods or services to business customers.

[99] Monthly meter reading is a legal requirement from 1 July 2009; hence the installation as such cannot be considered an innovation.

[100] Vindforsk II

[101] The Swedish energy industry's joint research and development coordinator.

margins in the power market seem to leave little room for innovations. With regard to the demand for climate-neutral district heat, the current model to sell this product on request is seen as an interim solution. The fact that this eventually might result in a new product shows that product stewardship strategies are incremental and based on a learning process. This might also be a consequence of the need for systemic innovations across different organizational units.

Clean technology: Uncertainty whether or not the Gravel Site project can be realized keeps current innovation activities on hold. The realization of the investment would involve a radical change of the production system, resulting in a system re-design. In the gas business, efforts are undertaken to phase-in clean technology and produce own biogas. Although based on tested technology, this represents an innovation from the group's point of view. It integrates a further element into the value chain and takes the group one step closer to making its fuel gas business sustainable, evidently strengthening the viability of the product.

Sustainability vision: The corporate vision to become climate neutral is a management innovation to align corporate activities behind a common goal and motivate employees throughout the group. A number of further innovations are obviously required if the company is to follow this vision. The vision is expressed in internal policies and management approaches that strive towards reducing the environmental impact of business. Regarding the environmental impact of operations, innovations are mostly of the autonomous type, aiming at system optimization. Currently, there is a gap between the vision and practices, mainly due to the delayed investment in the large biomass-fired CHP plant. However, various ways to achieve the goal are considered and innovations are in the pipeline.

Cooperation

One form of cooperation is the ***connection of external heat*** suppliers to the district heating system. This form of outsourcing is a convenient way to increase the portion of renewable fuels in the system. *Biomass-generated heat is produced at three nearby farms* and delivered to the district heating system all year round. Two farms use straw, a waste product from their grain production, as fuel. The third farm burns wood chips. According to the CEO of the production company, this cooperation is very favorable for all parties, not least due to the pricing model chosen. The difference in cost between heat production with natural gas and heat production with biomass is calculated and savings are divided between the group and the respective farm. Furthermore, there is a *cooperation with an industrial facility* producing surplus heat during the coldest season of the year. Connecting the facility to the district heating network makes heat deliveries equaling the yearly consumption of about 2000 single houses possible, thereby making use of energy that otherwise would have been wasted.

In order to secure ***access to renewable energy sources*** and increase the sustainability of its products, SouthEnGroup *continuously searches for cooperation partners* that could contribute to making the production mix more sustainable, for example farmers producing biogas. Furthermore, it *purchases wind energy directly from wind mill owners*. The group also *has a minority holding in a sustainable fuel producer* (25 % holding in a regional energy farming company producing rapeseed oil for fuel purposes). A further activity is the *signing of a Declaration of Intent* to contribute with energy solutions to a potential 'state of the art' research site nearby. If this project materializes, SouthEnGroup can take care of a large amount of excess heat from the research site[102].

Cooperative ventures refer to developing clean technology investments in a joint effort. Under this label, the group *cooperates with other publicly-owned energy companies* to jointly bring about larger wind farm projects. Cooperation with other smaller actors in the wind mill business is also seen as a convenient way to develop wind energy. Instead of developing own wind farm projects, the group cooperates with actors that have established wind mills already or are in the process of doing so. This spares the group from engaging in the costly and time-consuming application process for wind mill construction. Such cooperation involves joining resources (e.g. for financing) and competencies for project development, which facilitates a smoother realization of projects. Furthermore, the group has a 10 % *holding in a wind power development company* that promotes wind farm projects in cooperation with landowners and nearby residents.[103] This proved to be a favorable approach, reducing the NIMBY[104] problem significantly, perhaps because of the involvement of all parties that hold a stake in such venture. Furthermore, the group mentions that their *established contacts with a large foreign player* in the energy business, that has a strong focus on renewables, might yield interesting possibilities for future cooperation.

Cooperation for sustainable development at SouthEnGroup embraces a number of stakeholders. The municipality is an important cooperation partner since there are strong common interests such as reducing emissions and the impact on the climate. Cooperation in areas instrumental to making the energy system more sustainable is thus crucial. The promotion of district heating and fuel gas are two prominent examples. For instance, the group cooperates with the local authority's land use planning department to *promote the installation of district heating* with new housing constructions. This is seen as vital to district heating expansion, mostly due to the fact that there is fierce competition from other technologies such as heat pumps[105]. According to the Environmental Manager, the municipality is sometimes but not always ahead in the development. Climate goals and

[102]So-called seasonal thermal storage will be used, i.e. during summer the heat is stored underground for use during the cold period.

[103]Windmills provide an extra income for farmers who own the land, whereas the costs for financing the windmill are borne by a cooperative consisting of the development company, the farmer and nearby residents.

[104]NIMBY stands for Not In My Back Yard and refers to that local residents, despite being positive to a technology, are against locating such project in their neighborhood.

[105]These are preferred by the property developers because of their lower initial costs. However, they involve higher running costs for the buyers of the property.

actions reportedly are an important part of local policies, particularly in the area of transport (Khan, 2007). However, there is not always internal alignment with these policies. SouthEnGroup tries for instance to *speed up the transition to gas driven cars* in the municipality's car fleet.

The group also stands in *cooperation with the local car-pool*[106] that disposes of the group's mostly gas-driven company cars during non-office hours. A further area for cooperation is energy services. Not offering any energy saving services in-house[107], the group stands in *cooperation with a company offering energy saving solutions for property owners*.

The group is very keen to *cooperate* with other mostly small, local energy companies. This cooperation functions in the form of a network. The CFO mentions that

> In principle, we have some form of cooperation with all of the small energy companies in Southern Sweden. (11)

An effect of such cooperation is that the partners enter into agreements to share resources, such as running common emergency services or sharing IT-platforms. It can be argued that mostly economic motives stand behind such efforts. Nevertheless, it also benefits the environment if resource consumption can be reduced through cooperation and sharing resources.

Analysis: Cooperation

Emissions reduction: The cooperation with external heat suppliers based on bio-fuels is an innovative form of collaboration leading to a better production mix and lower emissions. It has led to a redesign of the production system, phasing in local renewable resources. An important characteristic of the cooperation is a pricing model that emphasizes fairness. Also cooperation with industry to make use of waste heat is an important piece of the puzzle to make district heat more sustainable.

Product stewardship: Cooperation is important for the promotion of fuel gas and district heating. District heat has become more sustainable thanks to cooperations which could eventually lead to strengthening the position of district heat as a product in relation to competing technologies. The product 'strategy' is also based on the belief that climate-neutral district heat is a must if this heating alternative is to stay competitive. Generally, the company is heavily dependent on external resources to make its existing products (especially district heating and fuel gas) more sustainable or diversify its product portfolio. Different forms of cooperations are an effective tactics to tie resources to the company without requiring a large financial commitment.

Clean technology: In the case of wind farms, a cooperative business model involving stakeholders led to a stronger acceptance of the technology, thereby strengthening the position of this clean technology. Cooperation seems an important means to develop an

[106] An economic association (ekonomisk förening).
[107] The group only performs energy inspections.

economically and socially viable wind farm business. Biogas ventures almost by definition require cooperation among different players due to the nature of the raw materials that lie at the base of biogas production. The cooperation between SouthEnGroup and the municipal sewage plant allows the group to develop competencies that are vital for the transition to renewable fuels.

Sustainability vision: Cooperation is part of the vision for sustainable growth of the group. Actual and potential cooperation partners are seen as resources that can be leveraged for growth and sustainable development goals. A corporate sustainability vision that explicitly embraces cooperation is well in line with the central idea held by academia (e.g. Hart, 1995) and other bodies that many societal actors need to get engaged if systemic changes towards sustainable development are to be achieved. Cooperation could also lead to that the sustainability vision is spread within the sphere of cooperation partners and in general lead to better possibilities to develop the region in a sustainable direction energy-wise.

Local embeddedness

With regard to ***infrastructure building***, one activity of SouthEnGroup is the *extension of the network for fuel gas filling stations*. In 2007, one new station was opened whereas an additional one is planned for 2009[108]. The part-owned regional energy farming company has *opened four filling stations for biodiesel*.

Under the topic ***regional development*** several activities can be found. Firstly, the group has a pronounced strategy to *seek cooperation with local players,* which is confirmed by a statement of the CFO:

> It is extremely important for us to stand in cooperation with local actors. It is part of our overall philosophy and vision that we want to act locally. (11)

Another area for regional development relates to biomass purchases. Whenever possible, the *focus is on locally-produced fuels.* For example, large amounts of local straw will be needed to fuel one of the Gravel Site boilers (40MW capacity). The group sees three benefits with the local fuel strategy. Firstly, it supports local agriculture and industries; secondly, the environmental impact from transports can be reduced and; thirdly, it is a way to minimize risk exposure. Purchasing local renewable fuels allows for better control of security of supply and the environmental consequences of production. In addition, getting rid of fossil fuels reduces the price volatility of input fuels.

Naturally, it is both in the group's and the municipality's interest to work for regional development. For instance, attracting the 'state of the art' research site mentioned earlier to the region is a common goal to work for in the development of the region. Regional development is also *supported* by the group's commitment to cooperate as one of the *main sponsors to a local initiative* aiming at making the municipality more attractive. Local commitment is seen as a strong feature by the Head of Market Analysis:

[108]Please note that these investments are subsidized by the Swedish Environmental Protection Agency.

> I believe that our local commitment is our biggest strength. It is expressed in different ways, for example, we contribute many million Swedish Crowns to the local sports and youth clubs in different ways. Our Board has only local representatives. […] All we do is done locally, so to speak. If we organize a conference, it's at a local venue. We try all the time to remember that what we do should benefit the local marketplace. (10)

Corporate governance reveals itself for instance in the owners' directive. In view of the fact that municipalities themselves work with the transition to a more sustainable society in accordance with their Agenda 21 commitments[109], strong attention is paid to energy issues[110]. The four municipalities jointly owning SouthEnGroup have issued owner directives, stipulating that the group shall reduce its impact on the environment. Given that the energy company is the municipality's most effective tool to reach its environmental goals, the owners and their political goals are a driving force for the changeover.

Another important aspect is that the owners put *lower financial demands* on the group than private owners would. The Business Development Manager mentions that:

> The group does not have the same requirements as to financial returns as a private company, given that it is municipality owned and, in addition, we are seen to deliver a benefit to society through our activities. Hence we can probably do more for the environment than a privately-owned company. More funds can be put on implementing favorable projects, but at the same time it is not possible to go for whatever we want for the environment. There has to be a sound economic basis so that the owners can get a reasonable financial return. (8)

As a consequence of the lower financial demands from the owners, the group can take a more long-term perspective on its projects. Hence it is possible to have longer payback periods, allowing the group to make investments that probably would not have been acceptable to private companies. The foremost goal of the company is not to maximize its return to the owners; contributing to social welfare seems just as important. This enables the group to take a long-term view on environmentally beneficial investments.

A further essential aspect of local embeddedness is the group's ***local strategy***, a strategy to preserve and strengthen its local roots. The Head of Market Analysis mentions that:

> The local perspective, local presence, is our strategy of differentiation – I mean from the other large actors. This is extremely important for us. Our strategy for the group is to be the leading energy group with an active local presence. (10)

As a consequence, all of the group's subsidiaries kept their *local brand name*. This further involves that most of the employees remain at their local work place instead of performing functions mainly from the head office as in more centralized companies. This has the advantage that the *employees can preserve their local knowledge* and thus assist customers

[109] Agenda 21 defines municipalities as key actors in the effort to reach sustainable development (UN, 1992).

[110] For instance, the law on municipal energy planning stipulates that all municipality require an energy plan.

more effectively and flexibly, for example with power failures[111]. Moreover, customers more readily identify with the local company than with a large actor, which safeguards built-up trust and customer loyalty.

Public welfare or how the group can contribute to a sustainable society is another aspect of the local strategy. The Head of Market Analysis considers the local focus combined with a strong environmental profile to be a strength of the group.

> I believe this gives us a lot of credibility. As a municipal company you are required to contribute to local public welfare, so to speak. If we can prove that we contribute to the city's development, that the environment is developing in a positive direction, then we will gain much larger credibility. In such a slaughtered business as energy, trustworthiness is absolutely vital. (10)

Judging on the group's possibilities to contribute to a sustainable society, again the local business model offers a promising approach. The local focus seems to be a business philosophy that embraces a multitude of values that can work as drivers towards sustainable development. This is firmly expressed in a statement of the CFO.

> Talking about sustainable development of society, here […] I am totally convinced, we have a successful concept in our local focus. […] By way of the choice we have made on how to organize ourselves, the vision we have for our local presence and to be close to our environment, […] this makes us able to contribute to a sustainable development of society, we are taking part in the development of society. We are not steered by Stockholm, Helsinki or Düsseldorf – I am convinced that, if so, it would be almost impossible to be a part of the development of society. (11)

Evidently, great potential is seen in the local business model.

Analysis: local embeddedness

Emissions reduction: Local embeddedness shows in the use of local fuels and waste heat that results in a better utilization of local resources and less transportation. An additional benefit of local resource use is that the group can better control its risks attached to fuel purchases (compared to purchasing palm acid oil, which can give rise to potentially harmful environmental concerns with stakeholders). Moreover, being locally embedded gives better possibilities to influence customers' and stakeholders' behaviour towards reducing their environmental footprint. The close connection between politics and energy planning goals promotes locally beneficial solutions.

Product stewardship: A large part of the company products are embedded in the local production and consumption structure, for example the gas filling stations and infrastructure. The marketing strategy is to be close to consumers which involves that emphasis is put on service and quality which should add value that compensates for possibly slightly higher prices. The local focus and a reputation as a good corporate citizen

[111]It was also reported that after the power failures caused by the storm Gudrun, customers were understanding and some even offered their help, showing that the group has a large 'trust capital' with local residents.

with a strong community engagement should increase the possibilities for the group to reach out to the targeted customers and market its products. However, hitherto little efforts have been made to market the products more specifically with the help of environmental arguments.

Clean technology: A locally embedded strategy is important for clean technology development as companies with a long history and track record of contributing to social welfare supposedly have better chances to get acceptance for new investment projects. There is, however, a risk for reputational damage from set-backs or disputes related to clean technology investments. If the Gravel Site plant can be built, it could make a considerable contribution to sustainable energy production in the Southern region. An additional effect of the project is that it would create a regional market for straw and hence an extra income for regional farmers (Simmons, 2008).

Sustainability vision: Being locally embedded is an established and important part of the group's sustainability vision. This vision comes closest to the notion of distributed economies where the power over the production system is exerted locally rather than determined externally. This results in that local or regional interests for the development of the energy system prevail instead of special interests of a non-local actor. The local government can through its influence over the energy company steer the development in a desirable direction, for example by setting other goals for the group than maximizing returns. For instance, stable workplaces or pursuing strategic expansion opportunities that benefit regional development could be desirable aims. The group can add value to the region by offering complementary benefits (for example contributing with innovative energy solutions to attract the state of the art research site to the region). Despite essentially being an independent economic actor, it is important that the group and its business are firmly grounded in the local political environment in order to create a consensus over the development path for the region energy-wise.

5.3 LocalEnCo

5.3.1 Introduction of LocalEnCo and its energy system

LocalEnCo is a small local energy company situated in a metropolitan area. Its current product offers cover electricity, district heating and contracting work with an emphasis on environmentally-friendly alternatives. Through its subsidiary it also engages in electricity transmission. Although the company has no own electricity production yet, it has been an independent power trader since 1998. The customer base is mainly local with 21,000 electricity and roughly 1,700 district heating customers. Currently, the company has 100 employees. The owner is the local municipality. LocalEnCo's vision reads as follows:

> We are the local energy company that sees customers' needs. With a long-term view and commitment to the environment we create value on commercial grounds. (LocalEnCo, 2009)

The corporate motto is to be "nearby and simple with a passion for the environment" (LocalEnCo, 2009). The business concept builds on acting locally in a near and open customer relationship. Closeness based on local roots, simplicity in customer relations and environmental responsibility are core values of the company (LocalEnCo, 2009).

LocalEnCo was founded in 1947 after the municipality purchased the privately-owned power provider in the area. A district heating network was established in 1963, expanded over the years, and is still growing today. In 1984, a central district heating plant was built. It was originally coal-based and has subsequently been transformed to peat. A number of small oil-fired hot water boilers serve as extra capacity during cold periods. In 2006, the decision was taken to invest in Grove Hill, a large biomass-based combined heat and power plant[112] worth 1 billion Swedish Crowns to be finalized end of 2009. The new plant is an important building block to strengthen the green company profile. It also represents a big step into the future as it allows the company to expand its business and offer a wider product range. Since the new plant will mainly be fired with wood branches and tops[113], all products will be renewable-based in the future.

Table 5.3 gives an overview of the company's energy production covering the three years closest to the study period. The shares of renewable and fossil fuel inputs are also indicated.

Table 5.3: LocalEnCo's energy production

	Year	Total in MWh	Biofuels (%)	Fossil fuels (Peat* & oil) ** (%)
Produced Power	No power production for the observed period. However, own renewable power production from 2010.			
Distributed Heat	2008 2007 2006	267 000 268 000 268 000	24.3 8.6 28.0	75.7 91.4 72.0
Produced Cooling	No cooling production or sale for the observed period. This will be a new product after completion of the CHP plant.			

*peat is considered to be a fossil fuel by the EU, whereas Sweden sees it as a renewable fuel. This makes it subject to the EU ETS but not to Swedish carbon tax.
** including heat purchases from third parties.
Source: Annual Reports LocalEnCo 2006, 2007, 2008.

When looking at the CO_2-intensity of energy production, there is a declining trend. Positively, LocalEnCo will be able to do away with nearly all direct emission once the new plant is up and running.

Table 5.4: LocalEnCo's CO_2 emissions

Year	Total in ton	Emission ratio per unit of distributed heat
2008	58 740	0.22 ton CO_2/MWh
2007	75 040	0.28 ton CO_2/MWh
2006	Not available	Not available

Source: Annual Reports LocalEnCo 2006, 2007, 2008.

[112] 23 MW electricity, 91 MW heat.
[113] So-called GROT.

5.3.2 The business – environment relationship

The question how business and the environment go together was also asked at LocalEnCo. The CEO's answer echoes earlier opinions:

> The relationship between business and the environment – I believe they go hand in hand. From time to time, one needs to find a balance, but to my belief the business risk in fossil-based projects is much bigger now in our industry than it is for renewable projects. So even if it has sometimes been cheaper to burn fossil fuels, when the oil price was low and CO2 cheap, I believe that it is more profitable and the business risk is lower with environmentally-friendly alternatives in the long run. (17)

Regarding the new power plant investment, the issue of renewables was above all framed as a question of risk exposure. Again, the CEO voices risk considerations as a driving force for a renewables-based investment:

> My judgment is that, seen over a period of 50 years – the lifetime of this new plant – the long-term business risk is lowest when running such plant biomass-fired. […] The risk for legal discrimination ought to be lower. The risk for customers to repudiate our production ought to be lower. This involves that the business risk with putting all eggs in one basket ought to be lower with this type of investment compared to a fossil fuel venture. […] So considering that you are to manage a capital of 1 billion Crowns over 50 years with a reasonable business risk, I am fully convinced that this is the best choice. (17)

From a broader perspective, the environment is seen as an integral part of an overarching societal responsibility of LocalEnCo. Business interests are therefore carefully balanced against wider societal interests, or in the Head of Markets' words:

> This is not a private company where we have to maximize profits. Rather, we have to see things from a wider perspective – we carry responsibilities towards society – we carry environmental responsibility and this involves, amongst other things, helping customers to save energy. (16)

To judge from the quotes, environmental issues are a serious concern, be it for moral, legal, reputational or risk management reasons. However, to paint a picture of what it involves to 'have a passion for the environment', the activities undertaken by LocalEnCo are most relevant to study.

5.3.3 Activities for environmental sustainability

Environmental integration

Integration into energy production system

Looking at the current production resources, the most notable ***fuel switching*** activity at LocalEnCo has been the *replacement of 30 % of peat with wood chips* in the current district heating plant. With this, the maximum capacity for biofuel co-combustion for the furnace has been reached. Notable is also that LocalEnCo *decided not to take advantage of the option to convert an older coal-based unit to gas* as this was considered inadequate given the company's green orientation. Instead the company opted for an expansion of the production resources, i.e. the Grove Hill investment. Despite having a single furnace, Grove Hill will have some *fuel flexibility*, allowing for the firing of moist biomass, peat and recycled wood. Furthermore, once the new plant will be operational, *top load production will be covered by the peat boiler*, replacing the distributed oil-fired units.

Energy efficiency in the Grove Hill investment implied the *installation of flue gas condensing* which results in an additional capacity of 21 MW. ***Usage of waste*** features the following activities. The *ashes from combustion are reused* as a component in a clay-like substance used to cover waste deposits, preventing them from leaking. *Solid ashes are recycled* as construction material and hence, no ashes are deposited in land fills.

Integration into management systems

LocalEnCo has an environmental management system which is certified according to ISO 14001 standards since 2002. The system is integrated with the ISO 9001 quality management system and the AFS 2001:1 working environment standard. This makes the company triple certified. The Environmental Controller adds:

> We are proud to be triple-certified; this is rather unusual for energy companies. Even more so, considering that we are quite small. (15)

In the Environmental Controller's view, having an integrated system is natural and efficient, given that all standards aim at continuous improvements.

> Having an integrated system works well. […] On our Intranet we have our management system which is accessible to all employees. We have a handbook for each process – district heating, electricity networks etc. The point is how to form these processes as effective as possible, with as little impact on the environment as possible and ensuring the best possible working environment. (15)

Moreover, the usefulness of routines is pointed out. Having established *routines for every process* is particularly important to control the environmental impact and ensure compliance with environmental regulations. Working in a systematic way with the improvement of routines is also vital for developing the environmental management system further, which in turn is important to maintain environmental certification.

Environmental goals *are revised annually*. The Environmental Controller has an important role in negotiating new goals and ensuring that existing goals are sharpened. In the discussions she is the champion who 'represents' the environment and ensures an appropriate ambition level. The environmental controller *follows up environmental goals on a quarterly basis* and informs on the progress over the Intranet.

When it comes to the ***integration of environmental criteria in management processes***, the Environmental Controller mentions that *environmental goals are integrated in the business plan* for every business area. They are also an *integral part of the balanced scorecard* performance management tool. Moreover, environmental criteria are applied when choosing suppliers and subcontractors. In practice, this is however a difficult issue since the dominant decision criterion often is price.

Investment planning was *timed with the political process* for the extension of the green certificates'scheme. Thanks to the decision taken in 2006 to extend the scheme to 2030, LocalEnCo opted for a combined heat and power plant instead of a much cheaper new hot water boiler. Regarding *calculation praxis* for the new plant, traditional calculation methods were used, i.e. a Net Present Value calculation was performed with a 6 % rate of return and a depreciation period of 30 years[114]. In addition to return, risk considerations have been an important decision criterion.

Several activities aim at ***reducing the internal non production-related environmental impact*** at LocalEnCo**.** For instance, double-sided printing is standard and efforts to reduce the own energy consumption are made. Although some of the company cars are environmentally-friendly, adapting the car-fleet to meet high environmental standards meets resistance from users and financial constraints. This reflects that symbolic efforts to improve the environment, i.e. which do not give a direct pay-off, are much harder to carry through. Then again, some changes that allow a more efficient use of the car-fleet (saving time and fuel) have been implemented.

Analysis: Environmental integration

Emissions reduction: Technical measures have led to reduced emissions but the current production system has largely come to its limits and only an investment into a new plant can produce more radical improvements. With regard to management systems, the role of the Environmental Controller seems to be pivotal to managing the environmental aspects of the company successfully (environmental champion). Having an advocate for the environment who puts personal engagement and zeal into her work appears absolutely crucial for driving the environmental work forward and anchor commitment for emission reductions at both the management level and the 'shop floor' level.

Product stewardship: Fuel switching measures have had an important impact on the product stewardship strategy, as will become evident in the section on innovations. It is argued that

---

[114]The assumed technical life-time is 50 years.

fuel switching opened up for further activities that ultimately resulted in a product stewardship strategy. It was the first step of an incremental strategy developing over time, although the intention originally was to cut costs as replacing part of the peat freed resources in the form of emissions allowances no longer required for compliance. Hence, serendipity played a role in the product stewardship strategy.

Clean technology: Environmental aspects have influenced the choice of the technology although the dominant drivers have not been the environmental aspects themselves but other characteristics associated with making environmentally sound investments, such as lower risk exposure and financial incentives. Furthermore, ethical/legitimacy aspects have played a role given that a fossil fuel solution was considered inconsistent with corporate image.

Sustainability vision: The triple certification of the business ensures high standards in strategically important areas and can be seen as a sign of resource commitment to continuous improvements in various areas of importance to the company. Nevertheless, the fact that symbolic measures, such as replacing the existing car fleet systematically, meets resistance, shows that the environmental commitment does not fully permeate the company. The dominant understanding currently seems to be that environmental measures need to have a positive effect on the Income Statement, which is, however, often hard to prove. Accordingly, as long as this notion (that no one wants to pay for environmental improvements) persists, there is at least some conflict between business and the environment.

Communication and learning

The Environmental Controller plays an important role for internal ***environmental network activities***. Being the sole responsible for environmental issues, she acts as an intermediary who spreads relevant environmental information from *environmental scanning* further into the organizations. Newsletters from industry organizations and Internet services subscribed for are her main sources of information. Furthermore, *external network gatherings* with environmental coordinators from various industries provide an important forum for exchanging experiences and hands-on tips for the Environmental Controller. Again, communities of practice represent a valuable learning opportunity. Moreover, the CEO participates in network activities with other energy company CEOs, creating the opportunity to discuss common challenges.

Environmental training at the company normally involves a short *introduction for new employees.* However, prior to the inauguration of the new plant an *environmental training program for all employees* will be held. Fairly recently, also *Board members received environmental training*. All training is planned and conducted by the Environmental Controller.

Several activities aim at creating a ***green organizational culture.*** In particular, the importance of the management leading the way to create commitment further down in the organization was pointed out. The Head of Markets further highlighted that

> The company is directed towards rewarding environmentally appropriate behavior and gaining greater understanding for the environment throughout the company. […] All we do and work for adds on and leads to larger awareness so that all employees maybe also take greater personal responsibility. But we need to show that the company leads the way. (16)

Furthermore, *single initiatives* to raise awareness are pursued, such as the participation in 'New Road Habits' that aims at making employees switch to more environmentally-friendly commuter habits.

At the operational level, the Environmental Controller is the 'spider in the web' *engaging employees in environmental work*. Personal contacts are the preferred way to persuade employees of the importance of getting environmental work, which is sometimes felt as a burden, done. She describes her efforts as informing, encouraging and spurring employees to commit to environmental work, which requires quite some social competence. Some may think that too much fuss is made about 'simply boiling water'.

The home page is the main means of ***environmental communication.*** On the one hand, it offers easily understandable information about the climate challenge and tries to engage customers. On the other hand, LocalEnCo outlines how it contributes to tackling the climate challenge. The first focus area is reducing greenhouse gas emissions from production internally and the second is assisting customers to act in a climate-friendly way. This involves offering environmentally benign products and helping customers to choose right.

> We want to help customers to make the right choice. This is where the challenge lies really. If we can get them to choose the right product, a lot is won. […] We want to offer customers environmentally-friendly products, that is our goal. (15)

It is also pointed out that the customer has consumer power; he himself chooses the way his electricity is produced. Also the *company newsletter* informs customers regularly on firm news and relevant energy-related topics. Another activity related to environmental communication is the decision to produce a *leaflet outlining what the company does for the environment* and what customers can do.

Environmental communication also involves *taking part in the debate*, for example publishing a newspaper article lobbying for more energy-efficient house-keeping in the EU by making use of district heating. Furthermore, LocalEnCo is *active to improve the situation for burning peat* as a fuel, which is discouraged by EU rules.

Business development is conducted during annual strategy days with the management committee and board members participating. Recommendations are made for a planning period of four to five years ahead.

Analysis: communication and learning

Emissions reduction: In accordance with von Malmborg (2002:312), an environmental management system can serve as "a tool for communicative action and organizational learning". LocalEnCo's case shows that communication is important to embed environmental considerations into the day-to-day work of employees and get the environmental work done (i.e. comply with requirements of the certified management system). Without the continuous efforts of the Environmental Controller to engage and encourage employees, the environmental management system could not be developed further and would not be more than a paper exercise. Hence communication is the lubricant in the environmental management machinery.

Product stewardship: In line with Hart (1997), creating preference for sustainable products and educate customers is part of LocalEnCo's product stewardship strategy. It involves giving guidance to customers as to what product to chose. To have customers make 'the right choice' is part of a learning process and an achievement as such. Hence, connecting the wider problems of climate change and environmental degradation to the consumer and his choice of products is a delicate task which requires communication skills and a convincing rhetoric.

Clean technology: Communication in relation to clean technology involves making stakeholders understand what the Grove Hill investment means to them, to the community, the environment etc. In much, the investment has a symbolic significance standing for the determination of the company to contribute to sustainable development within the range of its activities. Creating awareness about the company's green strategy is important for it to succeed. Hence, communication with all available means is a necessity, which the company seems to be well aware of. This is also why the plant is well exposed; it has a glass front allowing for the installations to be illuminated at night, so the plant is well visible for motorists passing by on the nearby highway. It seems sensible to 'cash in' on the investment by communicating this clean technology achievement in various ways, thereby strengthening the company profile.

Sustainability vision: Environmental training seems the most important activity to create a sustainability vision that is shared by all employees (as well as the board), in particular when large changes occur under a short time period as in LocalEnCo's case. The 'base' of the company has to be attuned to the sustainability vision that took form as a consequence of the green opportunities arising from the Grove Hill investment.

Innovation

Innovation in the case of LocalEnCo mostly refers to new products. ***Green product offers*** are an essential element of the corporate strategy. While the company has been offering green electricity labeled 'Good Environmental Choice' (an eco-label developed by the Swedish Society for Nature Conservation) for ten years, it was *first in Sweden to combine it with 'good environmental choice' district heating*. The Environmental Controller comments that:

> It is great that we have both heat and electricity labelled 'good environmental choice'. We are very proud of this given that we are so small compared to others. (15)

Complementing the normal product range with independently certified products is seen as an advantage as these follow high standards and "customers know what they get". The Environmental Controller explains that:

> The good thing with the label is that it considers the whole production chain from chopping the trees to producing heat. […] It takes a comprehensive view and sets out specific requirements. (15)

Considering that the quality of district heating varies depending on the input fuel, this product could be called the Rolls Royce version. Offering such product creates genuine value for customers also due to the fact that LocalEnCo sees it as an additional service to its customers and charges only extra production costs[115]. Presently, the product corresponds to the portion of heat produced with wood chips, but given that all production will be renewable in the future, there is large potential for an increase. While 'good environmental choice' district heating undoubtedly is a product innovation, it can even be considered a process innovation as it required the adaptation of internal procedures.

With the completion of Grove Hill, further green products will be made available. Electricity from the new plant will carry the 'Good Environmental Choice' label. Further 'productification'[116] of electricity is intended which involves that LocalEnCo will be *launching 'locally-produced electricity'* labeled 'Good Environmental Choice' as a new product. Furthermore, *district cooling will be offered*, replacing commercial customers' individual electrically-driven cooling units. This product also contributes to a good capacity utilization of Grove Hill during summer months, when district heating demand is low.

These new sustainable products reflect the company's efforts to offer environmentally-friendly alternatives to their customers and assist them in their environmental work. It should not be forgotten that many commercial customers use their environmental work for marketing purposes. Providing 'Good Environmental Choice' district heating can therefore strengthen commercial customers' environmental profile.

Another product area where LocalEnCo wants to expand is *energy services to industrial customers* aiming at energy efficiency improvements. The intention is to build up an internal organization and competency gradually by way of organic growth and learning by doing.

Activities for ***demand-side management*** entail *developing Internet pages* allowing customers to look at their current and accumulated energy consumption. Furthermore, the company offers *energy advice over the phone* to its customers.

For the ***phase-in of green technology***, i.e. the one billion Grove Hill investment, LocalEnCo found an *innovative, tailor-made financing solution*. The initial investment for the machinery is borne by its bank, whereas the company entered into a leasing agreement for the machinery with the bank.

Analysis: Innovation

Emissions reduction: Interpreting innovations broadly as the implementation of new ideas, the concept that LocalEnCo wants to help customers in their environmental work and assist

[115] These amount to an extra charge of one öre/KWh (0.01 Swedish Crowns) compared to standard heat.

[116] Productification refers to the process of taking an idea and transforming it into something that creates value for users (Productification, 2009).

them to strengthen their environmental profile can be considered a business model innovation promoting emission reductions. Notable is also the fact that the company does not add a profit margin to its ‘environmentally labelled green district heat’; rather it is seen as a service to customers, giving them the choice to reduce their emissions from heat consumption at virtually no extra cost.

Product stewardship: LocalEnCo hatched a number of innovations related to their products. Firstly, the idea to create a niche for the electricity produced at Grove Hill and market it as ‘locally-produced electricity’ labelled ‘Good Environmental Choice’ is a new approach to overcoming the obstacle of a homogenous product with little opportunities for diversification (marketing innovation). Furthermore, the development of ‘environmentally labelled green district heat’ is a product innovation, in particular given that the company was an early mover in launching the product. Both innovations are based on a productification of a homogenous good that is based on adding distinct qualities to the products that create additional customer value. Hence sustainable products are in many ways a matter of quality improvements that can, under certain circumstances, lead to innovations. It goes without saying that much has to fall into place in order to make singular (process) innovations into a finished product (referring to green heat), alternatively a large resource commitment is needed to get at the more radical innovations with the potential to change the production-consumption system.

Clean technology: As indicated, large resource commitments are necessary to contribute to the transition towards a more sustainable energy system. LocalEnCo has however made this commitment and has paved the way to accommodate more radical innovations. These take the form of for example district cooling, a new product for industrial customers reducing their electricity consumption. This innovation simultaneously allows for a better utilization of Grove Hill, increasing efficiency. The innovations are not so much technical (not depending on the latest technology), but conceptual and systemic. So it is the combination of different small innovations (product, process, marketing) that allow for the optimal use of clean technology. Hence innovations and clean technology are intertwined and support each other.

Sustainability vision: The business model is built on a well-developed sustainability vision of which product stewardship and clean technology are building blocks. The idea is to reduce emissions at the producer and the consumer end and contribute to embed resource efficiency based on sustainable production methods into production and consumption systems. The sustainability vision hence stretches to customers and their production systems.

Cooperation

With respect to the ***connection of external heat suppliers***, LocalEnCo collaborates with the neighboring district heating provider. The two district heating systems are connected, which allows for heat exchange across municipality borders, leading to that production resources are used in a financially and environmentally beneficial way.

The CEO considers *cooperating within the energy sector* as both meaningful and essential for the company:

> For a company of our size, networks and industry organizations are very important. […] We put a lot of time and effort into coordinating and cooperating with others. […] We network within the industry organizations, we read, we follow the debates. In essence, we are part of a living community in an industry. (17)

Other activities aim more specifically at ***cooperation for sustainable development.*** LocalEnCo has a *close dialogue and cooperation with the Swedish Society for Nature Conservation* which resulted in the development and implementation of 'Good Environmental Choice' district heating at the company. Moreover, the cooperation resulted in a deeper understanding of the climate challenge:

> They talk about that renewable fuels are not enough; you also have to uphold biodiversity in nature. […] We have stopped the greenhouse effect, but at the same time we have a biological desert in our forests due to monocultures and the use of pesticides. […] Then we have a new problem, a much poorer nature. (17)

LocalEnCo *cooperates with the local municipality* for example when it comes to land use planning, district heating expansion and energy planning. Furthermore, a close dialogue is held with the municipal energy advisors.

Last but not least, the company *uses cooperation partners to perform energy services* such as energy inspections for buildings. The rationale is that, being a small company, LocalEnCo does not have the resources to manage all activities in-house. Working with cooperation partners is a convenient way to satisfy customer needs.

Analysis: Cooperation

Emissions reduction: Other things equal, cooperation in the form of a connection of the district heating system with a neighbouring district heating company contributes to emission reductions thanks to a better utilization of the combined system. As suggested by Grönkvist and Sandberg (2006), the total need for primary energy can be reduced, resulting in cost cuts and environmental benefits. The absence of direct competition as well as shared norms and values, for example the common belief that companies should reduce their environmental impact and use resources efficiently, seems to legitimize this form of cooperation.

Product stewardship: Cooperation and a constant dialogue with the Swedish Society for Nature Conservation was a precondition for the development of the product 'Good Environmental Choice' district heating. Thanks to the cooperation, company representatives gained a more sophisticated understanding of the challenges and opportunities energy companies are exposed to and were better able to define their role, including their products' role, in working towards sustainable development. Cooperating with an organization that possesses broad knowledge and competence in the field enabled LocalEnCo to better define challenges and refine the product stewardship strategy accordingly. In the case of energy services, cooperation also enables the company to give its customers access to a wider product range than it can sustain on its own, resulting in satisfied customers despite limited resources.

Clean technology: As argued by Hart (1995), collaboration between public and private organizations creates beneficial conditions for clean technology deployment. In LocalEnCo's case, cooperation with the municipality facilitated the expansion of clean technologies. This is not only the case for district heating, but also regarding the Grove Hill plant.

Sustainability vision: Cooperation seems to be part of the business philosophy. The company wants to be a partner for customers, helping them to choose suitable products and use them in an appropriate way, furthering their own goals and values. Furthermore, the willingness to form part of a living community of energy companies requires openness for cooperation. This does not necessarily mean that the company's sustainability vision mirrors the industry's ideas on sustainability. Rather it enables the company to make a more sophisticated choice as to its sustainability vision and strategy, as it is better able to benchmark with other companies and identify opportunities.

Local embeddedness

Regarding ***infrastructure building***, the *expansion of the district heating network* is a corporate activity benefitting environmental sustainability. District heating is the municipality's preferred heating alternative as it contributes to a healthy local environment.

LocalEnCo's environmental strategy reflects the owner's directives for ***corporate governance.*** *The company is directed to actively work with environmental issues and assist its customers to improve energy efficiency*. The directive further outlines that the aim is not to maximize profit but to generate sustainable returns and community benefits in the long run. Although being an autonomous company, *LocalEnCo contributes to the environmental goals of the municipality* through its new investment and by expanding the district heating network. The company strategy is thus firmly anchored in municipal goals.

It is also felt that the company, thanks to municipal ownership, can pursue a long-term strategy based on continuity. The relationship between the board of directors, the CEO and management is described as good and founded on mutual trust. According to the CEO, this manifest in that municipal ownership enabled the company to *obtain beneficial financing conditions* for the Grove Hill investment.

> We have a synergy thanks to our owners. Having a municipal owner who acts as a guarantor, we can basically borrow money at identical conditions as the three big companies. […] Hence, we have no disadvantage of scale relating to the provision of capital. (17)

Local politicians see Grove Hill as a good investment for citizens, both to secure stable returns which go to other public services and to maintain low district heating prices.

LocalEnCo has a pronounced ***local strategy*** which is visible in several aspects. With respect to fuels, *biomass is purchased from local sources* (within a radius of 200 km), causing less pollution from transportation. Furthermore, *burning worn out loading pallets* is seen as a future option to use local fuels from the metropolitan area.

The local commitment and public welfare orientation is further expressed in the fact that the company is a *member of the employer's association for local public enterprises*, KFS.

> This is for the public welfare-oriented companies that are owned by a municipality, the County Council etc. […] The motto for this association is 'community benefit on commercial grounds'. […] This reflects even our company in some way; we are owned by the 60 000 municipality citizens. (17)

In accordance, LocalEnCo wants to be a personal company that customers can have confidence in. It even *encourages customers to come by at the offices to get personal advice* or pay their bill. It also *tries to involve citizens into the Grove Hill project*, pointing out that they are the ultimate owners of the plant. For example, citizens were invited to take the first dig with the spade and it is also intended that the inauguration of Grove Hill will be celebrated with citizens.

A symbolic activity reflecting the commitment to the local community is that the company *sponsors the school material on nature and the environment* in the municipality. An important new element of the local strategy will be the *marketing of 'locally-produced electricity'* labelled 'good environmental choice'. This will be a niche product addressed to the regional market.

Analysis: local embeddedness

Emissions reduction: LocalEnCo is the trump card for municipal energy planning aiming at emission reductions within community borders. This can be achieved both through the owner's directive and by agreeing on strategies and actions to reach the municipality's environmental goals. Another aspect of local embeddedness related to emission reductions is the use of local fuels, which obviously is preferable over transporting fuels over long distances, wasting energy for transportation.

Product stewardship: Local embeddedness is a natural consequence of having district heating as an important line of business and the company mission to contribute to local welfare. At LocalEnCo, local embeddedness is turned into an active strategy to strengthen the company profile and gain customer trust in its niche market. The company has initiated this journey by developing 'locally-produced electricity' labelled 'good environmental choice' as a new product. Local embeddedness allows the company to leverage its products and create a niche market that is inaccessible to competitors. Emphasizing the company's local embeddedness in several dimensions seems a valid strategy for the company.

Clean technology: The local embeddedness of the clean technology investment Grove Hill creates opportunities for the municipality and local industry to develop their profile towards environmental sustainability. Local corporate ownership also created favorable conditions for the financing of clean technology. Local embeddedness seems to offer a dimension of trust opening up possibilities for long-term sustainable solutions for the company and their customers alike.

Sustainability vision: The focus on sustainable returns and community benefits on commercial grounds is firmly anchored in the firm. Serving the community and being close to customers is part of the company philosophy. The symbiosis between LocalEnCo and the municipality seemed to open up for the realization of the sustainability vision, i.e. the Grove Hill plant, which lies at its base. This required the alignment of the vision between the management, the board of directors and the municipal executive board. It is hypothesized that this is an outcome of lengthy social processes, whereas trust is built up as a result of long-standing mutual positive experience. Naturally, a company with a long history and firm roots in the community stands good chances of building up this trust.

5.4 WestEnCo

5.4.1 Introduction of WestEnCo and its energy system

WestEnCo, the leading player on the energy market in Western Sweden, is active in the production and sale of electricity[117], district heating and cooling. It further provides natural gas, power network operations, broadband and is a leading energy services provider. The company holds stakes in a number of small energy companies in the region as well as a 50 % stake in a fuel-gas company. In the last few years, biogas development has turned into a promising new business line. In sum, WestEnCo has a versatile portfolio of energy solutions that is leading the company towards its vision to actively contribute to

> ‘a sustainable Western society’. (WestEnCo, 2009)

WestEnCo’s business concept is to provide services by using the infrastructure for the creation of long-term stability in its offerings. Customers’ needs are met by delivering services and products, and offerings are designed in consultation with customers so to improve their competitive situation. The core values guiding the way are far-sighted orientation, stability, competency and environmental focus. To be a company with a strong environmental profile is also part of the business concept. The role of the environment is further defined in the business policy:

> In our role to provide for our customers’ energy needs we safeguard the environment and work for a sustainable energy system in our society. Each employee feels responsibility for and pays respect to the environment. We work continuously to diminish the environmental impact and to prevent pollution from our operations. (WestEnCo, 2009)

Some of the focus areas for development in the near future are to be more active within renewable electricity and to keep developing towards more biogas. The development goal for wind power is to have 100 turbines in 2015. For the gas business, the share of renewable gas

[117] Please note that the electricity retail business was conducted by a part-owned subsidiary at the time of the investigation and was thus not included in the study.

should be 20 % by 2012, increasing to 50 % by 2020 and 100 % by 2050. Furthermore, the company wants to intensify its activities within the transportation sector (WestEnCo, 2009).

A short look at WestEnCo's roots shows that the company has a long history in the gas and the electricity business. WestEnCo originated in 1965 from a merger of Western Municipality's gas utility and its electric utility which go back as far as 150 years. Gas was gradually replaced by electricity in the early 19th century when the city built its own electricity plant. However, since 1910 electricity was mainly transmitted from the state-owned electricity provider. In 1952 district heating was introduced and a combined heat and power plant was built. The district heating system expanded gradually across the whole municipality and in 1972 the first waste heat deliveries from the refuse incineration plant were received. Fifteen years later, waste heat from refineries was added to the system. When it comes to renewable electricity, WestEnCo started experimenting with wind power in 1987, although a larger wind park was first established in 1996. For the gas business, natural gas was introduced in 1988, gradually replacing other gas alternatives. The infrastructure for both the district heating and the gas business grew further, crossing municipality borders in 1995 and 2002, respectively. Today, the district heating system is with just over 100 km pipelines one of the largest in Europe. Around the turn of the millennium a large off-shore wind park was projected which, however, never could be realized (WestEnCo, 2009; Rönnborg, 2006). In parallel, WestEnCo planned for a large-scale combined heat and power plant fuelled with natural gas. The idea was to make the city self-sufficient regarding electricity and heat and, at the same time, facilitate for district heating expansion in the years to come (Rönnborg, 2009). After a long planning phase, the plant was inaugurated in November 2006. It has a capacity of 555 MW heat and power and an efficiency of over 90 %[118]. From initially entirely depending on oil, the district heating system has been radically transformed and is currently based on waste heat, natural gas and bio-fuels. Looking at the overall position today, more than 50 % of the turnover is made in the district heating business. Moreover, WestEnCo invested heavily in its district heating system in 2007 and 2008[119]. In comparison, the gas business stands for roughly 20 % of the current turnover, of which biogas is a small but growing part. In 2007, a big venture in the gas business could be realized. The company opened Sweden's largest facility for the upgrading of biogas from sludge to natural gas quality (WestEnCo, 2009). As a consequence, the gas business has expanded considerably with a turnover tripling from 2007 to 2008. Biogas remains a prioritized area for development, which also shows in the WeReGas-project, planning to establish the world's largest biomass gasification plant. It represents an investment of about three billion Swedish Crowns (Western Municipality, 2008) and uses technique that has not yet been tested on such a large scale (WestEnCo, 2008).

---

[118] In average, the efficiency of European steam power plants is between 36 % to 46 % (EURAMET, 2009).

[119] 42 % of total investments in 2007, and 32 % in 2008 (WestEnCo, 2008, 2009).

A summary of WestEnCo's energy production over the last three years categorized by product is given in Table 5.5. The shares of production per energy source are outlined (in % of the total MWh produced). Fossil fuel production is shaded dark.

Table 5.5: WestEnCo's energy production

	Year	Total in MWh	Wind Power (%)	Natural gas & oil (%)	Waste-water (Heat Pump) (%)	Waste Heat (%)	Biomass/ Biofuels (%)
Produced Power	2008 2007 2006	637 000 902 000 340 000	1.5 1.0 3.0	98.5 99.0 97.0	n/a	n/a	n/a
Produced Heat	2008 2007 2006	3 508 000 3 603 000 3 644 000	n/a	31.0 33.0 25.0	1.5 4.0 2.0	58.0 54.0 61.0	9.5 9.0 12.0
Produced Cooling	2008 2007 2006	59 000 47 000 Not available	n/a	0.0 0.0	100.0 100.0	0.0 0.0	0.0 0.0
Biogas Production	2008 2007	50 700 Not available	n/a	n/a	n/a	n/a	n/a
Gas (transmission)	2008 2007 2006	687 000 651 000 690 000	n/a	n/a	n/a	n/a	n/a

Source: WestEnCo (Annual Reports 2006-2009; EMAS Reports 2007-2009), Western Municipality (2009).

In the district heating system, waste heat stands for more than half of the heat deliveries. The share of renewable energy sources is just above one percent in power production and below 10 percent in heat production. Combined heat and power production results in that the choice of district heating fuel vastly depends on power prices. Consequently, as long as power production is fossil-based, so is a substantial part of heat production. Looking at the ratio for CO_2 emissions per unit of energy produced shows an improvement. However, according to WestEnCo this is mainly due to a reduced production of combined heat and power in the main production plant for 2008 compared to 2007.

Table 5.6: WestEnCo's CO_2 emissions

Year	Total in ton	Total per unit heat/electricity produced
2008	331 000	0.073 ton CO_2/MWh
2007	445 000	0.102 ton CO_2/MWh
2006	538 000	0.135 ton CO_2/MWh

Source: WestEnCo (Annual Reports 2006-2009; EMAS Reports 2007-2009).

5.4.2 The business – environment relationship

Even if environmental focus is one of the core values of WestEnCo and the company has come a long way with its environmental work, there are clearly further challenges ahead as described by the Energy System Analyst for District Heating:

> Since I started here [three years ago] there has been a strong focus on biogas and even other investments in biofuels, wind power and all of this. So right now we very much look at many different things since we also feel an increased pressure from customers that we maybe haven't experienced to such an extent earlier. But also the climate debate, it seriously took off last autumn. […] So there has been a strong focus from customers; they don't want to buy heat that is produced in whatever way. To fulfill their expectations it is important to make improvements in order to have a more long-term sustainable production mix. This clearly resulted in a strong interest in these questions now. (5)

Looking at the district heating system from a sustainability perspective, moving towards more renewables is desirable, although there has to be a good balance in the production mix according to the Energy Systems Analyst:

> It feels like we have a good mix. At the same time we would like to have more biofuels, but then one is more vulnerable if the share of biofuels in the system is too large. It is also very important to be able to offer a stable price to customers and deliver stable results to the owners. Then it becomes important to be able to steer and change around in accordance with energy price fluctuations. So it feels reasonably good. Even though one could have some more biofuels, it feels quite good not to be totally dependent on it either. (5)

Flexibility and diversification of fuels hence are important aims in the district heating business, allowing the company to spread risks and allow for a stable performance. However, the flexibility logic is not solely tied to district heating. Rather, it is an important feature of the overall business strategy to have a diversified portfolio of activities.

> Here we come back to the notion of flexibility. We have a pronounced strategy not to put all eggs into one basket. If the debate turns around, if one type of energy gets looked upon as the plague seen from a new perspective, we're not standing on that leg only. Hence it is a pronounced strategy that we want to stand on several legs. And this naturally goes back to what we are investing in. (6)

Hence, flexibility is an important objective, functioning as a mechanism to manage risk exposure in different contexts. However, the question how environmental sustainability and financial goals can be reconciled remains open. From a developmental perspective, obviously new investments in production resources are the strongest indicator for how the future energy system will be shaped. Regarding sustainable investments, a Wind Farm Development Project Manager mentions that there evidently are limits to what the company can do, i.e. what is acceptable from a financial point of view.

> We have a goal that every business should be profitable; we don't happily make business that is unprofitable. There are limits to what can be called profitable, but sometimes we can accept investments that have longer pay-back periods. But this means taking both finances and environmental policies into consideration. (2)

At the same time, environmental sustainability seems to be an important criterion for the realization of new investment projects. Asked about the role that environmental sustainability has for new investments, the Environmental Controller replied:

> I believe that this is very much – and I have checked with my colleague – we agree that we both believe that there are no large investments done today without the environment as an argument.

> This is important to such an extent that there is not a single investment today that is done without it being sustainable as well. (4)

Accordingly, the relationship between business and the environment seems to be somewhat of a balancing act, whereas resource allocation to sustainable projects is directed by overall strategic goals. Also risk considerations come into the picture, making sustainable business solutions a central element of risk management. Although the above quotes indicate in which direction the wind blows, it is obvious that there are inherent conflicts and challenges to overcome on the pathway towards ‘a sustainable Western society’. The following section illustrates what activities are undertaken to strengthen the environmental sustainability of WestEnCo’s business.

5.4.3 Activities for environmental sustainability

Environmental integration

Integration into energy production system

The Environmental Engineer expresses that concern for environmental sustainability is for instance expressed in the choice of fuel. ***Fuel switching*** activities at WestEnCo involve the *conversion of boiler plants from natural gas to biogas*[120]. Further, two reserve boiler plants were transformed from fossil oil to bio-oil. *Bio-oil was also introduced as starting fuel* in the biomass-fired district heating plant, replacing fossil oil. The *connection of a neighboring district heating system to the main system* resulted in a large reduction of fossil oil use in the neighboring system. A long-term vision for energy production is to replace the natural gas used in the large combined heat and power plant with biofuels.

Energy efficiency, or in WestEnCo’s terms *resource efficiency*, seems to be the underlying logic of the company’s district heating system. Resource efficiency, i.e. opting for the least possible resource consumption and emissions per unit of energy delivered, involves the *maximum use of low quality energy*, for example from waste heat, to produce district heat instead of using high quality energy such as electricity. Resource efficiency is seen as a core competency of the company according to the External Affairs Manager

> It is resource efficiency that is our strength, which I think we talk too little about, especially in Sweden. (14)

Resource efficiency seems not to be just a technical issue, but also an important part of company philosophy and rhetoric.

Concerning the company’s production resources, efficiency is about *continuously optimizing the production system*, which involves both production resources, i.e. the physical plants, and production processes. To increase flexibility is an important aspect of system optimization. Essentially, system flexibility is a way to minimize risk in case of price fluctuations of input fuels. The Energy Systems Analyst explains that:

---

[120] Please note, however, that so far natural gas has been used as a fuel.

> We are well prepared for different fluctuations in energy prices. If the gas price goes up then we burn more wood chips and if wood chips go up we are running more on gas and heat pumps or what it could be. So, we are very flexible. (5)

Hence, the system is optimized according to its efficiency. However, this relates above all to economic efficiency, making price signals more important than environmental sustainability criteria[121].

With regard to production processes relevant activities are *improving the burning process* and *avoiding frequent start-ups and shut-downs of plants*. The *avoidance of top load production* is also an area where savings can be made both economically and for the environment as the most expensive fuels (used for top load) mostly also are the ones with high emissions.

Further energy efficiency activities are that *deliveries of district cooling mainly should be made by using surplus energy from district heating*. Also, a *cooperation with a large energy company* has been initiated that aims at identifying further possible energy efficiency measures in the district heating system.

Under ***upgrading of power plants,*** an interesting activity is the introduction of a remote control system for all power plants, making a high automatization of the plants possible. This is unique on such a large scale. A further upgrade was the *installation of a steam turbine for electricity production* in the biomass-fueled district heating plant. At the operational level, the strategic intent to have a strong environmental profile is generally expressed in a *generous resource allocation for the upgrading of power plants and environmental improvements*, as explained by the Facility Manager.

> I believe we have a strong environmental profile. We want to be environmentally-friendly, as much as possible, and this may cost something, they say. Of course, this has to be realistic. [...] One is prepared to incur some costs to show that we are environmentally effective. We are committed to the environment, we think this is important. So, district heating is going to be fossil-free in 2010 [if produced in boilers]. That's what was said. This means that we have to put in resources. (3)

Resource allocation is just one side of the coin. According to the Facility Manager, it is sometimes difficult to motivate plant engineers to come up with suggestions for improvements for the plants. The rejection of an engineer's suggestion for improvement can sometimes lead to frustration and may discourage the submission of further suggestions. Hence, to overcome behavioral barriers, the technical personnel needs training and encouragement as they are not so familiar with writing argumentations or making calculations for new investments.

The ***usage of waste*** at WestEnCo's biomass-fired plant involves basically two activities. The *solid ash has been reused on golf courses*. For the fly ash, a small project has been

[121]This is where policy measures such as emissions trading play an important role. Optimally, it should always be more expensive to burn fossil fuels than biofuels, which, however, is not always the case. Also, the free allocation of emissions allowances to new plants compromises wider environmental objectives.

initiated in which the *mechanical spreading of ash by way of a horse-drawn carriage* is tested.

Integration into management systems

WestEnCo wants its environmental work to be integrated into the daily activities; it should not be considered as a separate environmental program. Today, WestEnCo and most of its subsidiaries have a certified environmental management system according to ISO 14001. WestEnCo's district heating system was certified in 1998 in accordance with both ISO 14001 and EMAS principles. The internal management system integrates environmental management (ISO 14001) with quality management (ISO 9000) for which a common platform exists on the Intranet. A large part of the environmental management system is built upon common routines and instructions for the various energy production plants.

The day-to-day environmental work is performed in the ordinary line-organization. In addition, the Chief Environmental Controller relates to a number of environmental experts in various parts of the organization, who coordinate the environmental work on a broader basis (WestEnCo, 2007).

To describe how WestEnCo works with ***environmental goals*** three areas are shed light on. First, some principles and overarching goals are accounted for. Second, the follow-up of the goals is described and third, it is reported how environmental goals are revised.

Environmental goals exist at several levels and are particular for each business area. WestEnCo emphasizes that its overarching goal is to reduce emissions of greenhouse gases and other pollutants in relation to energy benefits supplied. A guiding principle is that the company *strives to attain lower emission values for its production plants than required* by the environmental regulator. Also here the general opinion is that WestEnCo is prepared to incur substantial costs for environmental improvements, since this is seen as an investment in the company's strong environmental profile. A concrete goal put up is that *heat deliveries should be run fossil free in the long run if produced in boilers*[122]*. The Energy Services Department has formulated its environmental goals in terms of sales targets for energy services*, arguing that if they can get customers to save energy, their most important environmental goal is reached.

At the operational level of the district heating business, *environmental goals are followed up weekly* in connection with the review of plant performance. Further, *goals are reviewed monthly by plant managers and environmental officers jointly*. The follow-up of the plants' environmental performance is facilitated by a data program that allows for emissions data to be read on a continuous basis and historically.

When it comes to the actual setting of environmental goals, different stakeholders influence their direction and level. Firstly, the municipality's prioritized goals are a source of

[122]Please note that at the time of the investigation, the goal was that district heat should be produced fossil-free by 2010 when produced in boilers (EMAS Report 2007).

input to the environmental plan and result in environmental goals. Furthermore, the Environmental Controller can make suggestions for improvements. Environmental goals are revised on a yearly basis. For the district heating system, the revision of environmental goals is described by the Environmental Engineer as follows:

> The process starts with the plant engineer and the 'orderer' from EFA, they sit together and discuss. This is probably the inception of improvement. Is there anything we can do? Why didn't we reach these environmental goals? [...] Can we make changes to fulfill the goals? Or if we have reached the goal, can we raise the limits somewhere? And this is also part of our quality work; we work with continuous improvements, become a little better every time. (1)

A sign of the ***integration of environmental criteria in management processes*** at WestEnCo is that the *environmental plan is an annex to the business plan*. Accordingly, it gets updated every year in connection with the annual strategy planning process.

When asked about how environmental aspects are accounted for in ***investment planning and implementation,*** the Energy Systems Analyst explains that:

> […] this is described in qualitative terms. When we write a decision support document for the Group management, we try to account for the benefit of an investment, both with regard to production and the environment; that it would reduce emissions by this much. But we don't….the environment is not in any way quantified in terms of money. We cannot put a sum for the environment in such document; this has to be done descriptively – discussing the benefits of doing something, and then what it costs and the expected profitability. (5)

Looking at calculation praxis for new investments showed that a number of methods are used in parallel, most notably net present value calculation and payback period. The span of the rate of return is between five to seven percent. However, *for strategic investments the financial requirements can be lower* as the following quote shows:

> The WeReGas project is not a project that can generate heaps of money, but it means taking a step towards 'the sustainable Western society'. Commit oneself to the gas society and the hydrogen society.....it doesn't need to give such high returns since it is another type of investment so to speak, a sustainable investment, not just a financial project. (1)

The same is true for small-scale investments that raise the production volume for biogas. These are considered strategic and hence a long-term perspective is taken when looking at their return potential, i.e. a longer pay-back period is granted. Most importantly, as mentioned by an interviewee, these investments allow the company to gain learning experience.

The question what the most important decision criteria for new investment were was answered as follows by the Energy Systems Analyst:

> They are without any doubt financial payoff and the environment. They are definitely the most important ones. I've become so close-minded - are there really other decision criteria than that? (5)

Regarding the implementation of new investments, environmental aspects are identified in line with the environmental management system and environmental plans are established.

Also, the impact of new investments on the overall environmental exposure of the company is checked.

To name just a few activities aiming at ***reducing the internal non production-related environmental impact***, WestEnCo has established *environmental requirements for subcontractors and suppliers*. The *guidelines for company cars* stipulate that a certain percentage of the fuel used should be gas or electricity. Furthermore, the business policy sets out that *business travels* should, whenever possible, be made in an environmentally-friendly way.

Analysis: Environmental integration

Emissions reduction: The company has worked extensively with the main components of technical integration to reduce emissions, i.e. improving energy efficiency and replacing fossil fuels. Substantial resources have been committed to fuel switching, for example by converting boilers, which allows running them on bio-fuels in the future. Optimization further means fine-tuning of processes and scheduling plant start-ups and shut-downs in the most efficient way. Obviously, the optimization of such large-scale production system requires expert knowledge, which WestEnCo undoubtedly possesses. Technical improvements require that new components or processes are integrated into the existing system without deteriorating the functioning of the current system. It seems thus to lie in the nature of these improvements that they are incremental, otherwise current operations might be put at risk. One word of caution worth addressing is that the flexibility imperative shifts the focus from environmental concerns to resource efficiency concerns, which sometimes but not always stand in conflict. Subject to economic rationality, environmentally sustainable production is just one out of several options. With regard to the management of environmental issues, the knowledgeable and experienced environmental organisation is a strength of the company. Its engagement in systematic environmental management combined with regular coordination with the production unit ensures continuous improvements. Noteworthy is also that the company has set up standards for the environmental performance of its subcontractors, thus encouraging environmental management throughout its supply-chain.

Product stewardship: The ongoing conversion to bio-fuels of large parts of the production system contributes to a more environmentally-friendly production mix for district heating, which is necessary to keep demanding customers. These improvements pave the way for a product stewardship strategy embracing green district heat offerings.

Clean technology: Environmental sustainability is a central parameter that has to be observed when planning new investments at the company. The environmental consequences of an investment project are important decision criteria next to financial payoff; hence they are carefully evaluated. The strategic importance of some clean technology ventures gives room to a more generous allocation of funds than would be motivated if purely financial motives lie behind these investments.

Sustainability vision: WestEnCo's explicit corporate vision of 'a sustainable Western society' raises the question how this is integrated into the operational core business. The most salient operationalization of the vision is the resource efficiency focus (maximum use of low quality energy). It seems however debatable if resource efficiency is a righteous standard to measure sustainability against. Anyhow, given that this sustainability vision is institutionalized within the company, this is the generally accepted working definition of sustainable development for the company that is postulated in different contexts.

Communication and learning

Environmental network activities occur for instance within the *internal network of environmental managers and employees from different areas* involved in environmental affairs. This forum opts at facilitating the exchange of experience and helps to drive the environmental work forward.

Within district heating production, the Environmental Engineers coordinate all environmental matters related to the day-to-day operation of the production plants, and contacts with environmental authorities. There is close communication between the Environmental Engineers and plant operators. Short reporting ways and regular feedback loops on plant performance allow for a swift adaptation of operations and also give input for investment decisions on the upgrade of plants. Environmental Engineers further make updates regarding changes in environmental legislation on behalf of the Environmental Controller. Moreover, Environmental Engineers form part of project teams for new projects such as the WeReGas biomass gasification plant. They are consulted to assess the adequate level of cleaning equipment and to apply for environmental permits.

External network activities are important to WestEnCo to judge from the fact that the CEO, members of the management, and employees from other levels have leading roles in energy-related industry organizations. WestEnCo is also *engaged in foreign business associations* such as Euroheat, amongst others. Network activities can be seen as vital for keeping up with developments and seizing new opportunities. The Business Development Manager for Renewable Gases sees it as crucial to be active in various networks, be it with business associations or in regional forums, in order to achieve an expansion of the biogas business.

Environmental training is held for new employees as well as for selected groups within the company. For instance, *training on environmental law* is held by Environmental Engineers, as required. In general, environmental training is at the discretion of the line managers. However, *the Chief Environmental Controller can take initiative for collective, company-wide training*. Within district heating, the Environmental Engineers also hold *environmental training for the plant operating staff*.

With regards to ***green organizational culture***, the Environmental Engineer mentions that there is widespread environmental awareness among employees:

> Today, one meets hardly anyone who doesn't have a clue about environmental issues. Mostly, everyone has an opinion. […] One does not need to struggle to do a good job, everyone understands that this is the way it is and should be. This, I believe, is very important! (1)

WestEnCo started to develop an environmental profile already in the 1970s (Polesie & Strid, 1998), and has been working with integrating environmental issues in the company ever since. The Environmental Engineer sees the greatest merit of the environmental work to lie in that "more and more people get aware of it", allowing the company to build up a collective engagement around environmental issues. However, although environmental work has a legitimate role in the overall conduct of business, the Environmental Engineer feels that progress can sometimes be slow when implementing changes.

Another way to involve employees in environmental issues is the '*suggestion box' on the internal network*, where employees can contribute with ideas for environmental improvements. The best suggestions get rewarded. There is also a *strong commitment to take responsibility in case of an accident* or leakage. Such incidents are handled in the best possible way, irrespective of costs.

Regarding ***environmental communication*** on the home page, WestEnCo emphasizes its long-term commitment to create a sustainable energy system in the Western region. Environmental issues are further communicated by way of *environmental reporting* which is based on three annual statements. It comprises an EMAS report for the district heating business as well as separate environmental reports for each plant that requires a permit[123]. Furthermore, the annual report devotes a number of pages to the environment and corporate environmental performance, including an account on environmental incidents.

A form of environmental communication is also WestEnCo's *participation at energy conferences and seminaries* where presentations are held on issues such as energy services or its gas development projects, etc. This is seen as beneficial to increase the trust in biogas with the public, investors and the agricultural sector, opening up for further development opportunities.

Internal competency building refers to knowledge necessary for new business development. It was mentioned that the *biogas ventures require knowledge on when and how to form companies* and whether or not it is meaningful to form a company around a new venture. Competency in working with biogas digestion is a further scarce resource which needs to be developed. It is considered important to bring experience from ongoing projects into new ones in order to continuously improve processes.

Stakeholder involvement and negotiations involve *a close dialogue with customers*, including them in the product innovation process. In addition, *regular discussions about efficient energy use take place with the large commercial customers and municipality-owned housing companies*. The External Affairs Manager sees this as vital in order to 'synchronize world views':

[123] These are a statutory requirement and contain particulars on environmental permits, emissions and mode of operations.

> Everything would be much easier if we had a common view; okay, everyone wants to have more environmentally-friendly stuff, but what does that mean? Having a common view on things makes everything much easier, but it is not at all self-evident that we have that. Especially when it comes to electricity and the environment. (14)

WestEnCo wants to take an active role in the climate debate, be it at the local, national or EU level (WestEnCo, 2008). Consequently, ***lobbying work*** is an important part of communication activities. The company tries to influence the debate by engaging in political dialogue. Lobbying work is described as a continuous learning process. It requires long-term engagement, as many issues have been driven for up to ten years. In Sweden, past successful lobbying activities concerned improving the taxation for combined heat and power production[124] and increasing the allocation of emissions allowances to new plants. A current issue concerns the tax exemption of biogas when transported in natural gas pipes[125]. WestEnCo sees these activities as crucial to make sustainable solutions economically feasible.

Through lobbying, the company tries to influence the understanding and shape of the future energy system. At an EU level, the External Affairs Manager describes this as 'a battle over ideological territory':

> There is competition, not so much over EU funds but over the ideological landscape, the views on energy systems and similar things. There, we are competitors; there are people who think that energy is energy and there is no possibility to differentiate. They have won a lot of ground under recent years, at least at a European level. Electricity and heat pumps are very much favored in the Renewables Directive […]. We can only state that there are many different interests and we are not the only ones who want a sustainable energy system. But the models for how this should look like differ significantly and this makes people fight each other instead of working together. (14)

Lobbying activities include *communicating with Swedish representatives in the EU Parliament*, providing them with input and initiatives on energy issues. WestEnCo further *writes debate articles and gives viewpoints on new directives*, for example on the EU's Energy Performance of Buildings Directive. Furthermore, activities in Brussels very much aim at making people aware of the benefits of using waste heat for district heating. Accordingly, regarding the Renewable Energy Directive, WestEnCo *tries to fend off writings that are detrimental to the use of waste heat in district heating*.

Under the heading ***business development*** two processes are shed light on: the strategy making process and the establishment of the business plan. The yearly strategy making process called POMS has a rolling three-year planning horizon and involves that each department establishes a strategy for the development of its product. The respective strategies

[124]This resulted in that the tax is only one tenth of what was originally suggested.

[125]Due to a disharmony in laws, biogas is taxed the same way as natural gas. A law change would make an environmentally beneficial energy solution also economically feasible. Moreover, the WeReGas project cannot be built unless the tax exemption has been implemented.

are then consolidated into a preliminary business plan for the coming period. The Business Development Manager for District Heat describes the POMS process as follows:

> This is an impressive portfolio of different ideas and projects that are tested both against the total system and against the market; we try to read the market. But we don't only read what customers want and the techniques available, we also have to read what the European Union says, what the Government says and what the regulations that are in the making mean to us; changes in the legislation, regulations from the National Board of Housing, Building and Planning and so on. It is fairly extensive work to keep an eye on the ideas that the authorities have. It's both high and low, so to say. (6)

Interesting aspects of the POMS process is that it involves a large number of people, in some departments up to 40. Also, the departments establish their development plans freely, meeting no budget restrictions in this initial phase. The subsequent establishment of a consolidated business plan uses a tool called LOTS which has been used and continuously refined since 1993. Having worked with the same tool over such a long period is seen as a strength, enhancing the continuity and purposefulness of the planning process.

Analysis: communication and learning

Emissions reduction: Several decades of working with environmental issues have led to that the environment is an authentic part of corporate values and culture. Naturally, this facilitates the implementation of more sustainable working practices at WestEnCo. The environmental work is geared towards continuous improvements and, given that the company has been certified for more than ten years, environmental management has undoubtedly reached high standards. However, there is the risk of 'business as usual' that could prevent the company from being receptive to the shifting requirements from its environment due to for example global warming concerns which would require double-loop learning rather than single-loop.

Product stewardship: Communication and learning is important for sustaining and extending business. If commercial district heating customers are dissatisfied, they might leave despite high switching costs. It is therefore important to keep a constant dialogue about the customers' wants and needs and 'synchronize world views'. The company's communication with stakeholders via environmental reports seems rather fragmented; it is difficult to gain a picture of the overall impact from the documentation. A comprehensive environmental report is only available for the district heating business, which is required for the EMAS certification. It should however be mentioned that in situations where environmental incidents could harm corporate image, the company shows that it takes full responsibility irrespective of costs.

Clean technology: For the biogas ventures not only specialist competencies need to be acquired on biological and chemical processes, but also more general knowledge is needed on how biogas ventures are best developed. These are continuous learning processes that evolve simultaneously with the growing practical experience with such ventures. It is also essential to reach out to a larger public and inform about on-going projects at workshops and seminaries, which allows for gaining trust and creating new opportunities for biogas development. Lobbying activities have been central to create acceptable conditions for sustainable technology deployment. Although the main goal of lobbying assumingly is to establish rules and regulations that benefit the firm, also follower firms can benefit from WestEnCo's achievements, if the company succeeds in removing some of the obstacles for disseminating clean technologies.

Sustainability vision: Two aspects unite communication and learning with the sustainability vision. Firstly, the CEO's commitment to environmental issues is an important factor for the embedding of the company's sustainability vision internally and in the numerous bodies he is active within. Second, lobbying work is a prominent example of communication and learning that aims at establishing the company's sustainability vision with external stakeholders. Given the 'battle over ideological territory' at an EU level with different competing views how the energy system should develop, it is valuable that WestEnCo assumes the responsibility to bring in its views in order to avert legal discrimination of typical features of the Swedish energy system.

Innovation

WestEnCo emphasizes that is wants to lie at the front edge when it comes to environmental management issues, which involves introducing new technologies and shaping the energy system of the future. Moreover, focusing on sustainable business solutions and future products is seen as a risk management measure (WestEnCo, 2008). The Business Development Manager for Renewable Gases believes that:

> When it comes to fuels, fuel gas or others – here I believe our actions will have consequences for how the system is going to look like in the future. In Western Sweden a large part of the developments takes place and at the same time we have a lot of biogas here. Even when it comes to electricity for the vehicle sector, what we do certainly matters. (13)

Also with regard to policy tools, WestEnCo wants to gain early experience. Within the framework of the Kyoto flexible mechanisms, *it participates in a CDM-project through one of the first Carbon Funds*. This provides the company with emission allowances that can be used for compliance with the EU ETS.

When it comes to ***green product offers*** WestEnCo frequently works together with consultants for the development of new environmentally-friendly products. At the time of the investigation, WestEnCo was *working on business models for climate-neutral district heating*. This resulted in a new service which involves that WestEnCo, against a charge, compensates for customers' district heating consumption by purchasing and invalidating emission allowances or investing in CDM-projects[126]. In June 2009 the *company extended its green product offers with 'good environmental choice' district heat* (for an additional charge of 25 Swedish Crowns/MWh). Furthermore, the Energy Services Department is in the

---

[126]12.5 Swedish Crowns/MWh are charged extra for this service.

process of *developing a green service for residential property owners* (called 'The Sustainable Pathway') that shows systematic pathways to develop residential property in accordance with certain environmental standards. The Head of the Energy Services Department explains how she looks upon the relation between the energy service business and its customers:

> I see energy services as the customer's partner when it comes to how to take care of his energy system and energy consumption. I am convinced that we can take this role on the market, we offer the sustainable alternative. The customer can rely on us, and we can guide him in the right direction. We want to work closer to the customer and more in dialogue with him. (12)

Hence, it comes as no surprise that customers are mentioned as the most important source of input for the development of new products in energy services.

The ***phase-in of green products*** is a strong endeavor, in particular related to the transportation sector. For example, WestEnCo promotes the use of natural gas in the shipping industry in order to replace dirty oil. The use of gas is further promoted in heavy trucks. However, the ambition is to gradually replace natural gas by biogas. As mentioned, the goal is to have 100 % renewable gas by 2050. It is reasoned that a higher availability of biogas also promotes its use in other applications than as a car fuel.

The development and ***phase-in of green technology*** is essential to reaching WestEnCo's targets for biogas. The flagship project is the biogas gasification project WeReGas, opting at the *large-scale production of biogas through the gasification of biomass and wood waste*[127]. The project is conducted together with and co-financed by a large player in the energy market[128]. The intended use of the gas is as vehicle fuel, in industrial processes and for combined heat and power production. Furthermore, various *smaller investments are made in biogas fermentation plants using not yet fully tested techniques*. The Business Development Manager for Renewable Gases explains their reasoning:

> We say that we want to lie at the front edge of development when it comes to biogas […]. The front edge for us is having the main focus on new technique and build, build and once again build new installations. But if we want to progress we have to dare to use new technique that is not yet well-tested. (13)

Moreover, the long-term plans for the combined heat and power plant to switch from natural gas to biofuels will require further technology development according to the External Affairs Manager.

> There, a long-term project is to reduce emissions by switching fuels which is also being discussed. And there it's technical development we talk about; can we in some way squeeze in solid fuels into a gas turbine? […] We have a couple of interesting ideas around that. (14)

---

[127]The first stage, initiated in 2009, involves the construction of a gasification plant for 20 MW. In the second stage, an additional 80 MW of capacity are to be built by 2016.

[128]Providing 20 % of the financing.

At WestEnCo, ***demand-side management*** is considered a necessity to maintain a good customer relationship:

> If we don't offer customers a good deal, which not only means a fair price but also helping him to keep his consumption down, then someone else will do it. Trying to sell as much as possible is not sustainable in the long run. Rather, we must try to offer the customer a competitive deal which means a good price and low consumption. That's just how it is. (5)

The concept of energy services builds upon the above reasoning by the Energy System Analyst. By optimizing the energy supply and operations of residential properties and commercial premises, energy services can contribute to a sustainable society and satisfied customers simultaneously. Energy services hence *offer a number of products with varying degree of involvement*. Examples of more simple services are energy statistics or energy maintenance and operations agreement. A more far-reaching service is the Climate Agreement, in which the company offers a desired in-house temperature, which results in average in a reduction of energy consumption by about one fifth. The Head of the Energy Services Department explains one of the principles for working towards a 'sustainable Western society':

> We integrate more on the raw material side and more towards the final consumer in order to optimize the energy system in the city. (12)

A further opportunity for integration was created through the *installation of electricity meters for remote reading* with customers, using the most advanced technology available. Energy Services is *in the process of developing business models for energy saving with private customers* based on this technology. Demand-side management in the district heating business involves *changes in the pricing model*, enabling customers to save money by using energy more efficiently.

When it comes to ***research and development***, WestEnCo is engaged on several levels. On the one hand, the company funds external research and development projects through its own research foundation[129], making it possible for researchers to test their ideas in a real-world situation. WestEnCo also takes part in external development projects with universities or the EU[130] by way of financial contributions or by having own employees collaborating in these projects[131]. Furthermore, the company conducts own development projects or participates in joint research projects within the industry.

[129] Around 20 research projects of strategic importance from different areas of energy production, distribution and consumption are funded on an on-going basis.

[130] WestEnCo forms part of an EU project within the sixth program framework for sustainable energy systems. The project aims at creating a demonstration platform for biogas as transportation fuel with the help of a European cooperation.

[131] One example is a waste refinery project of a nearby university in cooperation with the Renewable Gas Department.

Analysis: Innovation

Emissions reduction: WestEnCo's broad range of innovative activities that aim at reducing emissions show that there are still a large number of cheap or profitable measures to be taken. The company seems to possess appropriate structures and competencies to deploy these emission reductions in diverse industry contexts, which might point at a well-developed absorptive capacity within the firm. It can also be observed that innovations connected to emission reductions are increasingly systemic and directed towards customer behaviour (e.g. related to demand-side management and energy services). Furthermore, the engagement in a CDM/JI project at such an early stage signals that WestEnCo wants to lie at the forefront even with regard to environmental policy innovations.

Product stewardship: The product stewardship strategy of the company revolves around quality improvements and new products, developed in collaboration with customers and consultants. Hence, the innovation process resembles Van de Ven's definition of developing and implementing new ideas resulting from a lengthy engagement with others within an institutional context. The demand for climate-friendly district heating resulted in two new products offered as add-ons at an extra cost. Energy services, built on the idea of reducing customers' consumption, are also a line of business with a high potential to contribute to sustainable development and growth since they are seen to create many deep customer relations.

Clean technology: There is a perceived need for pioneering approaches requiring clean technology innovations in both the biogas business and district heating. This involves taking substantial risks as the techniques used are not yet fully tested. This is however necessary to develop the competencies of the future for the company, broadening its business beyond traditional fields of energy production into adjacent areas that are more sustainable in the long term. Clean technology innovations are the building blocks of a strategy that is adapted to an anticipated carbon-restrained economy.

Sustainability vision: WestEnCo wants to lie at the front edge and contribute to shaping the energy system of the future. Its firm belief and extensive ventures in biogas will undoubtedly have an impact on the future energy system. Also the company's openness and contributions to research and development are likely to make a difference. Through collaborative research drawing on the competencies within the larger socio-technical system, the company sets the direction for technology development and secures the resources and competencies that are required to work towards its sustainability vision.

Cooperation

When it comes to the ***connection of external heat*** suppliers, WestEnCo's district heating system is linked to the neighboring system of a competing energy company enabling the optimal use of joint resources.

Cooperation is important to secure ***access to renewable energy sources***, particularly for the development of the biogas business. New substrata, for example manure, are used for the fermentation to biogas[132], requiring cooperation with farmers. A *cooperation with local forest owners* has been initiated in an effort to make use of forest residues within the region (WestEnCo, 2008).

Cooperative ventures refer to developing clean technology investments in a joint effort. One out of many examples of such venture at WestEnCo is a project with a recycling company in Western Sweden to purify digester gas obtained from household refuse. Further similar projects may involve municipalities, regional actors, industries or farmers in the cooperation. The Business Development Manager for Renewable Gases explains why cooperating is fundamental for biogas development:

> When it comes to cooperations, we believe it is extremely strategic with cooperations. Partly because you have to, let's say, find a place that is worth building on. It is vital that those affected by it are positive, this can for example relate to a municipality. Then you need to get hold of raw material, substrata, there we can have cooperations with farmers or different types of industries that have raw materials. Then you need to cooperate in order to build a gas station…. The municipality maybe pushes for gas vehicles in public service or puts pressure on bus traffic. There are so many steps – suppliers maybe need to cooperate to develop new technology…. So it's the whole chain….it's the very basis for development! (13)

Furthermore, a biogas gasification test installation has been built in cooperation with the local university of technology, forming the base for the WeReGas investment project. When it comes to wind power, a *new wind mill was erected in cooperation with a housing company and other actors*, providing renewable electricity to a particular housing area. A further cooperative venture aims at *building up an infrastructure for electric vehicles*[133]. It involves developing a new technique for charging stations for electric cars in cooperation with a university and other actors.

Cooperation for sustainable development relates to a number of activities. For example, WestEnCo has *established an ecological foundation for the promotion of alternative energy sources*. The partner companies form a network where knowledge and ideas can be exchanged. With regard to energy services, WestEnCo engages in *knowledge sharing with other energy companies* from Sweden and Norway, for example regarding product development. The Head of the Energy Services Department is convinced that this is beneficial for the company:

> We think like this: We know that we lie pretty much at the forefront when it comes to energy services. The larger the number of energy companies that work the same way as we do, the better it will be for us since this will turn into a standard – this is like energy companies work. If

[132]In addition, this reduces the CO2 content of manure by a remarkable 80 %.

[133]The vision and goal is to build 10 000 charger stations for hybrid and electric cars in the region together with other actors within ten years.

> we can get other energy companies to work like we do, we can be reassured that we get better chances for survival and growth. (12)

Cooperation is thus a mechanism to institutionalize norms within a wider community of practice, strengthening both the participating companies' and WestEnCo's development opportunities.

A further cooperation for sustainable development is the *joint venture with a vehicle manufacturer* to transform its factory so it becomes carbon-dioxide free. The project involves a range of measures such as energy efficiency improvements, heat from a new bio-fuel plant and electricity from wind turbines. In another cooperation, WestEnCo, the local harbor company and a gas company work together to build a harbor terminal for LNG[134] transports. The gas could then mainly be used in shipping.

When it comes to EU-related matters, WestEnCo coordinates its activities with the officer dealing with EU issues at Western municipality. Furthermore, WestEnCo often cooperates with business associations and consultants when preparing EU issues.

Analysis: Cooperation

Emissions reduction: Besides the direct emission reductions from the connection with a neighbouring district heating system, indirect links between cooperation and emission reductions can be found. WestEnCo's broad competence in emission reductions makes it a suitable partner to implement far-reaching changes in large industrial companies. Similarly, Energy Services passes on knowledge on product development to other companies, enabling them to adopt similar practices and accomplish emission reductions with their customers. If resource efficiency can be strengthened in the housing and other sectors where energy services are relevant, a significant contribution to sustainable development can be made.

Product stewardship: Cooperation is an important element of the product strategy for energy services, aiming at establishing a common standard of good practice for the business. Since this institutionalizes WestEnCo's practices while offering a learning opportunity to other companies, there is a win-win situation. In the biogas business a variety of cooperations ensure access to raw materials that form the base of a product stewardship strategy attempting to rapidly increase biogas production volumes. Cooperation is a prerequisite for managing the complexity inherent in such ventures, given the involvement of many vastly different parties that have to interact in coordinated ways.

Clean technology: Cooperative efforts are an absolute must to strengthen clean technologies, be it for electric vehicles, biogas development or large-scale clean technology developments. The types of cooperations, WestEnCo's role in them, as well as the nature of cooperation partners cover a wide spectrum. Cooperation is seen as the very basis for development, particularly when it comes to biogas. Overall, the challenges of transforming the energy system simply can't be tackled by single actors; hence, a large player like WestEnCo can

[134] Liquefied Natural Gas.

assume an important role as a cooperation partner for the development and diffusion of clean technologies. Assuming the role of a 'prime mover' (Johnson & Jacobsson, 2000), it can initiate and contribute to the diffusion of new technologies.

Sustainability vision: Cooperation enables the company to realize its vision to alter the system design towards a biogas society. Clear goals for biogas development have been established, whereas fossil gas should be phased out by 2050. It is therefore vital to achieve growth in this business line, for which cooperation is the development formula.

Local embeddedness

With regard to ***infrastructure building***, one activity of WestEnCo is the *expansion of the district cooling network in central town,* which is due to continue for a couple of years. The company also plans to further *expand its natural gas network*. Since the network can also be used for biogas once production volumes are larger, this is seen to create the necessary infrastructure for a future changeover to biogas. Through its part-owned subsidiary, WestEnCo extends the network of filling stations for gas vehicles by one third per year. As mentioned, WestEnCo also participates in a project that aims at building up the regional infrastructure for charging electric and hybrid cars. A further infrastructural project was the *installation of electric sockets in the harbor*, allowing ferries and merchant vessels to turn off their engines when moored.

Under the topic ***regional development*** especially the company's endeavours towards a gas-based society stand out. In particular, WestEnCo participates in the regional cluster for biogas development, whereas its contribution to the cluster value chain lies in biogas production and distribution. An advantage of biogas is that its production is to a large extent locally embedded. This is how the Business Development Manager for Renewable Gases looks upon the product:

> We think that it is a very good product. You make use of waste and transform it into a refined product […]. And much of it is locally-produced. So this is a fuel that is produced locally and used locally, which, as a consequence, makes you reduce transportation costs. Then it is positive in general that this is a new branch of business, it can produce more jobs and all those effects. (13)

The manifold of projects described earlier confirm that there is a strong commitment to build up (bio)gas-based solutions for both industry and the transportation sector. An important step in this obviously is the commitment to build up the regional gas infrastructure. These activities are well in line with Western Municipality's goal for Western Sweden to become a leading region within biogas (BRG, 2009).

Corporate governance can for instance be studied by means of the Owners' Directive. In WestEnCo's case, this document stipulates that the company may not engage in activities beyond a radius of 120 km from the city without getting permission from the Municipal Council. This restricts WestEnCo's range of activities, at least geographically. A further area of influence is the municipality's budget as well as its environmental quality goals for the city. According to the Environmental Controller:

> The municipality's budget is strongly leading the way, but it's not only about money, it's also about – they have set up about 25 prioritized goals which should be worked on and we have picked the prioritized goals we can work with. […] Energy efficiency in premises, that's something we can work with. That's a goal we can take up and work in accordance with in our environmental plan. (4)

Hence the municipality's overarching environmental goals are embedded in the company's objectives and broken down into measurable environmental goals.

When it comes to the relationship between the management and the owners the general impression is that it is very much based on trust, as expressed by the Facility Manager:

> I believe that the management has a very good cooperation with the owners, that's the politicians in Western municipality. They have a very good dialogue [...] they rely very much on what we are doing. (3)

A shared understanding on the future development path is doubtlessly crucial for moving towards a 'sustainable Western society'. As raised by the Wind Farm Development Project Manager, it is very important to have political support for new investments. Political acceptance for sustainability projects for instance facilitates obtaining location permits for new plants.

Also regarding financing, WestEnCo seems to be able to rely greatly on its owner. Western municipality grants the company interest bearing loans[135] amounting to roughly 40 % of the balance sheet total. In comparison, only three percent come from commercial lenders[136]. WestEnCo points out that "financial strength is a prerequisite for converting to renewable energy" (WestEnCo, 2008). Getting the financial back-up from its owners can be thought to greatly facilitate pursuing development goals towards 'a sustainable Western society'.

Furthermore, WestEnCo states that it *wants to be a good corporate citizen beyond the energy benefits it provides*. It therefore has various cooperation agreements with a number of local sport clubs as well as cultural and social organizations.

Analysis: local embeddedness

Emissions reduction: Two points seem of relevance here. The fact that the company's environmental goals are firmly rooted in the municipality's goals makes sure that the company's emission reduction efforts are locally embedded. Long-range engagement in emission reducing technology, e.g. district heating, has contributed substantially to better air quality locally. Furthermore, offering products that are locally produced and consumed, as is the case for biogas, naturally creates far less emissions than relying on imported fossil fuels.

[135] Almost half of it is long term.
[136] Mainly the European Investment Bank.

Besides, it helps the agricultural sector to reduce its emissions of methane from manure.

Product stewardship: Infrastructural projects allow for a smooth deployment of the product strategy in the future. For example once biogas has the potential to replace natural gas it can be transported in the existing pipelines. An infrastructure that facilitates sustainable solutions enables other industries to become less polluting, e.g. shipping. At the same time LNG technology might become an interesting niche for WestEnCo to broaden its competencies.

Clean technology: Carrying through investments in clean technology meets many challenges and getting support from the owner evidently is beneficial to solve the equation. As mentioned, political acceptance is key to the realization of clean technology investments. Naturally, also the financial back-up from the owner creates favorable conditions for WestEnCo to make the large investments required.

Sustainability vision: WestEnCo's sustainability vision is embedded in the local context in many ways, which is expressed in a multitude of sustainable initiatives. Besides explicitly aiming at 'a sustainable Western society' the vision is anchored in the municipality's ambition to make Western Sweden a leading region for biogas.

5.5 Case study summary

In the following, a summary of the case companies' activities and practices that directly or indirectly improve the environmental sustainability of their business is provided, organized under the five greening mechanisms.

5.5.1 Environmental integration

The case companies are characterized by strong abilities to integrate sustainable business practices into energy systems and management processes. On the technical side, *fuel switching* is widely used, e.g. bio-oils replace fossil fuel oils. In SouthEnGroup, this regards the base-load, while WestEnCo introduced bio-oil as a starting fuel in biomass-fired plants and in top-load facilities. For LocalEnCo, fuel flexibility has been an important consideration when planning its new biomass-based cogeneration plant. An additional priority for the technical systems is *energy and resource efficiency,* i.e. opting for the lowest possible resource consumption and emissions per unit of energy delivered. This involves maximal use of low-quality energy, for instance waste heat, to produce district heat. For WestEnCo, resource efficiency is not only a technical issue, but also a part of the company philosophy. Process improvements, for instance relating to the burning process, are continuously worked with. Additional savings can be made by avoiding frequent start-ups and shut-downs of plants, and by preventing top-load production. Further efficiency improvements were made by linking separate district heating systems. To upgrade existing power plants, for instance a steam turbine for electricity production was installed at one of WestEnCo's facilities, while SouthEnGroup upgraded its energy system with an accumulator tank for hot water storage.

Regarding management processes, the certified *environmental management system* is the key driving force for improvements. WestEnCo and SouthEnGroup are early adopters of the scheme. In particular, establishing routines for every production process is important for controlling the environmental impact, whereas improving routines systematically is vital for developing the environmental management system further. All companies monitor their *environmental goals* regularly and revise them annually. SouthEnGroup recently sharpened its ambitions and decided to become 'climate neutral'. This involves mapping emissions from all sources each year and implementing measures to reduce them as much as possible. The remaining balance is compensated by way of emission reducing projects abroad. Consequently, SouthEnGroup has integrated environmental goals into its business plans, avoiding that business and the environment are treated as separate issues. Environmental measures have further been integrated into management systems, such as the performance management tool Balanced Scorecard, on which the staff incentive system is built. LocalEncCo emphasizes the importance of the Environmental Controller to negotiate new goals and ensure that existing goals are sharpened. At WestEnCo, environmental goals exist at several levels and are particular for each business area. Various stakeholders influence their direction and level, whereas the municipality's prioritized development goals are an important source of input to the environmental plan. WestEnCo strives to attain lower emission values for its plants than required for compliance. The general opinion is that the company is prepared to incur substantial costs for environmental improvements as they are investments in its strong environmental profile. A concrete aim is that heat deliveries from boilers should be fossil-free by 2010.

5.5.2 Communication and learning

Communication and learning facilitates the process of change towards environmental sustainability, both internally and with external stakeholders. At the large and the medium-sized company, the environmental coordinators meet regularly to discuss emerging environmental issues and to exchange experiences. SouthEnGroup uses the meetings to ensure that the centrally planned environmental work is spread across the entire group. Environmental managers at all companies view external network meetings with colleagues as a valuable forum for exchanging ideas on how to improve environmental work.

Fostering a *green organizational culture* is an important concern to the case companies. LocalEncCo sees management leadership on environmental issues as essential to create commitment at lower organizational levels. In the small and the medium-sized company, the environmental manager plays a crucial role in creating a greener mind-set. At the operational level, she is the 'spider in the web', engaging and spurring employees to commit to environmental improvements. All three companies provide environmental training to employees in order to create commitment and facilitate the implementation of environmental goals. SouthEnGroup highlights that empowering employees to take responsibility for the environment often results in bottom-up initiatives for environmental improvements.

Interviewees of the group emphasize that they feel free to raise new ideas with management. Hence, employee involvement is facilitated by an open communication climate. Moreover, all companies provide environmental training to the Board of Directors, strengthening their understanding of the company's environmental impact and how it can be mitigated.

Steering towards *behavioural changes* is a further key to reducing emissions internally. SouthEnGroup's goal to achieve climate-neutrality requires a holistic approach to emission reductions. It involves creating policies encouraging sustainable behaviour within most aspects of its business, including company cars, business travels, meetings and internal energy savings. Moreover, given that many environmental problems are 'imported' through the supply chain (e.g. Elkington, 1994), all case companies scrutinize their suppliers and subcontractors for their environmental impact and have established appropriate purchasing routines.

A *continuous dialogue* with customers ensures that product development is in line with customer needs. New energy services and the development of climate-neutral district heating are prominent examples of this engagement. At WestEnCo, regular discussions on efficient energy use take place with the major commercial customers and municipality-owned housing companies in order to 'synchronize world views'.

Environmental communication is performed by all case companies, predominantly through their webpages, where detailed information on environmental problems connected to energy production and consumption is provided. SouthEnGroup engages in a dialogue with stakeholders also through other measures, such as separate environmental reports and seminaries. WestEnCo takes part in the larger debate about the development of the energy sector. Through lobbying at a political level, the company tries to improve the economic viability of sustainable energy solutions. It also tries to influence the debate on the shape of the future energy system at an EU level, mainly to ensure that Swedish solutions will not be discriminated in the future.

Asked about the *internal competencies* required for clean technology implementation, WestEnCo mentions knowledge on how and when to form companies around a new venture to be crucial for the development of its biogas business. Competency in working with biogas digestion is another scarce resource that requires further development. Freshly gained knowledge needs to be transferred to new projects in order to continuously improve processes. SouthEnGroup mentions three crucial knowledge areas required for developing the planned cogeneration plant: 1) Technical competence, including environmental expertise. 2) Financial competence, referring to investment appraisal and the maintenance of a good credit rating, and 3) Legal competence with regard to obtaining the various permits required. These knowledge areas must be developed in parallel and coordinated internally.

Stakeholder involvement seems important to the smooth implementation of clean technology investments. LocalEncCo emphasized the importance of having a good relationship with its owners for realizing its investment in Grove Hill. The municipality acted as a guarantor for loans, enabling the company to obtain favorable financing conditions and hence eliminating the disadvantage of scale that small energy companies otherwise face. The municipality looks positively upon this investment as it contributes to a better environment and enables LocalEncCo to deliver stable returns and low district heating prices. Also WestEnCo emphasizes the importance of political support for realizing new investments. Political acceptance for clean technology projects facilitates obtaining location permits for new installations.

For SouthEnGroup, in contrast, the realization of Gravel Site, the large heat and power plant to be fired with regional biofuels, was more problematic. Despite efforts to build up a positive public opinion towards the project, it was much disputed by local residents. An appeal against the Environmental Court's decision to grant permission for the construction of the plant substantially delayed SouthEnGroup's transition to renewable energy production.

5.5.3 Innovation

Innovations at strategic and operational levels are crucial to competitiveness and to improving the environmental qualities of products and processes. Timely identification of threats and opportunities is vital to direct the innovation process. According to respondents, in particular commercial customers are concerned with the environmental impact of their energy consumption. LocalEnCo focuses on *green product innovations* that emphasize product quality. New sustainable products, such as 'Good Environmental Choice' district heating, reflect the company's efforts to offer environmentally-friendly alternatives and to assist in particular commercial customers to improve their environmental performance. SouthEnGroup satisfies the demand for climate-neutral district heat by selling it at request. It is seen as probable that this will eventually evolve into a new product. Product innovation at WestEnCo relates mostly to energy services. Several products with varying degrees of involvement are offered, helping customers to save energy. Furthermore, WestEnCo is developing a 'green' service for residential property owners, which comprises systematic pathways to develop residential property in an environmentally sound way.

Demand-side management is another key area for innovations. At SouthEnGroup, this involves launching a free statistics service that allows customers to check their energy consumption on a continuous basis. WestEnCo manages demand in the district heating business through changes in their pricing model, which enables customers to save money by using energy in a more efficient manner. The companies agree that demand-side management is necessary to maintain good customer relationships.

Another aspect of innovation is *the phase-in of green products.* SouthEnGroup took the initial step of providing 'green electricity' automatically to customers who did not make an active choice of tariff. For the fuel gas business, the company intends to gradually introduce biogas into the distributed fuel gas and increase the renewable share of the provided energy. WestEnCo makes large efforts to phase in more sustainable fuels even in other industries, for instance in shipping and heavy trucks.

WestEnCo emphasizes that it wants to be at the cutting edge when it comes to environmental strategies, introducing new technologies and shaping the energy system of the future. A case in point is the development of its biogas business. The *phase-in of green technology* is an essential part of WestEnCo's targets for biogas. The flagship project is a biogas gasification project involving the large-scale production of biogas through the gasification of biomass and wood waste. Furthermore, various small investments in biogas fermentation plants are made, using not yet fully tested techniques. WestEnCo's long-run plan for its cogeneration plant is to switch from natural gas to biofuels, which, however, requires further technology development.

Other clean technology investments relate to *tested technologies*. For instance, SouthEnGroup is about to build a biogas recovery and upgrading plant in cooperation with the public water treatment company. In addition, test drilling for additional geothermal wells is undertaken.

Furthermore, *research and development* are essential for clean technology development. While LocalEnCo and SouthEnGroup engage in research and development mostly through industry associations, WestEnCo is directly involved. Firstly, the company funds external research and development projects through its research foundation, enabling researchers to test ideas in a real-world situation. Secondly, the company takes part in external development projects with universities or the EU by way of financial contributions or through qualified employees collaborating in these projects. Thirdly, WestEnCo conducts own R & D and participates in joint research projects within the industry.

5.5.4 Cooperation

Cooperation with external parties allows for a more efficient use of resources and improves the sustainability of the production mix. An interesting example of this is the outsourcing of district heat production to local farms at SouthEnGroup, which allows for the beneficial use of waste products from farming while contributing to greener production. The pricing model is based on profit sharing, i.e. the difference between production costs using fossil fuels and biomass is split between the company and the respective farm. WestEnCo sourced nearly 60 % of its district heating from industrial waste heat in 2008, while LocalEncCo's district heating system is connected with the neighbouring provider's system, enabling the optimal use of joint production resources.

The companies also aim at increasing clean technology investments through *cooperative ventures*. At WestEnCo this involves for instance building a biogas gasification test installation together with the local University of Technology, which forms the basis for the planned investment in the state-of the art biomass gasification plant (WeReGas). Cooperative ventures allow joining resources (e.g. for financing) and competencies for project development, which facilitates a smoother realization of projects. SouthEnGroup cooperates with other often small municipal energy companies to bring about larger wind farm projects. It also cooperates with windmill development companies, sparing the company from

engaging in costly and time-consuming application processes for wind mill construction. In addition, the company has a 10 % holding in a wind power development company that promotes wind farm projects in cooperation with landowners and nearby residents. This proves to be a favorable approach, reducing objections by local residents.
Close cooperation between LocalEnCo and an environmental organization has opened up new areas of product development, enabling the company to be one of the first in Sweden to offer 'Good Environmental Choice' district heating. Cooperation with the local municipality is also seen as important, especially in the areas of land use planning, district heating expansion, and energy planning.

WestEnCo further engages in knowledge sharing with other energy companies on the development of energy services. As argued by WestEnCo, such a cooperation allows it to establish standards within a community of practice, strengthening both the participating companies' and its own development opportunities.

5.5.5 Local embeddedness

Energy companies can concentrate value at the local level by the embedding of their activities in the local setting in various ways. One of these ways is the building of an *infrastructure for sustainable products*. SouthEnGroup continuously extends its network of fuel gas filling stations. Similarly, WestEnCo has a strong commitment to building up (bio)gas-based solutions for industry and the transportation sector. Its efforts to build up the regional gas infrastructure clearly represent an important step in this strategy. The development of the natural gas network simultaneously creates the necessary infrastructure for a future transition to biogas, once production volumes are larger. WestEnCo also participates in a project that aims at building up the regional infrastructure for charging electric cars. A further infrastructural project was the installation of electric sockets in the harbour, allowing ferries to turn off their engines when moored.

When it comes to *regional development*, WestEnCo's commitment to a gas-based society stands out. WestEnCo participates in a regional cluster for biogas development, where its contribution to the value chain is the production and distribution of biogas. Regional development for SouthEnGroup relates to the company's strategy to seek cooperation with local players. For instance, SouthEnGroup believes that locally-produced fuels are advantageous because: 1) they support local agriculture and industries; 2) purchasing local renewable fuels increases the security of supply and improves control over the environmental consequences of production; and 3) locally produced fuels cause less pollution owing to reduced transportation.

Regional (or local) development goals of the municipalities and the energy companies frequently overlap. The promotion of district heating and fuel gas are prominent examples. The owner's directives give further directions as to the *corporate governance* of the case companies, stipulating for instance their range of activities. The relationship between the management and the owner, i.e., the municipality, is frequently described as based on trust.

The municipality and the energy company work together to improve the environment. For instance, municipal goals for environmental quality are embedded in WestEnCo's environmental plan.

Close ties with the owner also favor clean technology investments. For LocalEnCo, the municipality was willing to stand as a guarantor for loans, which compensated for the disadvantages of scale that smaller companies face when planning for increased production capacity. SouthEnCo emphasized the larger possibilities it has to take a long-term perspective on its environmentally beneficial investments thanks to lower financial demands from the owners.

The *local strategy* is a prominent feature of both SouthEnGroup and LocalEnCo. For LocalEncCo it manifests itself for instance in the fuel procurement policy. Biomass is purchased from local sources only (within a radius of 200 km), in line with the criteria for environmentally-certified heat. Moreover, LocalEncCo is oriented towards creating public welfare locally, which is reflected in its service-mindedness and community involvement. The company highlights that its ultimate owners are the municipality's citizens. Hence, it tries to engage the public in the construction of Grove Hill. LocalEncCo is also a member of the employer's association organizing public welfare-oriented companies that emphasizes creating community benefit on commercial grounds. Similarly, the local strategy is an essential feature of the sustainability vision of SouthEnGroup. It is a differentiation strategy, aiming at preserving and strengthening its local roots. Consequently, all group subsidiaries operate under their local brand name. Furthermore, the group is organized in a decentralized fashion. This enables employees to preserve their local knowledge and assist customers more effectively, for instance with power failures. Customers reportedly identify more readily with the local company than with a large external actor, which safeguards built-up trust and customer loyalty. The aims to create public welfare and contribute to a sustainable society are other aspects of the local strategy.

6 Providing answers to the research questions

This study examines how the transition towards an environmentally sustainable business is managed by municipal energy companies with a high environmental commitment. Three research questions have been investigated in the chosen empirical context. This chapter provides the answers to these questions by adopting the frameworks and tools presented in Chapter 4. For an overview, please refer to Figure 4.7, featuring the main model of analysis. The chapter is organized as follows: Each research question is introduced at the beginning of the section, followed by a short discussion of the choices made to answer it, given its particular nature. Subsequently, the analysis is presented in line with these choices.

6.1 Strategies for environmental sustainability

The first research question is of an exploratory nature, asking: *"What do strategies for environmental sustainability in municipal energy companies with a high environmental commitment entail?"* Strategies for environmental sustainability were explored with the help of three case studies as outlined in Chapter 2. The first research question focuses mainly on the content of such strategies. Environmentally-oriented activities and practices constitute the basic units of analysis of strategies for environmental sustainability. In Chapter 5, the empirical material was presented, providing a comprehensive description of what such strategies entail in municipal energy companies with a high environmental commitment. To provide a more in-depth answer to the first question, the empirical material is analyzed with the help of the '*Framework of conceptual areas of strategies for environmental sustainability',* outlined in Figure 4.1.

6.1.1 Emissions reduction

Emissions reduction focuses on activities that minimize emissions resulting from conducting business, or aim at increasing resource efficiency. The activities and practices identified under this conceptual area can be divided into two broad themes. The first relates to mitigating emissions from the energy production system, putting focus on technical solutions. The second relates to management processes that are people-oriented and aim at integrating environmental concerns broadly within the companies. Emissions reduction mainly addresses what is done internally to minimize the environmental impact from business activities.

Technical measures, such as fuel switching, were observed in all case companies. SouthEnGroup replaced smaller fossil fuel units, whereas WestEnCo prepared its boilers for a future switch to biofuels. SouthEnGroup and WestEnCo emphasize the importance of flexibility in the production system. WestEnCo's district heating system is of considerable size and continuous optimization is important for efficient resource use. A wide range of specialized competencies are needed to keep the system in good trim and find ways to develop it in a sustainable way. Both WestEnCo and SouthEnGroup managed to improve resource efficiency by building additional pipelines, connecting separate district heating systems, and by taking advantage of waste heat. Compared to the larger companies, LocalEnCo has fewer opportunities for system optimization, given its smaller production system. Also the flexibility of the system is restrained, which makes connecting it with a neighboring one even more relevant for efficient resource use.

SouthEnGroup utilizes cooperations with nearby farms to increase the share of renewables in the production mix. Using local fuels and waste products are other measures that take advantage of existing resources and keep emissions low. The group aims at making both its production and remaining organization carbon-neutral in the long run. This bold decision triggered extensive work to measure and reduce emissions, whereas consultants were useful to speed up the learning process. The group managed to halve its CO_2 emission over the past two years, while the other two companies reduced their emissions with approximately one fourth between 2007 and 2008. SouthEnGroup and LocalEnCo are planning a transition to renewable fuels, whilst WestEnCo has as of now a considerable share of fossil gas in its production mix, although plant efficiency is high. Phasing out fossil gas is a long-term goal and a matter of devising alternative fuels and production methods. Biogas is seen as one such substitute for the more distant future, complemented with innovations in combustion technology.

Considering emissions reductions more broadly, WestEnCo has good knowledge as to how the environmental impact of other industries can be reduced. This makes the company a valuable cooperation partner for local industries, rendering their energy use more efficient or sustainable.

The timely adoption of ISO 14001 norms and a well-established environmental organization seem central to achieving high environmental standards at the case companies. ISO 14001 is the main tool to achieve emission reductions. WestEnCo and SouthEnGroup have worked with the tool and thus with continuously improving their environmental management since 1998. Early involvement allowed for the accumulation of competence, learning constantly from experience. Furthermore, holding the environment as a core value over such a long period provided the foundation for formulating and implementing an ambitious strategy for environmental sustainability. This indicates the presence of time compression diseconomies; speeding up the accumulation of resources in environmental management is difficult for companies, despite high ambitions and generous fund allocation.

Significant differences were observed as to the organization of environmental management. LocalEnCo differs from the larger companies by building more strongly on personal communication and relations. The environmental controller plays a dominant role, acting as the 'spider in the web' to make the environment a prioritized issue. This may facilitate creating commitment towards the natural environment, supporting the radical change of course towards environmental sustainability. In general, LocalEnCo seems to have an advantage in that its activities are more easily coordinated thanks to proximity and stronger personal ties.

SouthEnGroup is organized in a centralized fashion. Environmental procedures are elaborated at the head office and the operative environmental management is rolled out to the subsidiaries through a network of environmental coordinators. Significant savings can be expected from opting for climate neutrality, although the implementation phase may be long and costly. Presumably, there are scale economies in implementing an emission reduction strategy throughout the 19 subsidiaries, given that experience can be exchanged in a tight internal environmental network. Policies to reduce the environmental impact have been elaborated for virtually all corporate areas, for instance travelling, company cars and supply management. Moreover, the integration of environmental measures in performance management and incentive systems reflects the commitment to environmental improvements.

Good corporate citizenship and being a role model in environmental management are driving forces for SouthEnGroup's environmental work. The group also has the resources to anchor sustainable energy solution with its stakeholders (for example by holding seminaries, issuing books etc). Overall, cooperation is an important means for the group to get hold of the renewable resources needed to implement its strategy for environmental sustainability.

WestEnCo's ordinary environmental work is managed in the line organization. Beyond that, specialized environmental staff is located in various parts of the organization. Environmental engineers closely collaborate with plant operators to ensure the follow-up of environmental goals and their continuous improvement. This is a socially complex process, requiring the involvement of plant engineers and central system engineers, if technical changes are required to fulfil environmental goals. Evidently, the larger the production system and the more employees involved in maintaining it, the more complex is the process.

All companies consider environmental commitment among employees to be vital for moving towards an environmentally sound business. Hence, environmental training is provided to empower employees to take responsibility for the environment in their daily working tasks. In the development of a green corporate culture, managers have an important role as decision makers, communicators and role models. The multitude of small actions and decision taken over an extended period of time result in that the environmental awareness of employees is increasingly reinforced. Allocating sufficient resources to environmental management and giving room to green ideas resulting from the environmental commitment of employees seem to create the right atmosphere for a green corporate culture. Obviously, time compression diseconomies make such a culture difficult to imitate.

To conclude from the case studies, emissions reduction is the very base of a strategy for environmental sustainability. Reducing emissions is of great concern to the companies, resulting in a large allocation of manpower and resources. Partly, this can be explained by the historically large impact of energy production on the environment, making environmental management crucial for regulatory compliance. It has therefore been an integral part of business for a long time, leading to that the emissions reduction strategies of the companies are well-elaborated.

6.1.2 Product stewardship

This conceptual area captures activities and practices that aim at developing new sustainable products and services or enhancing the sustainability of existing ones. Product Stewardship is thus closely linked to the developments in the markets the companies serve, making customer needs the starting point. The apprehension of potential changes in customer preferences resulting from climate change thus plays an important role.

The product stewardship strategies of the case companies differ significantly. However, a common feature is the close dialogue with commercial customers, which seems to offer important inputs for product improvements and innovations.

LocalEnCo has the most innovative approach to product stewardship, based on quality improvements that add value to customers. In line with Hart (1997), creating preference for sustainable products and educating customers is part of the product strategy. Giving customers a choice is LocalEnCo's key note. By offering environmentally-friendly products, customers are empowered to make 'the right choice'. LocalEnCo has been an early mover in introducing 'Good Environmental Choice' district heating, for which the long-standing, close relationship with an environmental organization has been catalyzing. Worth to note is that no profit margin is added to this green product. Rather, it is seen as an additional service that enables customers to enhance their environmental profile. Generally, LocalEnCo opts for environmental certification of its products, the highest possible quality standard. The strong local focus of the product stewardship strategy is expressed by the intention to offer 'locally-produced electricity' labelled 'good environmental choice' as a new product to its niche market. Another observation is that LocalEnCo's product stewardship strategy is more strongly focused on its core business than the other firms'. Although an extension of the product range is intended upon completion of the Grove Hill plant, the strategy remains within the traditional range of activities of energy companies. Possibly, a small actor has better possibilities to implement an ambitious product stewardship strategy as it may be easier to gather the fuel volumes required within its geographical reach. Generally, the local embeddedness of the strategy involves that the company can take better advantage of resources in its surrounding field, be they tangible or related to institutional settings.

Both LocalEnCo and SouthEnGroup see the need to make their product portfolio climate-neutral in the short or medium term. However, SouthEnGroup still lacks an overarching product stewardship strategy. For instance, to satisfy the demand for environmentally-friendly district heating, it draws on the ad-hoc solution to sell it at request. SouthEnGroup sees its products as environmentally-friendly compared to alternatives, but recognizes that these should be improved by increasing the share of renewables and making production more efficient. Overall, the intention is to enhance the products by gradually phasing in more renewables in the product mix, be it for district heating, fuel gas or electricity. Renewable power is phased in by making it the default option for customers who failed to make an active tariff choice. Moreover, different forms of cooperation are used to add renewable alternatives to the product portfolio or increase the share of renewables in current products.

In addition, SouthEnGroup is active in demand-side-management, encouraging customers to save energy and switch to environmentally-friendly electricity. High community engagement is seen as beneficial for business development. Accordingly, the company's product stewardship strategy has a pronounced local focus. Unlike the other companies that account for their environmental performance mainly within the annual report (except for the EMAS report on district heating issued by WestEnCo), SouthEnGroup establishes separate environmental reports to communicate the group's environmental performance.

At WestEnCo, the demand for environmentally-friendly district heating is met in two ways. Firstly, a service allowing the compensation of emissions from purchased district heating is offered to customers. Further, it follows in LocalEnCo's footsteps by offering 'Good Environmental Choice' district heating, although a profit margin is added. Seemingly, there is stronger commercial interest behind offering renewable alternatives. WestEnCo keeps a constant dialogue with its commercial district heating customers to learn about their needs and 'synchronize world views'. The company has a strong profile in sustainable products such as energy services and biogas development, where it has a leading position. Energy services, aiming at reducing energy consumption, have a high potential to contribute to sustainable development and growth as they create deep customers relations. Cooperation has been the very basis of the development of WestEnCo's biogas business. To improve sustainability in the region, WestEnCo works with integration both on the raw material side and on the customer side. Infrastructural investments continue to be important for deploying current and future sustainable products, such as district heating and cooling, biogas, and electricity for fuel purposes. It is also notable that knowledge sharing with other energy companies is employed as an instrument to institutionalize WestEnCo's way of working with energy services.

Evidently, product stewardship strategies are incremental and based on a learning process. The need for systemic innovations across different organizational units makes the product stewardship strategy socially complex and difficult to implement. This may be why the smallest company has the most sophisticated product stewardship strategy, while the other companies still have some way to go.

6.1.3 Clean technology

The third conceptual area of an environmentally sustainable strategy relates to activities in connection with investments in and research and development on renewable and bridging technologies. It entails efforts to reposition the company and develop the sustainable resources and competencies needed to prosper in a carbon-restrained economy. Activities in this area have the potential to bring about more radical changes to energy production compared with previous areas.

LocalEnCo's engagement with clean technology bears upon the Grove Hill combined heat and power plant under construction. It is based on renewable fuels and will allow the company to provide environmentally-friendly district heat, electricity and cooling. In much, the investment stands for LocalEnCo's determination to be part of a transition to a more sustainable energy system. Apart from matching LocalEnCo green profile well, risk considerations have been important when deciding on the configuration of a long-term investment such as Grove Hill.

Hart (1995) argues that collaboration between private and public organizations creates beneficial conditions for clean technology deployment. LocalEnCo meets favorable financing condition thanks to local ownership, given that the owner stands as a guarantor for the financial liability. This makes up for the disadvantage of scale that LocalEnCo otherwise had encountered when financing such a large investment. Grove Hill has a major and immediate impact on LocalEnCo's future product portfolio and, through skilful marketing efforts, enables the company to strengthen its green profile. The new plant creates opportunities for both the municipality and the local industry to improve their environmental profile. LocalEnCo shows that a combination of innovations (technical, product, process, marketing) can lead to a favorable use of clean technology, benefitting all stakeholders.

SouthEnGroup has several areas of clean technology investments. Wind farm developments in cooperation with partners are one of them. Furthermore, a biogas upgrading plant is in the building process. SouthEnGroup's biggest venture is the combined heat and power plant Gravel Site which is based on regionally available biofuels. Gravel Site would bring both environmental and efficiency gains. Above all, it is a crucial investment for repositing the company, allowing for heat and electricity production based on renewables. However, the company experienced that clean technology development need not be a smooth process, despite a widespread consensus that such investments are worth aiming at. In spite of efforts to involve stakeholders, Gravel Site met substantial resistance from the local community. The fact that the project has been stopped up due to pending litigation is a mayor set-back, significantly delaying the planned transition to renewables. To judge from SouthEnGroup's experience, clean technology development requires competencies in a range of fields; not least technical, juridical and financial. In addition, SouthEnGroup is dependent on commercial loans due to the lack of financial support from the owners. In order to obtain a good credit rating, resulting in beneficial financing conditions, the group is anxious to convey a favorable picture of themselves to financial market players.

At both SouthEnGroup and WestEnCo, environmental sustainability is a central parameter to assess new investments. Clean technology investments that are of strategic importance frequently meet lower financial requirements than purely 'financial projects'. WestEnCo has clear ambitions to lie at the forefront of technology development, in particular related to biogas. It is a first mover in building up a biogas infrastructure and is part of an expanding network aiming at promoting biogas production and use. Clearly, this enables WestEnCo to gain an important learning experience and secures a pole position by taking part in the formation of the institutional settings. WestEnCo's clean technology ventures reflect its innovative spirit and are designed for the long run. In addition, the ventures associated with the newer business lines require state-of-the art competence and involve substantial risks as the techniques are not yet fully tested. A case in point is the planned WeReGas project, involving the gasification of biomass on an unprecedented scale.

Besides having the resources to make large investments in new business lines deemed to be of strategic value for the future, WestEnCo is also heavily involved in research and development. This spans over a broad range of energy-related issues and is conducted in various forms of cooperations with researchers and universities. Through collaborative research, building on the competencies within the larger socio-technical system, the company sets the direction for technology development in its field. This reflects that it is eager to build up the competencies needed in a carbon-restrained economy.

Furthermore, WestEnCo puts much weight on having a balanced portfolio of production technologies and input fuels, avoiding undue exposure to risks from shifting prices, regulations or opinions. Optimizing the portfolio entails minimizing risks over time. Accordingly, portfolio thinking is more prominent at WestEnCo than in the smaller companies. A further distinguishing feature of WestEnCo is its intense engagement in lobbying to remove obstacles that make sustainable technologies financially unattractive.

The case studies show that clean technology ventures depend on complex social interactions as a result of the many pieces of the puzzle that have to fit together to realize such investments[137]. Hence, clean technology investments require a broad range of activities and competencies that need to be coordinated over an extended time period. Given the learning required in the process, and the time-consuming handling processes of authorities for granting permits, early movers in clean technology investments may have an advantage due to time compression diseconomies. Clean technology investments are key to radically improve the environmental performance of the case companies and to enable their repositioning. Therefore, progress or set-backs in this area crucially determine the development possibilities of the case companies.

6.1.4 Sustainability vision

The fourth conceptual area envisages the creation of a shared roadmap for sustainability within the firm and with its stakeholders, reconciling value creation for the company with

[137]In the planning phase, technical experts have to find a suitable configuration for the investment, coordinate with environmental engineers and financial experts. Parallel to establishing the technical parameters, a suitable location for the project has to be found. Subsequently, authorization of the project with several authorities needs to be requested. Other possible interests have to be observed under the process, requiring negotiations with nearby residents, interest groups etc. Moreover, the financing of such venture has to be secured.

wider goals for a sustainable society. This requires a wide commitment, expanding the scope of activities beyond the corporation.

LocalEnCo and SouthEnGroup emphasize that environmental scanning and contacts with trade associations and various stakeholders are important to direct further business development. Both companies maintain that the only acceptable direction for developing business is towards renewable technologies since this is both profitable and ‘the right thing to do’. The business development is thus perceived to go hand in hand with sustainable development.

The case companies’ sustainability visions differ significantly. LocalEnCo has the most sophisticated philosophy as to mitigating the environmental impact from energy production. Its ambitions are in line with the criteria established by the Swedish Society for Nature Conservation that embrace biodiversity, amongst others. The vision stretches far, embracing the environmental certification of its products. Enabling and encouraging customer to make an environmentally-sound choice is a further element of the vision. At the same time, LocalEnCo is oriented towards creating public welfare, which is reflected in its service-mindedness and community involvement. The focus on sustainable returns and community benefits on commercial grounds is firmly anchored in the firm. For LocalEnCo it is also important to cooperate and be part of a ‘living community within an industry’; this in order to capture the big picture and position the company accordingly.

SouthEnGroup’s sustainability vision is embodied in the commitment to become climate-neutral, setting high ambitions for its strategy for environmental sustainability. It constitutes a strong force to align employees behind a common purpose. The vision is backed up by steering documents and performance measurement tools, which systematically support employees in considering environmental aspects in their daily working tasks. The commitment to become climate-neutral also sets a clear signal to external stakeholders as to the future development of the group. However, currently there is a gap between the vision and practices due to the delayed investment in Gravel Site. Furthermore, the corporate vision embraces cooperation as a means to develop the business in a sustainable way, which is essential to achieve systemic changes. Being locally embedded is another important element of the group’s sustainability vision. The group’s openness to collaboration with other industries and energy companies, coupled with broad competencies, make it a strong cooperation partner in the regional development of the energy system. SouthEnGroup’s vision comes closest to the notion of distributed economies (Johansson et al., 2005), where the power over the production system is exerted locally.

WestEnCo’s corporate vision, aiming at ‘a sustainable Western society’, embraces sustainability explicitly. This vision is firmly established with employees. An economical use of energy and resources and the establishment of a sustainable energy system in the region are essential building blocks of the long-term vision and strategy. Resource efficiency, involving the maximum use of low quality energy, is a key note of the vision. Furthermore, biogas development is seen as an important building block to approach WestEnCo’s sustainability vision, an endeavour that is in line with the municipality's ambitions. Cooperation is the formula to realize the vision to alter the system design towards a biogas society. The company's firm belief and extensive ventures in biogas are very likely to influence the configuration of the future energy system in the region.

A further distinguishing feature of WestEnCo is that it is heavily engaged in different networks, such as industry associations. The CEO's commitment to environmental issues seems important to embed the company's sustainability vision internally and in the numerous bodies he is active in. WestEnCo puts considerable resources on shaping the future conditions for the energy business by lobbying work at a national and a European level, or knowledge exchange within the industry.

Comparing the sustainability visions, interestingly, each company has developed a distinct vision that follows their interpretation of the role the company can play in the transition towards a more sustainable energy system. At the same time, the vision embodies an opportunity for creating firm value and represents a tool for aligning employee efforts.

6.1.5 Interconnectedness of the conceptual areas

Hart (1995) raises the question of how the strategic domains are interconnected. He offers two competing views on this: Either, there is a sequential logic, meaning that an environmental strategy evolves in a path dependent manner, given that the acquisition of one resource depends on the previous development of other resources (Dierickx & Cool, 1989). The alternative view is that the strategic domains are mutually embedded. Due to the overlap between the strategies, resources are accumulated in parallel and hence synergies across strategies are likely to arise. Following this view, working simultaneously with different domains is beneficial.

The case studies suggest that the second view more accurately reflects how environmental strategies unfold. Despite the fact that strategies for environmental sustainability are firmly grounded in emissions reduction, there is no evidence that product stewardship necessarily is the next step. Only one case company pursues a product stewardship strategy built upon its emissions reduction strategy. Conversely, investments in clean technology appear as the enablers of a product stewardship strategy at the other companies. The sustainability vision neither developed as a result of the achievements in prior conceptual areas. It probably evolved simultaneously with the opportunities identified that are embedded in the other strategic domains. It appears that incremental steps in different domains allow for cross-fertilization, gradually building up a more sophisticated strategy.

Analyzing the embeddedness of the strategic areas more in detail, it is evident that an emissions reduction strategy is least dependent on the other strategic areas. Furthermore, both emissions reduction and clean technology generate opportunities for a product stewardship strategy. However, product stewardship frequently relies on systemic innovations and cannot be pursued in isolation. Progress in emissions reduction is mostly of an incremental nature, allowing for singular innovations only[138]. Reaching a certain threshold, the strategy cannot evolve any further without major investments. As the strategy becomes more sophisticated, the need for clean technology investments becomes more urgent. Clean technology investments result in radical improvements in production methods and accordingly open up for innovations that are of a systemic nature[139]. It is thus argued that the conceptual areas are mutually embedded and that the integration of activities in the different areas results in a more sophisticated and coherent overall strategy. Integration of the strategic areas allows to harvest synergies; this requires close communication and cooperation between different functional areas to make 'the whole greater than the sum of its parts'.

Finally, being active in all conceptual areas without having a sustainability vision is likely to result in an overall strategy that lacks coherence. The opposite, having a vision that does not rest on simultaneous efforts in any of the other areas would be perceived as hypocritical. The sustainability vision represents the roadmap for the strategy for environmental sustainability. Without a clear vision, it is difficult to align the other domains to jointly work towards a common goal. The vision indicates the direction of development without prescribing in detail how it should be fulfilled. It represents a 'guiding-star' that fosters employee involvement in fulfilling the vision to the best of their capabilities. In line with Hart (1995), it is argued that the vision accelerates the pace of resource accumulation and capability building in the other strategic domains.

6.1.6 Concluding thoughts

The case studies suggest that unique historical conditions and events over time were essential for the design of the energy systems at the companies studied and, as a consequence, the strategies for environmental sustainability that can be devised. Looking at the location, geographical preconditions are decisive for the choice of fuels. The proximity to large industries disposing of waste heat formed the energy system at WestEnCo. This might be one reason why the company developed resource efficiency as its core competence and attaches much weight to the concept. SouthEnGroup, situated in an area endowed with geothermal heat, took advantage of that local resource when building up its district heating system. Furthermore, operating in an agricultural area creates opportunities for the use of local renewable fuels. Both companies can profit from the close location to a university in development projects. Events over time have influenced SouthEnGroup's production portfolio, in particular when cooperation created the opportunity to acquire withdrawal rights for electricity in a Norwegian hydro power station. This is a valuable asset given the group's aim to produce energy from renewable resources only. The historic importance of natural gas in the Western region might also have shaped WestEnCo's competencies in such way that the

[138] To exemplify, replacing a portion of fossil fuels with renewables allows for the environmental certification of a portion of the district heat.

[139] For example, the realization of Gravel Site would allow for the simultaneous production of renewable heat and electricity while making use of local renewable resources.

use of gas is firmly anchored in the firm's vision for the development of a sustainable society. The development of a strategy for environmental sustainability can be seen as a path dependent, cumulative process evolving over time, whereas early commitment and unique historical conditions determine the depth and characteristic features of such strategy.

6.2 The greening mechanisms facilitating environmental strategy implementation

This study aspires to go beyond a content description of strategies for environmental sustainability and explain how the transition towards an environmentally sustainable business is managed by the focal companies. Mechanisms are used as a tool to explain how municipal energy companies move their strategy forward. This is reflected in the second research question: *"What are the mechanisms that facilitate the implementation of a strategy for environmental sustainability in municipal energy companies with a high environmental commitment?"* It is central to answer this question to learn how the transition towards environmentally sustainable business is managed on a more abstract level. The task was to go beyond the empirically observable and develop concepts of the more fundamental mechanisms propelling such a transition. Five greening mechanisms were elaborated in an abductive process in parallel with the collection of the empirical material and subsequently theoretically substantiated. These mechanisms add a dynamic component to the study of environmentally sustainable strategies (see Section 4.3 and Figure 4.2). Representing a central contribution of the present research, they permeate much of the structure and analysis of the empirical material. Connecting the literature (see Sections 4.3.1 to 4.3.5) with the case studies, the subsequent sections delineate the five greening mechanism.

6.2.1 Environmental integration

To mitigate the environmental impact from conducting business in a comprehensive way, the natural environment needs to be an integral part of managing firm activities. The empirical chapter illustrates the strong capabilities of the case companies to integrate environmental aspects into the different business processes and management areas of energy production. Typically, this follows an incremental path. On the technical side, similar to the measures outlined by Lund (2007), efforts build on fuel switching, resource efficiency and power plant upgrades. Frequently, external energy sources are integrated, collectively optimizing energy use. Regarding management systems, a network of environmental staff committed to improving routines and goals was central to advance environmental standards. Considering the tacit nature of environmental management (Boiral, 2002), also the timely involvement with environmental issues and early adoption of ISO 14001 norms was important (cf. Russo, 2009). At SouthEnGroup, the decision to opt for climate-neutrality called for a holistic approach to address environmental sustainability, resulting in comprehensive guidelines advocating behavioral changes. Seeing the environment not as a disconnected problem but as a strategic issue, justified the integration of environmental criteria into steering documents and management tools. Furthermore, good environmental behavior is also fostered within the supply chain. In sum, allowing environmental considerations to permeate corporate decisions, systems and activities seems crucial for the transition to sustainable business practices.

6.2.2 Communication and learning

Firms possessing good abilities to communicate and learn can acquire a better understanding and capacity to handle the challenges ahead triggered by climate change. From an internal perspective, communication and learning is vital to create employee commitment to environmental issues and foster a green organizational culture. Frequent dialogue between individuals or groups within the organization is crucial in the process of organizational learning (Bood, 1998). Learning is essential to build the internal competencies required to reduce the environmental impact of the company or implement new investments. Furthermore, not only single-loop learning (Argyris & Schon, 1978), mainly focusing on effectiveness, is required. In some instances, double-loop learning, involving the modification of organizational norms as such is called for. This relates for instance to finding new business models that stretch beyond the traditional energy business. Implementing a strategy for environmental sustainability is best described as a continuous learning process. However, communication and learning also has an external perspective. Wheeler and Sillanpaa (1998) consider effective stakeholder communication about the environment to be a powerful way to build trust and loyalty. It also raises awareness with the general public about climate change (Moser & Dilling, 2007) and its linkages with energy consumption.

In the case companies, external stakeholders are mobilized in various ways to reduce their environmental impact. For example, demand-side management creates incentives for customers to save energy. Arroyo and Preston (2007) hold that companies' commitment to climate change mitigation influences public perception of the issue. Similarly, the communication of a sustainability vision can strengthen the relationships with stakeholders, which in turn increases the opportunities to further develop the organization in a sustainable direction. Emphasizing the importance of clean technology investments and creating a dialogue with stakeholders can build momentum for sustainable energy investments and speed up the implementation process. To sum up, communication and learning creates a platform for the organizational and behavioural changes that drive the sustainability agenda forward.

6.2.3 Innovation

Innovations represent an essential ingredient of a proactive strategy for environmental sustainability, strengthening the sustainability of products and processes. Following Van de Ven (1986) not only technical advances but also product, process and administrative innovations should be taken into account. In the case companies, clean technology development is only conducted by WestEnCo. However, other forms of innovations were within reach for all corporations. For instance, the companies exploit new business opportunities by developing green products such as biogas and environmentally-certified district heating. SouthEnGroup's commitment to climate-neutrality can be considered a management innovation (Birkinshaw et al., 2008) to speed up the transition to sustainable business practices. Innovative ways to govern business relationships such as profit sharing in district heating and stakeholder engagement in wind power development add to the range of measures for developing sustainable business. The level of absorptive capacity (Cohen & Levinthal, 1990) is decisive for the firm's ability to predict the potential of technological novelties. A high level of absorptive capacity can be found in WestEnCo. The company pursues pioneering approaches in both the biogas business and district heating, driving clean technology innovations forward. Proactive strategies for environmental sustainability require novel approaches to business development and hence, innovative solutions are the very fabric of such a strategy.

6.2.4 Cooperation

Cooperation is not only a means to use resources more efficiently, as addressed by Gebremedhin and Carlson (2002), it also proved to be an important way to expand business and disseminate clean technology. The case companies engaged in strategic cooperation to extend available competences and to get access to renewable energy sources. Cooperation that results in synergies allows for resources to be used more efficiently. Economies of scale and better financing possibilities for clean technology investments were further rewards. Cooperation also allows for risk sharing between partners, facilitating the implementation of projects that are beyond a single actor's capacity. Regarding energy services, WestEnCo uses cooperation as a mechanism to institutionalize norms within the industry. Gray (1989) regards shared understanding as the basis for choosing a collective course of action. In addition, the existence of a shared vision regarding the nature of the problem is one of the central factors influencing cooperation (ditto).

The case companies not only cooperate within the industry, but also systematically seek cooperations with other actors to move towards a system transition. Openness and trust are vital for successful cooperation (Grönkvist & Sandberg, 2006; Smith et al., 1995), which may explain the case companies' endeavors to preserve and strengthen their 'trust capital'. Moreover, finding new forms of cooperation can give positive results. Wind farm expansion is favored by a cooperative business model involving land owners and nearby residents, whereas cooperation with local farms increases the share of biomass-based district heating. Offering ways to overcome resistance to new projects, cooperation has great potential to increase renewable energy production. Evidently, the challenge to green the energy business cannot be achieved by energy companies alone. Embracing cooperation as a means to develop business in a sustainable way seems essential to achieve systemic changes. This is also well in line with the central idea held by academia (Gray 1989; Hart 1995) and other bodies (UNEP, 1992a; Schmidheiny 1992; Stern 2006) that many societal actors need to get engaged if systemic changes towards sustainable development are to be achieved. On the whole, cooperation offers numerous opportunities to improve the sustainability of the energy system.

6.2.5 Local embeddedness

The final greening mechanism, local embeddedness, has several dimensions. Firstly, the structures for energy provision are closely intertwined with the economic activities and social dynamics in the area, making the municipal energy company a key actor to promote sustainable activities. Production systems are tied to extant industrial structures and geographical conditions, as exemplified in the use of waste heat and geothermal energy. Companies frequently source renewable fuels from regional industries and agriculture, which is favorable from a resource consumption perspective. Corporate efforts to build up an infrastructure for sustainable products contribute to sustainable regional development. Municipal energy companies can, by anchoring their activities in the local context and investing in regional clean technology projects, concentrate value creation from the energy system at the local level (cf. Johansson et al., 2005). This is in line with Hess (2004), who regards the degree of an actor's commitment to a particular location as an important factor for value creation. Secondly, the companies are embedded in the political structures; they are a valuable tool for the municipality to realize own goals such as lower emissions and a healthy environment (cf. Sandoff, 2008). Finally, a pronounced local strategy seems favorable not only for the product strategy (Wiser, 1998; Wiedman, 2005), but also for clean technology development. Emphasizing the local identity contributes to developing the 'trust capital' needed to engage other actors in cooperations and investments for sustainable development. Local embeddedness can thus be seen as a driver for sustainability by virtue of aligned interests between public owners and managers and the focus on sustainable development in the region.

6.3 Creating value from strategies for environmental sustainability

The third research question *"How can strategies for environmental sustainability contribute to the sustainable development of municipal energy companies and society?"* addresses the issue of creating value by pursuing such a strategy. As discussed in Sections 3.5.1 and 4.4, the traditional view on value creation applied in the RBV is only concerned with value created for the firm. The intention is to broaden this view. The third research question reflects that value creation is two-fold: value is not only created for the firm, but also between the firm and the society, which is addressed as 'shared value' (Porter & Kramer, 2006, 2011). The greening mechanisms underlying strategies for environmental sustainability are considered instrumental to the development of organizational capabilities and resources that form the basis of value creation according to the RBV (Barney, 1991). Thus, the mechanisms were used as screening devices to identify capabilities and resources created from engaging in a strategy for environmental sustainability (see Figure 4.5). This analysis step ('Analysis 3'), leading to an inventory of capabilities, is described in the method chapter (see Section 2.13).

The following sections provide further analysis of the capabilities and resources developed in the studied companies, catalyzed by the greening mechanisms.

To shed light on whether and how the mechanisms contribute to the sustainable development of the firm and society, the analysis is performed from different angles. In Section 6.3.1, an overall picture of the capabilities developed is presented. Subsequently, Section 6.3.2 provides an analysis of *capabilities creating value for the firm versus capabilities creating shared value*. Thereafter, Section 6.3.3 focuses on examining *generic capabilities versus firm-specific capabilities*. Finally, capabilities that complement those currently highlighted by the natural-resource-based view are outlined, in particular capabilities creating shared value by aiding the transition towards a more sustainable energy system.

6.3.1 Value creating capabilities and resources

In all, 108 capabilities and resources originating from or relating to the strong environmental focus of the case companies were identified in the analysis. As mentioned in Chapter 2, a broader, more inclusive definition of capabilities and resources is applied here than in the traditional RBV[140], reflecting the wider view taken on value creation. To keep the analysis of the capabilities and resources clear and concise, only numerical tables are presented in the main text. The complete list of capabilities and resources, together with associated variables of interest (e.g. case company, value creation category etc.), can be found in Appendix 3. In addition, an overview of the capabilities and resources developed within each conceptual area (listed according to greening mechanism) can be found in Appendix 4.

Before focusing on particular aspects of interest as to the characteristics and patterns in regards to the capabilities, a bird's-eye view is given, followed by a short analysis of overall patterns. Table 6.1 presents an overview of the capabilities and resources identified, categorized according to their respective conceptual area of a strategy for environmental sustainability and the greening mechanism that gave rise to them.

[140] In the RBV, a competitive advantage can be gained through resources that are valuable, rare, imperfectly imitable and non-substitutable.

Table 6.1: Overview of capabilities and resources

Conceputal area/ greening mechanism	Environmental integration	Communication and learning	Innovation	Cooperation	Local embeddedness	**Total number**
Emissions Reduction	12	7	4	3	6	**32**
Product Stewardship	2	4	5	4	5	**20**
Clean Technology	6	10	5	5	4	**30**
Sustainability Vision	4	8	5	5	4	**26**
Total number	**24**	**29**	**19**	**17**	**19**	**108**

A general analysis of the capabilities and resources developed within the conceptual areas of a strategy for environmental sustainability shows that Emissions Reduction displays most capabilities (32), followed by Clean Technology (30). Sustainability Vision contains 26 capabilities and Product Stewardship has with 20 capabilities fewest. Compared to what Hart and Milstein (2003) regard as challenging areas, a slightly different picture emerges here. In their opinion, Emissions Reduction and Product Stewardship are more easily addressed than the more long-term strategic areas Clean Technology and Sustainability Vision. In the present research, the externally-oriented strategies Product Stewardship and Sustainability Vision seem to represent the biggest challenge, in particular Product Stewardship. This divergence may partly be explained by the fact that the products offered by energy companies are largely homogenous and thus difficult to diversify, which may somewhat restrict the possibilities for Product Stewardship strategies. Furthermore, the present findings confirm earlier ones (Hart & Milstein, 2003; Hart, 1995) in that Emissions Reduction is the most easily accessible area of an environmentally sustainable strategy.

From the point of view of the greening mechanisms, *communication and learning* is the largest category (29), followed by *environmental integration (24)*. While *innovation* and *local embeddedness* gives rise to 19 capabilities each, *cooperation* contains fewest capabilities (17). The large number of capabilities created through communication *and learning* reflects that this mechanism contains two interrelated phenomena, both of a multifaceted nature. Containing most sub-themes of all greening mechanisms, the high number of capabilities was quite expected. *Environmental integration* contains nearly as many capabilities as the largest category. Even here, two sizable groups of capabilities and resources can be found, a technically-oriented and a process-oriented one. However, the number of capabilities generated within each greening mechanism is not necessarily a reflection of its importance for corporate greening. Rather, the qualitative aspects have to be given attention.

Commenting on the largest categories at the intersection of the conceptual areas and the greening mechanisms, *environmental integration* seems particularly important for Emissions Reductions. This reflects the importance of integrating environmental aspects into both the technical systems and management systems of the companies, following the idea of continuous improvements. Communication and learning has strong bearing on the conceptual areas Clean Technology and Sustainability Vision. Clean technology investments can be facilitated through a dialogue and external environmental communication with key stakeholders. Learning is not only a lever for clean technology ventures, but also for promoting an energy system transition in accordance with the sustainability vision. Within Product Stewardship, no particular greening mechanism stands out. It seems safe to say that much needs to be done when it comes to product innovations within the stationary energy sector. At the same time, given the infrastructural nature of the energy business (cf. Sandoff, 2006b) and the limited reach of municipal actors, local embeddedness seems important to deploy a product stewardship strategy. Least capabilities are found at the intersection of environmental integration and product stewardship, reflecting the difficulties to green homogeneous products such as electricity and heat.

These are general reflections as to the patterns emerging on an aggregate level. When looking at each case company individually (Appendices 5 to 7), WestEnCo developed most capabilities in all (86), followed by SouthEnGroup (71) and LocalEnCo (60). Merely judging from these numbers, earlier findings that large companies are in a better position to integrate environmental issues into business activities (Hillary, 2000; Roy et al., 2001; Roy & Thérin, 2008; Worthington & Patton, 2005) are only partially confirmed as this advantage does not seem to be large. However, the purpose of 'counting capabilities' is not to rank the companies, but rather to provide a basis for comparing their strategies and analyzing strengths and weaknesses. The number of capabilities can stand as a proxy for the level of engagement, although company size should be taken into consideration. Obviously, this is only an indication and not an absolute measure. A large number of capabilities in certain areas can indicate a strategic focus or deeper engagement, potentially highlighting the relative importance of some greening mechanisms for certain conceptual areas.

Similar to the aggregate level, also each company separately developed most capabilities within Emissions Reduction. Interestingly, the second largest category differed between the firms. WestEnCo developed nearly as many capabilities in Clean Technology (see Appendix 7). For SouthEnGroup (Appendix 5), Sustainability Vision was the second largest category and for LocalEnCo (Appendix 6) Product Stewardship. This reflects well the perceived strength of each case company. When taking the perspective of a portfolio of strategic areas (Hart & Milstein, 2003), WestEnCo's strategy has slight weaknesses in Product Stewardship compared to the other conceptual areas. Similarly, SouthEnGroup's strategy is least developed within Product Stewardship, while LocalEnCo's strategy is well-balanced.

Seen through the lens of the greening mechanisms, firm-specific focus areas emerge even more clearly. Compared with the other companies, WestEnCo developed considerably more capabilities within *communication and learning* as well as *innovation*. SouthEnGroup has relative strengths in *environmental integration* and *cooperation*, whereas LocalEnCo developed most capabilities within *local embeddedness*.

Some final considerations regard the resources identified. These have been included in the above analyses, but deserve additional comments. Twenty-five resources are included in the total 108 capabilities and resources. Many of them can be considered as invisible assets (Itami, 1987). Some relate to human resources, whereas others are the result of a path dependent process, allowing for the resource to be built up over time. A further category relates to attitudes[141] that facilitate a strategy for environmental sustainability.

The analysis has so far concentrated on the aggregate level to create a general overview. More detailed analyses will be provided in the subsequent sections, whereas the value creation dimensions of organizational capabilities and resources are focused on next.

6.3.2 Capabilities creating firm value versus capabilities creating shared value

This section analyzes the creation of value for the firm versus the creation of shared value between the firm and society. The capabilities were divided in two groups, one featuring the capabilities that create value for the firm only, and the other containing capabilities that both create firm value *and* shared value. The two groups are analyzed separately with a point of departure in the greening mechanisms. Subsequently, the results are compared and discussed.

Capabilities creating firm value

Forty capabilities that primarily generate value for the firm could be found among the 108 capabilities in total. The value creation dimensions for firm value identified in Chapter 4 are *cost savings*, *corporate reputation* and *future position* (see Section 4.4.1 and Figure 4.7). Table 6.2 below lists the number of capabilities under the respective greening mechanisms giving rise to them, followed by the dimension(s) under which each capability is seen to create value. Please note that capabilities can generate value in several dimensions. Summing up the columns does therefore not lead to the total of capabilities indicated. A more detailed table, featuring the sub-theme that gave rise to each capability and the company or companies possessing the capabilities, can be found in Appendix 8. The capabilities are subsequently analyzed with a point of departure in the greening mechanisms to learn more about the mechanisms' nature and value creation capacity.

[141] Which may stem from the values and beliefs of managers (cf. Marcus, 2005).

Table 6.2: Capabilities primarily creating firm value

Greening mechanism/firm value creation criteria	Environmental integration	Communication and learning	Innovation	Cooperation	Local embeddedness	Total number
Total capabilities	**16**	**12**	**3**	**5**	**4**	**40**
Cost saving	10	8	-	2	1	**21**
Reputation	9	2	1	1	4	**17**
Future position	11	11	3	5	4	**34**

The table indicates that the greening mechanism *environmental integration* generated most capabilities creating mainly firm value. A comparison with Table 6.1 indicates that two out of three capabilities under *environmental integration* primarily create firm value (16 of 24). Of this follows that the purpose of the majority of these capabilities is to improve the internal technical and management systems as well as processes. The benefits arising from these capabilities are almost as much reputational (9) as related to cost savings (10) and a favorable future position (11). Two thirds of these capabilities are possessed by all companies.

When looking at *communication and learning*, 12 of the total of 29 capabilities create value primarily for the firm. Most of them relate to the internal communication of environmental issues or to organizational learning. The benefits these capabilities bring to the firms are mostly cost savings and a favorable future position. Half of these capabilities can be found in all companies. A resource worth particular attention is the 'green organizational culture' which is seen to create firm value in all three dimensions. A green organizational culture may well constitute one of the most valuable invisible resources (Itami, 1987; Sharma & Vredenburg, 1998) resulting from a strategy for environmental sustainability.

Few *innovation* capabilities create primarily firm value (3 of 19). Their benefit relates mostly to a favorable future position. Less than a third of *cooperation* capabilities (5 of 17) create value solely for the firm, and most of them relate to resources built up in relation to cooperations. The main benefit of these capabilities lies in creating a favorable future position. Only four of 19 capabilities under *local embeddedness* benefit mainly the firm. Even here this mostly relates to resources. The benefits arising are primarily reputational and favor the future position of the companies.

Analyzing the dimensions in which capabilities mainly creating firm value occur most frequently, most of them contribute to improving the future position (34), whereas about half of them potentially generate cost savings (21). Slightly less than half (17) contribute to improving corporate reputation. To conclude from this, a favorable future position, naturally, may be a result of cost savings and/or improved reputation and therefore often arises in parallel with one of the other value creation dimensions. In some instances, however, a favorable future position is the only dimension according to which a capability creates firm value, which may be an indication of the long-term view held by the firms.

An analysis with regard to the case companies shows that SouthEnGroup possesses most capabilities that primarily benefit the firm (37), WestEnCo has considerably fewer such capabilities (28) and LocalEnCo possesses with 25 capabilities fewest. A tentative interpretation of these differences is that SouthEnGroup strongly focuses on firm value creation and internal aspects because of its more demanding structure (19 group companies underlying the parent company), and as a result of the tough competitive position experienced[142].

Capabilities creating shared value

A count of the capabilities that generate value both for the firm and for society results in 68 such capabilities. Three value creation criteria have been elaborated in Section 4.4.2: *transferability, coordination*, and *far-sightedness*. Table 6.3 first lists the number of capabilities developed under the respective greening mechanism, followed by the criteria according to which the capabilities are considered to create shared value. Appendix 9 provides a more detailed table, featuring the sub-theme that gave rise to each capability and the company or companies possessing the capabilities.

Table 6.3: Capabilities creating shared value

Greening mechanism/shared value creation criteria	Environmental integration	Communication and learning	Innovation	Cooperation	Local embeddedness	Total number
Total capabilities	**8**	**17**	**16**	**12**	**15**	**68**
Transferability	1	8	5	2	2	**18**
Coordination	2	7	6	10	9	**34**
Far-sightedness	5	4	6	2	9	**26**

[142] As mentioned in several interviews with the company, a number of strong actors are active within the region.

The three largest categories of capabilities creating shared value are *communication and learning* (17), *innovation* (16) and *local embeddedness* (15). When looking at the relative shares, the figures indicate that the potential to create shared value is greatest for *local embeddedness, innovation* and *cooperation*. Five out of six capabilities within *local embeddedness* create shared value. The respective number is approximately four out of five for *innovation* and two out of three for *cooperation*.

Local embeddedness is an interesting greening mechanism as the large majority of the capabilities create shared value *and* can be found in all case companies. Their main contribution to sustainable development lies in enabling coordination and far-sighted actions. More than half of the capabilities within *communication and learning* generate shared value (17 of 29), mostly promoting transferability and coordination. One fourth of the capabilities could be found in all case companies. External environmental communication and dialogue are the dominating themes within communication, whereas half of the capabilities relate to different aspects of learning. *Innovation* capabilities create value only according to one of the criteria each, although the distribution among the criteria is almost equal. Few of the capabilities are possessed by all companies. Innovations are known to create spillover effects (e.g. Teece, 1986), and the contribution to shared value creation was therefore expected. Capabilities creating shared value under *cooperation* mainly do so because they alleviate coordination problems. Few of these cooperation capabilities are however possessed (or needed) by all companies. Most of them can be found within WestEnCo, and slightly fewer within SouthEnGroup.

Environmental integration seems to hold least potential for creating shared value. Nevertheless, the capabilities under technical integration relating to resource efficiency are crucial to optimizing resource use from a systems perspective as they manage to cope with the social complexity of achieving system optimization. Most remaining capabilities under this greening mechanism create shared value because they relate to far-sighted thinking and behavior connected to clean technology investments.

Looking at the type of shared value potentially created overall, half of the capabilities improve coordination (34), 26 promote far-sightedness and slightly more than one fourth (18) facilitate transferability.

Looking at the capabilities and resources creating shared value from a firm perspective, WestEnCo stands out with 57 capabilities. SouthEnGroup and LocalEnCo score 36 and 34, respectively. Hence, WestEnCo possesses 20 such capabilities that are unique to the firm. A tentative conclusion from this finding is that large, diversified companies have greater potential to contribute to the creation of shared value. With that said, the effect of the strategic orientation of the company, aiming at promoting a transition to a sustainable energy system following its vision to contribute to ‘a sustainable Western society’, should not be underestimated. Assumingly, the large size and scope of the company are a necessary but not sufficient condition for the broad creation of shared value.

The small and the medium-sized company developed almost an identical number of capabilities creating shared value, albeit hardly any capabilities are exclusively possessed by these two companies. Hence, few of these capabilities are specific to small and medium-sized firms. LocalEnCo developed six firm-specific capabilities generating shared value and SouthEnCo two.

A pervasive characteristic of many of the capability generating shared value is network embeddedness which is recognized as an environmental capability by Walls et al. (2011). This is due to the fact that environmental capabilities can be acquired through networks by way of sharing information, trust, or joint problem solving (McEvily & Marcus, 2005).

Comparison between capabilities creating firm value versus capabilities creating shared value

Comparing the capabilities that primarily create firm value with those benefitting both the firm and society, it is noticeable that considerably more capabilities create value for both the firm and society than mainly for the firm (68 compared to 40). Furthermore, interesting patterns emerge with regard to the capacities for value creation in different dimensions. *Environmental integration* seems to hold the highest capacity to create value appropriated by the firm. The greening mechanisms with least potential for firm value creation are *innovation*, *cooperation* and *local embeddedness*. The opposite is true for shared value creation, where *environmental integration* shows least potential and *innovation, cooperation* and *local embeddedness* most. Obviously, the two categories of capabilities are exclusive of each other and therefore these patterns are clear opposites. *Communication and learning* plays a somewhat ambiguous role as it contains capabilities that relate to aspects that can be internal or external to the firm. With a few exceptions, the internally-oriented capabilities relate more closely to firm value creation, whereas the externally-oriented capabilities potentially contribute to shared value creation. Capabilities in *communication and learning* mostly promote transferability and coordination from a shared value perspective, while contributing to firm value by saving cost and creating a favorable future position.

The most important potential benefit of capabilities creating firm value is a favorable future position, whereas coordination is the most frequent criteria according to which value for both the firm and society can be created. Drawing conclusions from this observation, coordination may well hold the greatest potential for these firms to create a favorable future position. Managing the transition towards a sustainable energy system requires companies to manage social complexity beyond the company. This connects back to the greening mechanisms *cooperation* and its potential to create both firm and shared value.

6.3.3 Generic versus firm-specific capabilities

A further aspect of interest is to analyze whether and to what extent strategies for environmental sustainability of highly committed municipal energy companies are similar or firm-specific regarding the organizational capabilities developed. In which areas are similarities most frequently found and what can this tell us about strategies for environmental sustainability more broadly? This is best studied by looking at the extremes. Two sets of capabilities have been compiled and analyzed: Capabilities shared by all companies and firm-specific capabilities, i.e. those only possessed by one company. Prior to the analysis, a short summary of the rationales for generic versus firm-specific strategies is given based on prior literature.

Similar versus firm-specific environmental strategies in the literature

A brief review reveals that there is a tension between best practices of environmental management shared among firms and firm-specific approaches to environmental management and strategies. Aragón-Correa and Sharma (2003) consider proactive environmental strategy to consist of best practices, showing commonalities across firms. Some best practices may be linked to cost advantages, for instance process-focused practices that increase efficiency and productivity or decrease inputs and waste (Christmann, 2000; Hart, 1995). Others entail product-focused practices such as highlighting the environmental attributes of products or services to green consumers, and are linked to reputational advantages (Hart, 1995; Aragón-Correa & Sharma, 2003)

Conversely, Walls et al. (2011) conclude that the combinations of environmental capabilities are unique between firms, although some patterns emerge. Following Aragón-Correa and Sharma (2003) a proactive environmental strategy is distinctive in its details as a result of social complexity and organizational specificity. It involves firm initiatives based on managerial discretion (Majumdar & Marcus, 2001) and the interpretation of environmental issues as opportunities (Sharma, 2000). Several authors (Milstein et al., 2002; Dixon & Whittaker, 1999) observed that there are significant differences in management approaches between companies regarding environmental issues in any given area, despite being exposed to similar pressures from legislation, policy instruments and customer preferences. According to Sharma and Vredenburg (1998:740), environmental strategies may lead to “different paths of learning and knowledge creation” for each firm regarding the interface between business and the natural environment. Hence, firms with similar characteristics are likely to develop different strategies to manage this interface.

In the following, the capabilities and resources developed by the case companies are first analyzed with regard to generic capabilities, also addressed as best practices, to manage the interface between business and the natural environment. Subsequently, an analysis is made of specific capabilities that reflect strategic choices of the firms or are a result of particular endowments, for instance resulting from unique historical conditions or path dependency (Barney, 1991). Table 6.4 summarizes the findings.

Table 6.4: Generic and firm-specific capabilities

Greening mechanism/ capabilities	Environmental integration	Communication and learning	Innovation	Cooperation	Local embeddedness	**Total number**
Generic capabilities	13	11	3	5	12	**44**
Firm-specific capabilities	5	11	13	8	2	**39**

Generic capabilities (best practices)

Overall, 44 capabilities could be found in all case companies, indicating that strategies for environmental sustainability are similar in many ways. The capabilities figuring under each greening mechanism and sub-theme are listed in Appendix 10.

Most generic capabilities are found under *environmental integration* (13), followed by *local embeddedness* (12). Notably, generic capabilities are much less common in *cooperation* and *innovation*. Eight generic resources are included in the above list.

This tells us that the three case companies have similar approaches regarding *environmental integration*; more than half of the capabilities under this mechanism are generic (13 of 24). This observation is most pronounced for the sub-theme processual integration, which is not surprising as the environmental management system (ISO 14001) is directed towards spreading best practices (cf. Gavronski et al., 2008). Continuous improvement is a central concept underlying several of these capabilities, as suggested by Hart (1995). Embedding a green mindset with employees relating to various procedures is another characteristic of some generic capabilities, which is connected to the capability for employee involvement mentioned by Hart (1995). In *communication and learning*, slightly more than a third of the capabilities are shared (11 of 29), whereas common approaches to external environmental communication are most salient. Several valuable resources are seen to result from external environmental communication. Also capabilities relating to internal communication are shared, pointing at generic ways to handle the social complexity of environmental management. Further common capabilities are found in relation to organizational learning. The scarcity of generic capabilities in *innovation* and *cooperation* (3 of 19 and 5 of 17, respectively) was expected, given the strategic nature and path dependence of innovations and cooperations. However, stakeholder involvement regarding product development is one best practice that has been identified as an important capability previously (Hart, 1995; Hart & Milstein, 2003; Sharma & Vredenburg, 1998). Capability development regarding sustainable products occurs in all companies, although pursued with differing intensity. A further best practice is cooperation within the energy sector, particularly with a view to efficient resource use. Furthermore, to conclude from the cases, municipal support is a prerequisite for the development of a strategy for environmental sustainability. This is related to *local embeddedness*, where nearly two thirds of the capabilities are generic (12 of 19). To judge from this fact, a locally embedded business is a widespread best practice amongst municipal energy companies. This permeates the business, ranging from the territorial embeddedness of greening the technical systems to good corporate citizenship and the embeddedness of goals for the sustainable development of the region. To my knowledge, the local embeddedness dimension has not been addressed as an area for developing environmental best practices in prior literature on business and the environment.

The positive news from the findings on generic capabilities is that a fair share of environmental capabilities can be developed by all municipal energy companies, irrespective of size. Hence, there is great potential for a more widespread implementation of strategies for environmental sustainability within the stationary energy sector.

Firm-specific capabilities

In all, 39 firm-specific capabilities could be found; somewhat fewer than the generic capabilities (44) and slightly more than one third of all capabilities identified (108). The firm-specific capabilities are listed in Appendix 11, indicating which case company acquired the capability.

As shown in Table 6.4, most firm-specific capabilities are found in *innovation* (13) and slightly fewer (11) in *communication and learning,* whereas *environmental integration* and *local embeddedness* feature least firm-specific capabilities. Among these feature nine firm-specific resources.

Looking at the distribution of firm-specific capabilities between the case companies, WestEnCo developed 23 such capabilities, SouthEnGroup nine, and LocalEnCo seven. Approximately two thirds of the capabilities relating to innovations are firm-specific (13 of 19). This may have several reasons: Cohen & Levinthal (1990) consider innovative performance to be history- or path dependent. According to Chesbrough and Teece (1996), especially systemic innovations often rely on tacit knowledge deeply embedded in individuals or firms. Moreover, given the strategic importance of innovations, the firm-specificity of innovative capabilities is quite expected. The range of firm-specific innovation capabilities is broad, spanning from management innovations to product innovations and R & D capabilities. Furthermore, several resources have been built up in relation to innovations.

In the NRBV, strong innovative capabilities are regarded as complementary assets to pollution prevention (Teece, 1986, Christmann, 2000) or are seen to arise from a commitment towards pollution prevention (Sharma & Vredenburg, 1998). While innovation capabilities promote emission reductions also according to the present study, they have bearing on all strategic areas. Naturally, a product stewardship strategy benefits from product innovations, and clean technology is promoted by R & D involvement in collaborative settings, which confirms Hart and Dowell's (2011) conclusion that strong R & D capabilities are required for a proactive clean technology strategy.

WestEnCo is clearly superior to the other firms in terms of innovation capabilities. The literature on absorptive capacity (Cohen & Levinthal, 1990) maintains that learning is cumulative and that the absorptive capacity of a firm depends on "the links across a mosaic of individual capabilities" (Cohen & Levinthal, 1990:133). Drawing on a large stock of absorptive capacity, novel linkages and associations may allow WestEnCo to make use of its capabilities in different settings. LocalEnCo seems to have an advantage with respect to transforming innovations into green products. Speed and flexibility have been outlined as beneficial features of small firms compared to large (Dean et al., 1998). Flexibility and well-integrated functions can explain why LocalEnCo succeeds best with a product stewardship strategy. SouthEnCo's innovation capabilities refer to the distinct sustainability vision and its anchoring in the firm.

Firm-specific capabilities within *communication and learning* are predominantly found in WestEnCo, evidencing the strategic choice of the firm to be a forerunner in many areas. Arguably, the previously identified capability for higher-order learning, triggered by a proactive environmental strategy (Sharma & Vredenburg, 1998; Sellers, 2010), is what can be observed also at WestEnCo. However, it is difficult to identify the knowledge-based invisible resources (Itami, 1987; Sharma & Vredenburg, 1998) that are built up in the company. The capability of WestEnCo to manage a complex (creative) planning process regarding strategy making (POMS) is similar to the capability to integrate the natural environment into the strategic planning process identified by Judge and Douglas (1998).

Almost half of the capabilities within cooperation are firm-specific (8 of 17). SouthEnGroup is noteworthy with regard to capabilities and resources developed within *cooperation*. As observed by Schwartz (2009), companies often use the same strategic tools as used earlier for solving other problems, a process called automorphism. It has its roots in Weick's (1991) discussion within organizational learning that firms tend to meet new external stimuli with the same approaches as used previously. Cooperation is deeply embedded in SouthEnCo's vision for sustainable growth and, at the same time, it is a strategic means to implement its goal to move towards climate neutrality. Likewise, WestEnCo has developed a range of specific capabilities related to *cooperation*. Most importantly, cooperation capabilities are key to building up the biogas business. Moreover, cooperation facilitates institutionalizing working practices within energy services.

Only five of 24 capabilities within *environmental integration* are firm-specific. The respective numbers are two of 19 for *local embeddedness*. Accordingly, there appear to be least opportunities for firm-specific approaches in these areas. It can also be argued that local embeddedness, due to historical circumstances and path dependence, is firm-specific for the very location where each company operates. Imitation of such capabilities does therefore not represent a competitive threat. Replication leads to spreading best practices without harming the competitive position of the firm.

Of the few firm-specific capabilities within *environmental integration* and *local embeddedness,* most capabilities are related to strategic preferences of the firms. For instance, the focus on resource efficiency of WestEnCo has given rise to two capabilities, whereas LocalEnCo's strong emphasis on quality and green products likewise resulted in two capabilities.

Comparison between generic and firm-specific capabilities

Similar to the earlier comparison, findings for the generic capabilities are quite opposite to those for firm-specific ones. Firm-specific capabilities are abundant particularly in *innovation*, but also more frequent within *cooperation*. In *communication and learning,* there are as many generic capabilities as firm-specific ones. However, some firm-specific capabilities have a stronger orientation towards higher-order learning. As noted, this greening mechanism contains most capabilities overall. *Environmental integration* and *local embeddedness*, the mechanisms with most generic capabilities, score least firm-specific ones.

Another interesting observation is that only five (of 39) firm-specific capabilities yield cost savings, whereas the number is 16 (of 44) for best practices. In addition, the relative share of capabilities contributing to an enhanced reputation and/or future position is slightly larger for firm-specific capabilities. Comparing numbers can, of course, only give an indication of tendencies. A preliminary conclusion from this finding is that best practices spread more easily when they are likely to result in cost savings or other short-term benefits. The pay-off of firm-specific capabilities may be more intangible or long-run.

Firm-specific capabilities are more complex and require more resources and/or time to build up. They entail greater efforts or deeper relationships, indicating their path dependency. Consequently, time compression diseconomies make them more difficult to imitate. Many of these capabilities involve greater risks and are oriented towards clean technology. Although all firms attempt to reposition their internal competencies around more sustainable technologies, WestEnCo clearly dominates when it comes to protecting and nurturing disruptive and leapfrog clean technologies, which is a crucial capability to reposition the firm according to Hart and Dowell (2011).

6.3.4 Capabilities complementing the natural-resource-based view

While the focus in the NRBV literature lies on identifying capabilities that aid the creation of firm value by embracing an environmentally sustainable strategy, one aim pursued in this research is to widen this perspective and identify capabilities that create value that is shared between the firm and society.

With a point of departure in the criteria elaborated for how shared value can be created by municipal energy companies, i.e. *transferability, coordination*, and *far-sightedness* (see Section 4.4.2), the following six capabilities with a potential to create shared value by aiding the transition towards a more sustainable energy system have been identified from the case studies.

- *A capability to facilitate and encourage the adoption of sustainable practices with customers.*
  The adoption of sustainable practices with customers can be promoted by creating incentives for good environmental behavior, e.g. through innovative pricing models that encourage a more efficient energy use. The complexity of behaving in an environmentally sound way is also reduced by offering green choices or making existing products more environmentally-friendly. By acting as a facilitator for their stakeholders and customers to make choices and take actions that reduce their environmental impact, energy companies can lower the barriers to change. This also entails making customers more aware of the environmental impact of their energy use, empowering them to take responsibility and make an active choice.

- *A capability for cooperation with diverse partners to pursue sustainable initiatives*
  Actively seeking cooperations as a means to find sustainable solutions within the energy sector is a valuable capability that can support a strategy for environmental sustainability in many aspects. Cooperation can for instance lead to improved sustainability of the production mix and a more efficient use of resources. Furthermore, cooperations facilitate clean technology R & D and investments. Attention has to be paid to creating openness and trust (Grönkvist & Sandberg, 2006) as well as a shared vision (Gray, 1989) which are central factors influencing cooperation.

- *A capability for systemic innovations that redesign the production-consumption system.*
  This capability aims at finding solutions to solving problems of the commons (common-pool resource problems). Such a capability facilitates a system transition, i.e. a change of the socio-technical regime towards a low-carbon economy. It requires companies to take responsibility for the wider system.

- *A capability to institutionalize sustainable practices within the industry and with other stakeholders.*
  Through knowledge sharing and cooperation, the imitation of sustainable practices is encouraged. This reduces the transferability problem and time compression diseconomies that slow down the transition to sustainable practices.

- *A capability to act in a far-sighted manner in accordance with a sustainability vision.*
  This requires companies to handle technically and socially complex issues with regard to the technologies of the future. Enabling factors for such a capability are lower requirements for returns on sustainable investment as well as a vision that is shared with key stakeholders.

- *A capability to contribute to regional sustainable development.*
  Municipal energy companies can promote regional sustainable development in various ways. The spreading of sound environmental practices within the region contributes to better energy efficiency and less pollution. Resources are more fully used, resulting in less waste in terms of for instance excess heat, renewable residues and the like. On the customer side, offering sustainable products at little additional costs may create green local clusters. Quality of life is improved by a strong focus on renewables and clean technology. Furthermore, investments in clean technology, often in cooperation with other actors, promote regional sustainable development. The creation of new markets (particularly relating to biogas) offers opportunities for a system change. By using local renewable resources energy security is improved and various risks are mitigated. In addition, the creation of a green profile for the municipality or region can attract new business to the area, offering additional job opportunities. Going beyond these benefits, value from the energy business is created and appropriated locally, as any surplus goes to the municipality.

7 Concluding discussion

This study aims at elucidating how the transition towards an environmentally sustainable business is managed by municipal energy companies with a high environmental commitment. In this chapter conclusions are drawn on three areas of inquiry embodied in this aim. First, strategies at the core of such a transition, addressed as strategies for environmental sustainability, are investigated. The next section draws conclusions on the characteristics of such strategies and discusses differences between the case companies. Second, mechanisms that facilitate the process of embedding such strategies in the companies, i.e. greening mechanisms, are discussed in section 7.2. Third, the contribution of strategies for environmental sustainability to the sustainable development of the firm and society, by means of the capabilities and resources developed in this process, is addressed. Conclusions on value creating capabilities and resources are drawn in Section 7.3. Thereafter, the contributions of the thesis are outlined, and its implications for theory and practice are discussed. Finally, limitations are addressed, and suggestions for further research are made.

7.1 The strategies for environmental sustainability of the environmentally committed municipal energy companies

The strategies for environmental sustainability of the case companies seem to be firmly integrated into their general corporate strategies, rather than constituting add-on strategies. Distinct elements of the sustainability strategy represent central parts of the business development at the studied companies. They represent vigorous areas of management and development, reflecting how the companies envision their future position on a market increasingly concerned with environmental performance. To judge from the study, strategies for environmental sustainability are primarily driven by the perceived need to reposition the company for future competitiveness and growth, risk management considerations and reputational concerns.

Although some common patterns could be observed in the case companies, leading to similar capabilities and resources, it is concluded that strategies for environmental sustainability are company-specific rather than standardized. This confirms Sharma and Vredenburg's (1998) observations. The firm-specificity of the strategies indicates that there are different understandings and approaches as to how the sustainability of the energy business can be improved. Companies have individual interpretations of what a sustainable energy system entails and what the possibilities and role of the company involve. Arriving at a company-specific approach can be seen as a process of sensemaking (Weick, 1988) that translates into a vision and strategy for environmental sustainability. Frequently, companies' visions stretch the limits of traditional energy companies to become facilitators of a sustainable society in energy issues.

There are several likely reasons why corporate strategies for environmental sustainability differ. From a broader perspective, actions to combat climate change are a relatively new phenomenon, and the deep and far-reaching changes in the business practices required are not yet fully understood. Therefore, it is probable that associated (best) practices (that follow new norms and values) are in the formation stage, not yet institutionalized.

Differences can also be ascribed to each company's particular background, e.g. historical circumstances, geographical variations, ambitions of the owners and existing resources and competencies. Obviously, unique historical conditions and path dependence shape the development of strategies for environmental sustainability. Path dependence determines such strategies not only from the point of view of the technical configuration, but also through the process of automorphism, meaning that the transition to sustainable business is tackled with the same strategic tools used when solving previous challenging problems. This is related to Grant's (2001) recommendation to build a strategy on the company's relative strengths. The case companies' strategies for environmental sustainability combine well with their perceived relative strengths: WestEnCo focuses strongly on resource efficiency and staying at the forefront of clean technology development; SouthEnGroup takes advantage of cooperations and strong local embeddedness; and LocalEnCo leverages its sustainability strategy with service-mindedness and agile internal coordination. The development of a strategy for environmental sustainability can thus be seen as a path dependent, cumulative process evolving over time, whereas early commitment, unique historical conditions and automorphism influence the depth and characteristic features of the strategy.

Due to the variety in approaches towards managing "the interface between business and the natural environment" (Sharma, 2000:682), what a strategy for environmental sustainability entails is best answered conceptually, although empirical illustration can create further understanding. The variety of strategies for environmental sustainability does, however, not constitute a problem as such. Given the complexity of the challenge, diversity in sustainable solutions may be preferable over a single development trajectory.

Surprisingly few differences in the companies' strategies for environmental sustainability could be assigned to size. Contrary to the general perception in the literature (e.g. Aragón-Correa, 1998; Sharma, 2000, Roy et al., 2001), large companies do not seem to be in a better position to integrate environmental concerns into business. However, size seems to affect the scope and reach of such strategies; In this study, the two larger case companies, WestEnCo and SouthEnGroup, are eager to build up the competences and resources to explore new business lines, which affects their range of products and technologies. The largest company, WestEnCo, clearly takes higher technical risks, which is compensated by a portfolio approach towards production technologies, input fuels and business lines, allowing flexibility and risk minimization over time. A distinguishing feature of the largest company is also its willingness to engage in political dialogue on the future of the energy system. In contrast, LocalEnCo, the small company, concentrates mostly on the core energy business, i.e. providing electricity and heat. Due to its small-sized production system, it is forced to put 'all eggs in one basket' regarding the choice of production technology. Its technical options are limited, resulting in less operational flexiblity. Technical disadvantages seem, however, to be outweighed by organizational agility. No evidence points at small size as an obstacle, preventing a company from adopting an ambitious strategy for environmental sustainability. On the contrary, the small company's strong local embeddedness and the more manageable volumes of renewable fuels required facilitate living up to an ambitious vision. Furthermore, the activities conducted under the environmental strategy are more easily coordinated, resulting in a more coherent strategy. This is quite a challenge for large or decentralized firms. To conclude, municipal energy companies irrespective of size have good possibilities to implement a strategy for environmental sustainability.

Strategies for environmental sustainability are conceptually framed as the aggregate of environmentally-oriented activities and practices conducted in the four areas of *emissions reduction, product stewardship*, *clean technology* and *sustainability vision*. These areas differ in the degree of organizational commitment required and the potential held to contribute to environmental sustainability. The study of the case companies suggests that emissions reduction forms the very base of the strategies for environmental sustainability. The companies have long experience with environmental management, and their emissions reduction strategies are well-elaborated.

According to this study, product stewardship seems to be the most challenging conceptual area, contrary to Hart & Milstein's (2003) suggestions. This strategy is based on an incremental learning process, and calls for parallel changes in the business model. Requiring systemic innovations across different organizational units, product stewardship seems to create challenges for the two larger companies, whereas the small company sets a good example with its ambitious product stewardship strategy.

The clean technology strategy is crucial to achieve radical improvements in environmental performance and to reposition the company. As observed by Makadok (2001a), if a firm fails to acquire crucial resources, as in the case of SouthEnGroup's delayed investment in Gravel Site, the firm's capacity to generate economic value from its capabilities is restricted. Success or failure in clean technology deployment plays a crucial role for the development trajectory and future prospects of the case companies. Since clean technology ventures depend on complex social interactions, extensive coordination of activities and capabilities is required.

Sustainability vision might have the greatest potential to create further understanding of how the transition to a more sustainable energy system can be managed. Each company developed a distinctive vision for the changeover towards a more sustainable business and used it as a tool to align corporate activities and employee efforts towards a common objective.

The conceptual areas are mutually embedded rather than unfolding in a path dependent manner, which is in line with earlier findings (e.g. Fowler & Hope, 2007). Working simultaneously within different areas is beneficial since incremental steps in each area allow for capabilities and resources to be accumulated in parallel. Given the mutual interdependence of the conceptual areas, coordinating and integrating capabilities and resources acquired in each area results in synergies. Gradually, a more sophisticated and coherent strategy for environmental sustainability evolves. Moreover, a sustainability vision seems vital to align the conceptual areas and develop the company in the desired direction.

Social complexity is a key characteristic of sustainable strategies, in particular as firm size increases. Coordinating the various processes entailed by a strategy for environmental sustainability is a challenging management task involving many areas of the organization and even beyond. The follow-up and revision of environmental goals, the development of sustainable products and the planning process for clean technology investments are examples of such socially complex tasks. As raised by Conklin (2006), it is essential for firms to build capacity in handling social complexity, given the need for effective collaboration beyond the corporation to tackle wicked problems such as climate change. The breadth of challenges inherent in the strategies for environmental sustainability, as envisaged in the four conceptual areas, provides a means to develop that capacity.

7.2 The greening mechanisms

The concept of greening mechanisms captures the dynamic ways in which highly committed municipal energy companies work with sustainability issues. These mechanisms seem to facilitate the embedding of a strategy for environmental sustainability in the firm and its surrounding field. A mechanism scheme can deal with the complexity involved in the implementation of a strategy for environmental sustainability, and explain by what means a certain effect could be produced, thus providing a ‘how-possible’ explanation (Hedström & Ylikoski, 2010). Being a central interest of this study, the scheme of greening mechanisms is seen to provide insights and give guidance as to how environmental sustainability can be integrated in companies and embedded in their surrounding organizational field. The scheme features the five greening mechanisms *environmental integration, communication and learning, innovation, cooperation* and *local embeddedness*.

Environmental integration refers to strong capabilities to integrate environmental aspects into the technical and management systems of the case companies. Thus, environmental considerations permeate corporate decisions, activities and systems. *Communication and learning* creates a platform for organizational and behavioural changes towards environmentally sustainable business. Good abilities to communicate and learn help the studied firms to acquire a better understanding and capacity to handle the challenges ahead triggered by climate change. In addition, effective stakeholder communication can facilitate driving the sustainability agenda forward. Furthermore, strategies for environmental sustainability require novel approaches to business development and hence, *innovation* is an essential ingredient of such strategies at the case companies. A broad definition of innovation seems important to catch more subtle changes, such as business model and management innovations. Developing green products is an important area for innovations directed at consumers, but even more so clean technologies that allow for more radical changes in the production of energy. Similarly, *cooperation* offers many opportunities to improve the sustainability of the energy system. It not only facilitates a more efficient resource use, but also promotes business expansion and the dissemination of clean technology. A willingness to cooperate is crucial for achieving the systemic changes required to manage the transition to sustainable practices, products and technologies. These are beneficial not only to the firm but also to its stakeholders and the local community.

Local embeddedness seems to be a characteristic feature of highly committed municipal energy companies. The case companies are driven by the desire to contribute to the sustainable development of society within the sphere of their activities and to increase the local quality of life. This purpose of the company may differ from the view of multinational energy companies that to a large extent have a dominating role in the configuration of the energy system. This research exposes an alternative, the locally embedded 'task force' whose incentives ultimately are community-based.

Through clean technology investments in the region and an embedding of their activities into the local context, the studied municipal energy companies can concentrate value creation from the energy system at a local level (cf. Johansson et al., 2005). Thus, they constitute a valuable tool for their respective municipal owner(s) to realize important goals beyond the provision of infrastructural services (cf. Rönnborg, 2009). Furthermore, strong local embeddedness, manifested in political support and public trust, could be a way to avoid delays in clean technology investments. Therefore, a shared understanding of the future development pathway for both the company and the region is crucial for taking strong actions. In light of the firm belief that the local level is an appropriate platform for finding solutions to sustainability challenges (Hägerhäll, 1988; UN, 1992), municipal energy companies are well-positioned to assist with the transition towards a sustainable society.

7.3 Value creating capabilities and resources

Walls et al. (2011) maintain that firms with a long history of environmental strategy are more likely to have built valuable environmental capabilities. In this research, 108 capabilities and resources were identified that can be associated with the case companies' strategies for environmental sustainability. The occurrence of these capabilities in each conceptual area, each greening mechanism and at each intersection was examined. A similar analysis for each company provided a basis for comparing strengths and weaknesses as well as qualitative aspects of their strategies. In the final step, the capacity of the capabilities to create firm value and shared value was assessed. The extent to which the capabilities were found in all firms, or were firm-specific, has also been examined.

To conclude from the analyses, considerably more capabilities and resources hold the potential to create shared value rather than value predominantly for the firm. The most frequently identified benefit creating firm value is the contribution to a favorable future position. For capabilities and resources generating shared value, coordination is the most commonly suggested benefit. This indicates that firms must be capable of handling social complexity beyond the firm in order to manage the transition towards a sustainable energy system. Thereby, coordination may well hold the greatest potential to create a favorable future position for the firm, confirming the relevance of the greening mechanism *cooperation*.

Two thirds of the capabilities within *environmental integration* generate mainly firm value. More than half of these capabilities are found in all three firms, pointing at the important function of environmental management systems to spread best practices. *Local embeddedness*, *innovation* and *cooperation* hold the largest potential to generate shared value. The main contribution of the three mechanisms to sustainable development seems to lie in enabling coordination and far-sighted actions. Interestingly, the large majority of capabilities and resources developed within *local embeddedness* creates shared value *and* can be found in all three firms. Overall, WestEnCo developed most capabilities generating shared value, and many of these capabilities are unique to this firm.

To judge from the best practices identified, strategies for environmental sustainability involve similar activities and practices in many areas. Generic capabilities are mostly developed within *environmental integration, local embeddedness* and *communication and learning*. Cooperation within the energy sector, particularly regarding efficient resource use, is a further best practice.

It can be concluded that *local embeddedness* is a widespread best practice among municipal energy companies, holding strong potential to contribute to shared value. Despite similar capabilities, this dimension differs between firms, given the path dependent development of the capabilities anchored in the specific historical, geographic and structural conditions of the area of operations where each firm has its roots. These capabilities and resources resemble the concept of non-rivalrous resources over which firms do not need to compete (cf. Kraaijenbrink, 2010). Fostering capabilities and best practices underlying *local embeddedness* can create value for society without harming the competitive position of the firm, thus creating opportunities for replication.

Overall, slightly more than a third of the capabilities and resources identified are firm-specific. As could be expected, the greening mechanism *innovation* contains a high share of firm-specific capabilities. These innovation capabilities have bearing on all conceptual areas of a strategy for environmental sustainability. WestEnCo is clearly superior to the smaller firms in terms of innovation capabilities, which may be linked to a capability for higher-order learning.

Many best practices can be associated with cost savings, while the firm-specific capabilities are more likely to generate reputational advantages or a favorable future position. Hence, the benefits of best practices are more tangible and short-run, while the firm-specific capabilities generate more intangible, long-run benefits. Two tentative conclusions can be drawn from this; Firstly, best practices spread more easily when they can be associated with cost savings and, secondly, firm-specific capabilities are frequently more complex, requiring more time and resources to form. They are path dependent and difficult to imitate, thus representing authentic capabilities and resources in the sense of the RBV.

Among the 108 capabilities and resources, 25 can be characterized as resources. Many of them have been built up over time or are related to knowledge or attitudes embedded in human resources, thus sharing features with the invisible resources described by Itami (1987).

The suggested capabilities seen to create shared value by aiding a transition towards a more sustainable energy system (addressed in Section 6.3.4) represent the essence of what distinguishes strategies for environmental sustainability in highly committed municipal energy companies. These capabilities complement the natural-resource-based view, and surpass the traditional boundaries of the firm. Working on various fronts to facilitate an energy transition, strategies for environmental sustainability target diverse stakeholders: Customers, since their behavior is decisive for the volumes and type of energy produced; competitors, as institutionalizing sustainable business practices benefits the firm and the wider industry; and regional actors, since they are vital partners for optimizing resource use, for cooperations facilitating clean technology investments, and for working towards a sustainable region in energy matters more generally. The far-sighted visions and actions of the companies aim at systemic innovations at a local or regional level, speeding up the transition from the current socio-technical regime to a low-carbon economy.

7.4 Contributions

This thesis explores a novel way of knowledge creation by linking the concepts of activities, mechanisms and capabilities to elucidate value creation from environmentally sustainable strategies in firms and by firms towards society. The mechanism concept in particular has not been addressed before in literature on business and the natural environment.

Firstly, an empirical contribution is made by offering detailed case studies and descriptive accounts of strategies for environmental sustainability in three highly committed municipal energy companies. These case studies provide close insights into the management of environmental sustainability issues in a subgroup of companies in the Swedish stationary energy sector. Such accounts can exemplify the implementation of environmentally sound business practices in a high-impact sector.

The study context chosen is of particular interest for two reasons. Firstly, given the fact that Sweden is recognized as a forerunner in climate change mitigation, backed-up by stringent energy policies, investigating Swedish firms at the forefront of 'greening' the energy system can offer insights into corporate responses to such policies. The sustainability strategies pursued and their benefits to the firm and society are particularly interesting. Secondly, the choice of municipal energy companies as objects of study can contribute to knowledge on the governance of sustainability issues in publicly-owned corporations. Such insights are valuable, given the differences in understandings of corporate sustainability between public and private organizations (Russel et al., 2007) and the dominant focus of prior studies on private firms. Thus, this study sheds light on the business logic of locally embedded firms with an ambition to contribute to a sustainable society with respect to energy issues.

A further contribution is made by developing a scheme of greening mechanisms. This scheme suggests a way to interpret and explain how environmental sustainability is embedded in municipal energy companies and their surrounding organizational field. Mechanisms-based explanation is a methodological as well as an epistemological novelty for studying the transition to sustainable business. The approach goes below the surface of what is directly observable, and investigates the more fundamental conditions of the phenomenon under study (Danermark et al., 2002). The mechanism-based approach rests upon practical rationality (Sandberg & Tsoukas, 2011), enabling the development of a theory close to practice.

A methodological implication of using a mechanism scheme is that an additional layer of analysis is added between activities and practices on the one hand, and capabilities and resources on the other. This strengthens the robustness of the analysis. Moreover, the combination of the greening mechanisms with a conceptual framework based on extant research in this area allowed for cumulative knowledge creation. Thereby, a more fine-grained picture could be gained of the transition towards sustainable business, shedding light on the processes inside the 'black box' where organizational capabilities and resources take form (cf. Sheehan & Foss, 2007).

The use of a mechanism scheme makes a methodological contribution by providing an alternative to how value creation processes can be studied. According to Marcus (2005), little research has been done on the formation of an overall competence in environmental management. The greening mechanisms provide valuable insights into the efforts required to develop the capabilities and resources underlying a strategy for environmental sustainability.

From a narrative perspective, mechanisms-based description and explanation can create a consistent storyline, while providing an empirical language that facilitates the comprehension of a complex phenomenon.

The opportunities for developing and spreading environmental best practices created by the local embeddedness dimension are an interesting empirical finding. This has not been explicitly addressed in earlier literature on business and the natural environment.

Furthermore, a theoretical contribution is made by linking the field of sustainability with the resource-based view. The concept of shared value creation between business and society

(Porter & Kramer, 2006; 2011) is connected to the resource-based view, and a set of criteria is established against which the creation of shared value can be assessed. This addresses the scarcity of attempts to bridge strategic management research and sustainability research. The criteria particularly relate to the wicked problems encountered when implementing sustainability strategies. The findings highlight the importance and benefits of conceiving strategies that are not confined to the boundaries of the firm. Bridging firm strategy and sustainable development considerations requires that a broader set of challenges is addressed by firms than the traditional aspiration of serving markets. It necessitates a thorough understanding of the challenges and opportunities inherent in a system transition such as the change towards a more sustainable energy system.

7.5 Implications for theory and management

The '*framework of conceptual areas of strategies for environmental sustainability*' operationalizes such strategies as the aggregate of environmentally-oriented activities and practices performed in four qualitatively different areas. This reflects that such strategies encompass distinct fields propelled by different drivers and future prospects. This conceptualization can create awareness with managers that the transition towards environmentally sustainable business requires simultaneous commitment and resource allocation in four distinctive areas. Hence, it is a multidimensional challenge. The framework can also be used as a tool to assess current corporate activities and practices, identifying strengths and weaknesses, similar to what was suggested by Hart (1997).

Secondly, providing a middle range theory of greening mechanisms can reduce the complexity of making business more sustainable, presenting an opportunity to bridge the theory-practice gap between academia and management (e.g. Sandberg & Tsoukas, 2011). Organizational practitioners can contemplate their strategies and practices from a different angle, providing them with an opportunity for reflection and new insights that can infuse their strategic planning. Jointly, the 'framework of conceptual areas' and the 'scheme of greening mechanisms' can enrich the discussion on sustainable practices in organizations (Wikström, 2010) and facilitate action.

Furthermore, practitioners and decision-makers in energy companies can gain awareness of the capabilities and resources enabling the transition towards environmentally sustainable business, as well as how these can be built up. The challenges to manage such a changeover are thus made more explicit and intelligible.

As highlighted by Kogut and Kulatilaka (1994), capabilities are valuable because of their inherent complex options on future opportunities. By elucidating qualitative aspects of the capabilities and resources created in highly committed companies, more could be learned about the contribution of each greening mechanism to the sustainable development of the firm and society. This creates a platform for firms and policy makers to assess the potential of anticipated measures and alternative development pathways based on a number of qualitative indicators.

Building on the notion of shared value creation (Porter & Kramer, 2006; 2011), this study hypothesizes how firms can simultaneously create value for the firm and shared value between the firm and society. It becomes increasingly clear that the dominant focus of the strategy literature on proprietary value (e.g. Henneberg et al., 2005) is insufficient to cope with the complex challenges of our time. The implications for theory are that researchers should broaden their perspectives on value creation and pay more attention to the tensions and synergies between firm value creation and shared value creation.

Policy makers and local politicians should be made more aware of the shared value that municipal energy companies can deliver by engaging in a strategy for environmental sustainability and working for an energy system transition in their area of operations. This force should be harnessed through a close dialogue between local politicians and the municipal energy company. Furthermore, given the importance of clean technology investments for the sustainable development of the energy system and society, barriers to such investments from e.g. lengthy and cumbersome approval processes should be removed.

7.6 Final reflections and suggestions for further research

Conducting case studies of three municipal energy companies differing in size and organizational structure, and in which the process of interest was 'transparently observable', is one of several conceivable ways to study the issues of interest. Method choices inevitably result in strengths and weaknesses. In this research, empirical depth was favored over breadth to gain understanding of the qualitative characteristics of the transition process in companies. These characteristics are difficult to capture otherwise. Evidently, how we choose to look at the world affects what can be seen.

At the same time, the phenomenon of interest was kept broad at the firm level in order to gain an overarching picture of the empirical reality in a specific sub-field of the energy sector. Conducting problem-based research oriented towards practice required trade-offs as to the depth in which theoretical dimensions could be taken into account. It appears as if the comprehensive challenges triggered by sustainable development concerns are not reconcilable with a strictly disciplinary approach to knowledge creation. They may conflict with the traditionally more narrow research focus of disciplinary research. Problem-based research seems to benefit from theoretical breadth and a flexible research design. A bigger toolbox is required to tackle contemporary real-life problems, and new combinations of knowledge are needed. The lack of a clear academic home base might be somewhat risky, but on the positive side, this research may create opportunities for a cross-disciplinary dialogue. Takeaways from this study might be interesting or relevant to a broader audience.

As addressed by George and Bennett (2005), it has to be kept in mind that case study findings are most likely to apply to the subclass of cases that share similar features, and this in a contingent way. The generality of findings made in this thesis, however, seems less of a concern. Exemplary case studies of how the pressing need to manage the transition towards a sustainable energy system is handled may not necessarily require this kind of justification.

Their value lies in illustrating how a pressing issue of public interest is handled. Nevertheless, the congruence of most findings with prior research and theory may be an indicator of generality. Moreover, it has been a guiding principle to present the case studies in a detailed and transparent fashion, allowing for the reader to form an opinion whether or not the conclusions drawn seem reasonable.

Furthermore, it has to be acknowledged that the phenomenon under study is embedded in the overarching endeavours to combat climate change on a local, national and global level. This thesis zooms in on a tiny fraction of these broad, on-going endeavors. Although the impact of such local efforts is negligible in view of the general trends in greenhouse gas emissions, experiences made here are not altogether irrelevant in view of Sweden's good contacts with various high-emitting nations. The efforts made in the Swedish context may be a drop in the ocean but at the same time rings may spread on the water.

Against the background of a warming climate, further insights in the workings of strategies for environmental sustainability are needed. This thesis can lay a foundation for further research that could go more in depth or apply the suggested frameworks in other settings. My foremost suggestions for follow-up studies are the following:

- To investigate if the greening mechanisms derived from the empirical study hold even in other contexts than that of Swedish municipal energy companies. Privately-owned energy companies in Sweden or abroad might be suitable fields to test the framework or elaborate a corresponding one. It could even be of interest to use the framework to study environmental strategies of municipal energy companies in other countries with strong environmental policies, for instance Germany.
- A further suggestion relates to making more in-depth studies of the four conceptual areas with energy companies that differ in various ways. In particular, it might be interesting to use a forward looking approach to assess the effects of differing corporate sustainability visions on the strategies implemented in the companies, and the consequences this might have for the development of the energy system as a whole.
- Another area of interest refers to shared value creation and the social aspects of the transition towards sustainability. In the past, technical and economic aspects have largely dominated the discussions. More emphasis should be put on problem framing, knowledge transfer and how social aspects can foster environmental sustainability. In this respect, further studies of the role of local embeddedness in managing the energy transition may be fruitful.

References

Alcamo, J. (2010). Information Note. How Close Are We to the Two Degree Limit? http://www.unep.org/yearbook/2010/PDF/Information_note.pdf (14 March 2011)

Alvesson, M., Sköldberg, K. (2009). *Reflexive Methodology. New Vistas for Qualitative Research*. Second Edition. London: Sage.

AMA (2007). Creating a sustainable future. American Management Association, New York.

Ambrosini, V., Bowman, C. (2001). Tacit Knowledge: Some Suggestions for Operationalization. *Journal of Management Studies*, 38(6): 811-829.

Amit, R., Shoemaker, P. (1993). Strategic assets and organizational rent. *Strategic Management Journal*, 14(1): 33-46.

Andersen, M. (2002). Organizing Interfirm Learning. In: de Bruijn, T., Tucker, A. (Eds.): *Partnership and leadership: building alliances for a sustainable future*, pp. 103-119, Dordrecht: Kluwer Academic Publishers.

Andersen, M., Neergaard, P. (2005). Environmental Management in SMEs – ways to success? A case study. In: Füssel, L. (Ed.): *Corporate Environmental Performance*. Lund: Studentlitteratur.

Andrews, R. (1997). National environmental policies: The United States. In: Jaenicke, M., Weidner, H.J. (Eds.): *National environmental policies: A comparative study of capacity building*, pp. 25-43, New York: Springer.

APPA (American Public Power Association) (2012). U.S. Electric Utility Industry Statistics. http://www.publicpower.org/files/PDFs/USElectricUtilityIndustryStatistics.pdf (4 July 2012)

Aragón-Correa, J.A. (1998). Strategic Proactivity and Firm Approach to the Natural Environment. *The Academy of Management Journal*, 41(5): 556-567.

Aragón-Correa J., Sharma S. (2003). A contingent resource-based view of proactive corporate environmental strategy. *Academy of Management Review*, 28(1): 71–88.

Aragón-Correa, J., Hurtado-Torres, N., Sharma, S., García-Morales, V. (2008). Environmental strategy and performance in small firms: A resource-based perspective. *Journal of Environmental Management*, 86(1): 88-103.

Argyris, C., Schon, D. (1974). *Theory in Practice*. San Francisco, CA: Jossey-Bass.

Argyris, C., Schon, D. (1978). *Organizational Learning: A Theory of Action Perspective*. Reading, MA: Addison-Wesley.

Aristotle (1961). *The Metaphysics.* Trans. H. Tredennick. Cambridge, MA: Harvard University Press.

Armas-Cruz, Y. (2011). Determinants of environmental management and implications for firms' economic performance. *Journal of Environmental Planning and Management*, 54(8): 1077-1106.

Armstrong, C., Shimizu, K. (2007). A Review of Approaches to Empirical Research on the Resource-Based View of the firm. *Journal of Management*, 33(6): 959-986.

Arora, S., Cason, T.N. (1995). Why Do Firms Volunteer to Exceed Environmental Regulations? Understanding Participation in EPA's 33/50 Program. *Land Economics*, 72(4): 413-432.

Arroyo, V., Preston, B. (2007). Change in the marketplace: business leadership and communication. In: Moser, S., Dilling, L. (Eds.): *Creating a climate for change. Communicating Climate Change and Facilitating Social Change*. Cambridge, U.K.: Cambridge University Press.

Ascher, W. (2006). Long-term strategy for sustainable development: strategies to promote far-sighted action. *Sustainability Science*, 1(1): 15-22.

Astley, G. (1984). Toward an appreciation of collective strategy. *Academy of Management Review*, 9(3): 526-535.

Atkinson, S., Schaefer, A., Viney, H. (2000). Organizational Structure and Effective Environmental Management. *Business Strategy and the Environment*, 9(2): 108-121.

Auld, G., Bernstein, S., Cashore, B., Levin, K. (2007). Playing it forward: Path Dependency, Progressive Incrementalism, and the "Super Wicked" Problem of Global Climate Change. International Studies Association Annual Convention, Chicago, IL, Feb 28th – March 3, 2007.

Azar, Ch. (2008). *Makten över klimatet,* Falun: Albert Bonniers Förlag.

Azar, Ch. (2011). Rundabordssamtal Adlerbertska Forskningsstiftelsen jubileumskonferens. http://urplay.se/169124 (28 March 2012)

Baeten, G. (2000). The tragedy of the highway: Empowerment, disempowerment and the politics of sustainability disourses and practices. *European Planning Studies*, 8(1): 69-86.

Bansal, P. (2005). Evolving sustainably: a longitudinal study of corporate sustainable development. *Strategic Management Journal*, 26(3): 197-218.

Bansal, P., Hunter, T. (2003). Strategic explanations for the early adoption of ISO 14001. *Journal of Business Ethics,* 46(3): 289-299.

Bansal, P., Roth, K. (2000). Why Companies Go Green: A Model of Ecological Responsiveness. *The Academy of Management Journal*, 43(4): 717-736.

Barney, J.B. (1986). Strategic Factor Markets: Expectations, Luck, and Business Strategy. *Management Science*, 32(10): 1231-1241.

Barney, J.B. (1991). Firm Resources and Sustained Competitive Advantage. *Journal of Management*, 17(1): 99-120.

Barney, J.B. (1999). *Gaining and Sustaining Competitive Advantage*. Reading, MA: Addison-Wesley.

Barney, J.B. (2001). Is the Resource-Based "View" a Useful Perspective for Strategic Management Research? Yes. *The Academy of Management Review*, 26(1): 41-56.

Barney, J.B., Wright, M., Ketchen, D.J. (2001). The resource-based view of the firm: Ten years after 1991. Journal of Management, 27(6): 625-641.

Barney, J.B., Clark, D.N. (2007). *Resource-Based Theory – Creating a Sustaining Competitive Advantage*. Oxford: Oxford Press.

Bartelmus, P. (2003). Dematerialization and capital maintenance: two sides of the sustainability coin. *Ecological Economics*, 46(1): 61-81.

Baylis, R., Connell, L., Flynn, A. (1998). Company size, environmental regulation and ecological modernization: further analysis at the level of the firm. *Business Strategy and the Environment*, 7(5): 285–296.

BDF (Baltic Development Forum) (2009). Sustainable Energy Scenarios. Energy Perspectives for the Baltic Sea Region. Copenhaguen: Ea Energianalyse.

Beck, U. (1992). *Risk Society. Towards a new modernity*, London: SAGE Publications.

Benbasat, I., Goldstein, D., Mead, M. (1987). The Case Research Strategy in Studies of Information Systems. *MIS Quarterly*, 11(3): 369-386.

Bendell, J. (2003). Talking for Change? Reflections on effective stakeholder dialogue. In: Andriof, J., Waddock, S., Husted, B. and Rahman, S.S. (Eds.): *Unfolding Stakeholder Thinking: Relationships, Communication, Reporting and Performance*, pp. 145–161, Sheffield: Greenleaf.

Benn, S., Dunphy, D. (2007). *Corporate Governance and Sustainability – Challenges for Theory and Practice*. Abingdon: Routledge.

Berchicci, L., King, A. (2007). Postcards from the Edge. *The Academy of Management Annals,* 1(1): 513-547.

Bergström, S., Catasus, B., Ljungdahl, F. (1998). *Miljöredovisning*. Malmö: Liber Ekonomi.

Berke, P., Conroy, M. (2000). Are we planning for sustainable development? *Journal of the American Planning Association*, 66(1): 21-33.

Berkowitz, S. (1997). Analyzing Qualitative Data. In: Frechtling, J., Sharp, L. (Eds.): *User-friendly handbook for mixed method evaluations*. National Science Foundation.

Berry, M.A., Rondinelli, D.A. (1998). Proactive environmental management: A new industrial revolution. *The Academy of Management Executive,* 12(2):38-50.

Birkin, F., Polesie, T., Lewis, L. (2007). A new business model for sustainable development: an exploratory study using the theory of constraints in Nordic organizations. *Business Strategy and the Environment*. 18(5): 277-290.

Birkinshaw, J., Hamel, G., Mol, M.J. (2008). Management Innovation. *Academy of Management Review*, 33(4): 825–845.

Bjerke, B. (1999). Business *Leadership and Culture: National Management Styles in the Global Economy,* Cheltenham: Edward Elgar.

Bogner, W.C., Thomas, H., McGee, J. (1999). Competence and Competitive Advantage: Towards a Dynamic Model. *British Journal of Management* 10(4): 275-290.

Bood, R. (1998). Charting Organizational Learning: A comparison of multiple mapping techniques. In: Eden, C., Spencer, J. (Eds.): *Managerial and Organizational Cognition. Theory, Methods and Research*. London: Sage.

Boons, F. (1997). Do We Really Need a New Theory for Explaining the Greening of Organizations? Paper presented at the thirteenth European Group of Organization Studies (EGOS) colloquium, Budapest, 3-5- July.

Bourdieu, P. (1990). *The logic of practice.* Stanford, CA: Stanford University Press.

Bowen, H. (1953). *Social Responsibilities of the Businessman*, New York: Harper.

Bowen, F. (2000). Environmental Visibility: A Trigger of Green Organizational Responses. *Business Strategy and the Environment,* 9(2): 92-107.

Boyd, B., Bergh, D., Ketchen, D. (2010). Reconsidering the Reputation--Performance Relationship: A Resource-Based View. *Journal of Management*, 36(3): 588-609.

Boyle, G., Everett, B., Ramage, J. (Eds.) (2003). *Energy Systems and Sustainability,* Oxford: Oxford University Press.

Branco, MC, Rodrigues, L. (2006). Corporate Social Responsibility and Resource-Based Perspectives. *Journal of Business Ethics*, 69(2): 111-132.

Branco, MC, Rodrigues, L. (2008). Factors Influencing Social Responsibility Disclosure by Portuguese Companies. *Journal of Business Ethics*, 83(4): 685-701.

Brewer, T. (2005). Global warming and climate change: new issues for business strategy, government policy, and research on business-government relations. In: Grosse, R. (Ed.) *International Business and Government Relations in the 21st Century*, pp. 147-170, Cambridge: Cambridge University Press.

BRG (Business Region Gothenburg) (2009).

Brooksbank, R. (1991). Defining the small business: a new classification of company size. *Entrepreneurship & Regional Development*, 3(1): 17-31.

Bryman, A. (1989). *Research Methods and Organization Studies*. London: Unwin-Hyman.

Buchholz, W. (2001). Open Communication Climate. http://atc.bentley.edu/faculty/wb/printables/opencomm.pdf (3 September 2009)

Burgelman, R. A. (1991). Intraorganizational ecology of strategy making and organizational adaptation: Theory and field research. *Organization Science*, 2(3): 239–262.

BusinessDictionary (2009). Collaboration. http://www.businessdictionary.com/definition/collaboration.html (5 September 2009)

Buysse, K., Verbeke, A. (2003). Proactive Environmental Strategies: A Stakeholder Management Perspective. *Strategic Management Journal*, 24(5): 453-470.

Camillus, J.C. (2008). Strategy as a wicked problem. Harvard Business Review, 86(5): 98-106.

Cascio, J. (1996). ISO 14000 Series Overview. In: Cascio, J. (Ed.): *The ISO 14000 Handbook*. Fairfax, VA: CEEM Information Services.

CDP (Carbon Disclosure Project) (2010). CDP 2010 Europe 300 Report. https://www.cdproject.net/CDPResults/CDP-2010-Europe-300-Report.pdf (15 March 2011)

Chan, R. (2005). Does the Natural-Resource-Based View of the Firm Apply in an Emerging Economy? A Survey of Foreign Invested Enterprises in China. *Journal of Management Studies*, 42(3): 625-672.

Chandler, A. D. (1962). *Strategy and structure: Chapters in the history of the industrial enterprise*. Cambridge, MA: MIT Press.

Chappin, E., Dijkema, G. (2008). On the impact of CO2 emission-trading on power generation emissions. *Technological Forecasting & Social Change*, 76(3): 358-370.

Chesbrough, H. (2003). The Era of Open Innovation. *MIT Sloan Management Review,* 44(3): 35-41.

Chesbrough, H. (2004). Managing Open Innovation. *Research Technology Management,* 47 (Jan-Feb): 23-26.

Chesbrough, H. (2006). Open Innovation: A New Paradigm for Understanding Industrial Innovation. In: Chesbrough, H., Vanhaverbeke, W., West, J. (Eds.): *Open Innovation: Researching a New Paradigm*, pp. 1-27, Oxford: Oxford University Press.

Chesbrough, H., Teece, D. (1996). When is Virtual virtuous? Organizing for Innovation. *Harvard Business Review*, 74(1): 65-73.

Chidiak, M., Tirpak, D. (2008). Mitigation Technology Challenges: Considerations for National Policy Makers to Address Climate Change. UNDP (United Nations Development Programme). http://www.undp.org/climatechange/docs/English/UNDP_Mitigation_Technology_Challenges_final.pdf (13 May 2011)

Christiansen, A., Wettestad, J. (2003). The EU as a frontrunner on greenhouse gas emissions trading: how did it happen and will the EU succeed? *Climate Policy*, 3(1): 3-18.

Christmann, P. (2000). Effects of “Best Practices” of Environmental Management on Cost Advantage: The Role of Complementary Assets. *Academy of Management Journal*, 43(4): 663-680.

Christmann, P., Taylor, G. (2002). Globalization and the environment: strategies for international voluntary environmental initiatives. *Academy of Management Executive,* 16(3): 121-135.

Clark, B., Montgomery, D. (1998). Deterrence, reputations, and competitive cognition. *Management Science*, 44(1): 62-82.

Clark, T. (1990). International Marketing and National Character: A Review and Proposal for an Integrative Theory. *The Journal of Marketing*, 54(4): 66-79.

Coglianese, C., Nash, J. (Eds.), (2001). *Regulating from the inside: Can environmental Management Systems achieve policy goals?* Washington, DC: Resources for the Future.

Cohen, W., Levinthal, D. (1990). Absorptive Capacity: A New Perspective on Learning and Innovation. *Administrative Science Quarterly*, 35(1): 128-152.

Cole, R. E. (1989). *Strategies for learning*. Berkeley: University of California Press.

Collier, U., Löfstedt, R. (1997). Think globally, act locally? *Global Environmental Change*, 7(1): 25-40.

Conklin, J. (2001). Wicked Problems and Fragmentation, CogNexus Institute, Maryland, www.cognexus.org/id29.htm

Conklin, J. (2006). *Dialogue Mapping: Building Shared Understanding of Wicked Problems*. Chichester, U.K.: John Wiley & Sons.

Contractor, F., Lorange, P. (1988). *Cooperative strategies in international business*. Lexington, MA: Heath.

Cooper, K., White, R.E. (2012). *Qualitative Research in the Post-Modern Era: Contexts of Qualitative Research.* Dordrecht: Springer Science+Business Media B.V.

Covin, J.G., Slevin, D.P. (1991). A Conceptual Model of Entrepreneurship as Firm Behavior. *Entrepreneurship Theory and Practice*, 16(1): 7-25.

Cox, R. (2010). *Environmental Communication and the Private Sphere. 2nd Edition*. Thousand Oaks, CA: SAGE Publications.

Cummins R. (2000). "How does it work?" versus "What are the laws?": two conceptions of psychological explanation. In: Keil, F.C., Wilson, R.A. (Eds.): *Explanation and Cognition*, pp. 117–44, Cambridge, MA: MIT Press.

CWIB (Centre for a World in Balance) (2009). Our Common Future: Report of the World Commission on Environment and Development. http://www.worldinbalance.net/agreements/1987-brundtland.php (18 June 2009)

Cyert, R. M., March, J. G. (1963). *A behavioral theory of the firm*. Englewood Cliffs, NJ: Prentice-Hall.

Dalenbäck, J. (2002). Energy in Sweden: Leading the way to a sustainable future? *Refocus,* 3(5): 46-49.

Damsgaard, N., Green, R. (2005). Regulatory reform in the Swedish Electricity Industry – Good or bad? http://www.sns.se/document/sos_elmarknad_2005_eng.pdf (5 May 2009)

Danermark, B., Ekström, M., Jakobsen, L., Karlsson, J. (2002). *Explaining society: Critical realism in the Social Sciences*. London: Routledge.

Darnall, N., Edwards, D. (2006). Predicting the cost of environmental management system adoption: The role of capabilities, resources and ownership structure. *Strategic Management Journal*, 27(4): 301-320.

Dean, T. J., Brown, R. L., Bamford, C. E. (1998). Differences in large and small firm responses to environ-mental context: Strategic implications from a comparative analysis of business formations. *Strategic Management Journal*, 19(8): 709-728.

De Groene, A., Wijen, F. (1998). The Influence of Stakeholders Networks on Enviornmental Learning in Organizations. http://www.p2pays.org/ref/26/25575.pdf (15 September 2009)

Deming, W. (1986). *Out of the crisis*. Cambridge, MA: MIT Center for Advanced Engineering Study.

Denzin, N. (1994). Evaluating qualitative research in the poststructural moment: the lessons James Joyce teaches us. *International Journal of Qualitative Studies in Education*, 7(4): 295-308.

Denzin, H. (1984). The Research Act. Englewood Cliffs, NJ: Prentice-Hall.

Dierickx, I., Cool, K. (1989). Asset Stock Accumulation and Sustainability of Competitive Advantage. *Management Science*, 35(12): 1504-1511.

Dixon, F., Whittaker, M. (1999). Valuing Corporate Environmental Performance: Innovest's Evaluation of the Electric Utilities Industry. *Corporate Environmental Strategy*, 6(4): 343-354.

De Wit, B., Meyer, R. (2004). Strategy – Process, Content, Context – An international perspective. Third Edition. London: Thomson Learning.

Diesendorf, M., (2000). Sustainability and sustainable development. In: Dunphy, D, Benveniste, J, Griffiths, A., Sutton, P. (Eds): *Sustainability: The corporate challenge of the 21st century*, pp. 19-37, Sydney: Allen & Unwin.

Dilling, L., Farhar, B. (2007). Making it easy: establishing energy efficiency and renewable energy as routine best practice. In: Moser, S., Dilling, L. (Eds.): *Creating a climate for change. Communicating Climate Change and Facilitating Social Change*. Cambridge, U.K.: Cambridge University Press.

Dimento, J., Ingram, H. (2005). Science and Environmental Decision Making: The Potential Role of Environmental Impact Assessment in the Pursuit of Appropriate Information. *Natural Resources Journal*, 45: 283-309.

Dincer, I. (2000). Renewable energy and sustainable development: a crucial review. *Renewable and Sustainable Energy Reviews,* 4(2): 157-175.

Dixon, F., Whittaker, M., (1999). Valuing Corporate Environmental Performance: Innovest's Evaluation of the Electric Utilities Industry. *Corporate Environmental Strategy*, 6(4): 343-354.

Dobers, P., Strannegård, L., Wolff, R., (2001). Knowledge Interest in Corporate Environmental Management. *Business Strategy and the Environment*, 10(6): 335-343.

Dollinger, M. Golden, P., Saxton, T. (1997). The effect of reputation on the decision to joint venture. *Strategic Management Journal*, 18(2): 127–140.

Dual Citizen (2010). The 1st Global Green Economy Index - A Project Measuring National Green Reputations.
http://www.dualcitizeninc.com/ggei2010.pdf (2 May 2011)

Dubois, A., Gadde, L.E. (2002). Systematic combining: an abductive approach to case research. *Journal of Business Research*. 55(7): 553-560.

Duncan, R.B., Weiss, A. (1979). Organizational learning: Implications for organizational design. In: Staw, B. (Ed.): *Research in organizational behavior*. pp. 75-123, Greenwich, CT: JAI Press.

Dunn, S. (2005). Down to business on climate change – An overview of corporate strategies. In: Begg, K., Van der Woerd, F. Levy, D. (Eds): *The Business of Climate Change – Corporate Responses to Kyoto,* pp. 31-46, Sheffield: Greenleaf

Dunphy, D., Griffiths, A., Benn, S. (2003). *Organizational Change for Corporate Sustainability: A Guide for Leaders and Change Agents of the Future, Understanding Organizational Change.* London: Routledge.

Dyer, J.H., Singh H. (1998). The relational view: cooperative strategy and sources of interorganizational competitive advantage. *Academy of Management Review*, 23(4): 660–679.

Easton, G. (1995). Case research as a methodology for industrial networks: a realist apologia. In: Proceedings from the 11th IMP Conference, Manchester, Manchester Federal School of Business and Management, Manchester, pp. 368-391.

EC (European Commission) (2008). The EU climate and energy package.
http://ec.europa.eu/environment/climat/climate_action.html (25 January 2008)

EC (European Commission) (2010). European Climate Change Programme
http://ec.europa.eu/clima/policies/eccp/index_en.htm (15 May 2011)

EC (European Commission) (2011). Measuring greenhouse gases.
http://ec.europa.eu/clima/sites/campaign/pdf/measuring_gases_en.pdf (12 May 2011)

Eccles, R., Ioannou, I., Serafeim, G. (2011). The Impact of a Corporate Culture of Sustainability on Corporate Behavior and Performance. Harvard Business School. Working Paper 12-035.

Eckersley, R. (2004). *The Green State.* Cambridge, USA: MIT Press.

EEA (European Environmental Agency) (2010). Atmospheric greenhouse gas concentrations (CSI 013) - Assessment published Nov 2010.
http://www.eea.europa.eu/data-and-maps/indicators/atmospheric-greenhouse-gas-concentrations/atmospheric-greenhouse-gas-concentrations-assessment-3 (27 May 2011)

Ehrenfeldt, J. (2004). Environmental Management: New opportunities for institutional theory. In: Hoffman, A.J. Vetresca, M. (Eds.): *Organizations, Policy and the Natural Environment: Insitutional and Strategic Perspcetives*. Palo Alto, CA, USA: Stanford University Press.

Eisenhardt, K. (1989). Building Theories from Case Study Research. *Academy of Management Review,* 14(4): 532-550.

Eisenhardt, K., Graebner, M.E. (2007). Theory Building from Cases: Opportunities and Challenges. *Academy of Management Journal*, 50(1): 25-32.

Elkington, J. (1994). Towards the Sustainable Corporation: Win Win-Win Business Strategies for Sustainable Development. *California Management Review*, 36(2): 90-100.

Elkington, J. (1997). *Cannibals with Forks: The Triple Bottom Line of the 21st Century Business*. Oxford, U.K.: Capstone Publishing Ltd.

Elliot, S. (2011). Transdisciplinary perspectives on environmental sustainability: A resource base and framework for IT-enabled business transformation. *MIS Quarterly*, 35(1): 197-213.

Elliot, W.P. (1983). A Note on the Historical Industrial Production of Carbon Dioxide. *Climatic Change,* 5(2): 141-144.

Elster, J. (1983). *Explaining Technical Change: a case study of the philosophy of science*. Drammen: Cambridge University Press and Universitetsforlaget.

EMAS (2011). Om EMAS.
http://www.emas.se/Om-EMAS/ (30 September 2011)

Emmons, W. (1997). Implications of Ownership, Regulation, and Market Structure for Performance: Evidence from the U.S. Electric Utility Industry Before and After the New Deal, *The Review of Economics and Statistics,* 79(2): 279-289.

Encarta (2009). Cooperation.
http://encarta.msn.com/dictionary_/COOPERATION.html (19 September 2009)

Enkvist, P., Nauclér, T., Oppenheim, J. (2008). Business Strategies for Climate Change.
http://www.mckinseyquarterly.com (23 April 2008)

EPA (U.S. Environmental Protection Agency) (2009). Environmental Management Systems.
http://www.epa.gov/ems/info/act.htm (3 September 2009)

EPI (Environmental Performance Index) (2010). Sweden.
http://epi.yale.edu/Countries/Sweden (13 May 2011)

EREC (European Renewable Energy Council) (2004). Renewable Energy Policy Review Sweden. www.erec.org/fileadmin/erec_docs/Projcet_Documents/RES_in_EU_and_CC/Sweden.pdf (25 February 2010)

Ericsson, K., Huttunen, S., Nilsson, L., Svenningsson, P. (2004). Bioenergy policy and market development in Finland and Sweden. *Energy Policy,* 32(15): 1707–1721.

Ericsson, K., Nilsson, L. (2004). International biofuel trade—A study of the Swedish import. *Biomass and Bioenergy*, 26(3): 205–220.

Esaiasson, P., Gilljam, M., Oscarsson, H., Wängnerud, L. (2007). *Metodpraktikan – Konsten att studera samhälle, individ och marknad*. Vällingby: Elanders Gotab.

Etzion, D. (2007). Research on Organizations and the Natural Environment, 1992-Present: A Review. *Journal of Management*, 33(4): 637-664.

Euramet (2009). Metrology for improved power plant efficiency.
www.euramet.org/...2009/...2009/srt05.pdf (12 November 2009)

Euroelectric (2009). Envirrnmental Statistics of the European Electricity Industry 2005-2006 to March 2008.
http://www2.eurelectric.org/Content/Default.asp?PageID=655(10 October 2009)

Fens, T., Rikkert, B. (2005). EU ETS: the first steps: Pricing uncertainty and security of supply concerns. *Refocus*, 6(3): 60-61.

Fiol, C. (1994). Consensus, Diversity, and Learning in Organizations. *Organization Science*, 5(3): 402-420.

Fiol, C. (2001). Revisiting an identity-based view of sustainable competitive advantage. *Journal of Management*, 27(6): 691-699.

Fiol, C., Lyles, M. (1985). Organizational Learning. *Academy of management review*, 10(4): 803-813.

Fischer, M. (2001). Innovation, knowledge creation and systems of innovation. *The Annals of Regional Science*, 35(2): 199-216.

Fisher, P.S. (1982). Alternative institutional structures for state and local government ownership of railroads, *Logistics and Transportation Review,* 18(3): 235-254.

Flick, U. (2002). *An Introduction to Qualitative Research*. London: Sage Publications.

Flyvbjerg, B. (2001). *Making Social Science Matter*. Cambridge: University Press.

Fogelberg, H., Sandén, B. (2008). Understanding reflexive systems of innovation: An analysis of Swedish nanotechnology discourse and organization. *Technology Analysis & Strategic Management*, 20(1): 65-81.

Fombrun, C. (1996). *Reputation: Realizing value from the corporate image*. Boston, MA: Harvard Business School Press.

Fowler, S., Hope, C. (2007). Incorporating Sustainable Business Practice into Company Strategy. *Business Strategy and the Environment*, 16(1): 26-38.

Freeman, ER (1984). *Strategic Management: A Stakeholder Approach*. Boston, MA: Pitman/Ballinger.

Frosch, R., Gallopoulos, N. (1989). Stategies for manufacturing. *Scientific American*, September: 144-152.

Fudge, C., Rowe, J. (2000). *Implementing Sustainable Futures in Sweden*. Swedish Research Foundation MISTRA. Stockholm: Swedish Council for Building Research BFR.

Füssel, L. (Ed.) (2005). *Corporate Environmental Governance – Perspectives on organizing and communication.* Lund: Studentlitteratur.

Galaskiewicz, I., Shatin, D. (1981). Leadership and networking among neighborhood human service organizations. *Administrative Science Quarterly*, 26(3): 434-448.

Gavronski, I., Ferrer, G., Paiva, E.L. (2008). ISO 14001 certification in Brazil: motivations and benefits. *Journal of Cleaner Production*, 16(1): 87-94.

Gebremedhin, A. (2003). *Regional and Industrial Co-operation in District Heating Systems*. Linköping Studies of Science and Technolgy, Dissertation No. 849. Linköping: Unitryck.

Gebremedhin, A., Carlson, A. (2002). Optimisation of merged district-heating systems - benefits of co-operation in the light of externality costs. *Applied Energy*, 73(3-4): 223-235.

George, A., Bennett, A. (2005). *Case Studies and Theory Development in the Social Sciences*. Cambridge, MA: MIT Press

Ghemawat, P. (2001). *Strategy and the Business Landscape; core concepts*. Upper Saddle River, NJ: Prentice Hall.

Giddens, A. (2011). *The Politics of Climate Change*. Cambridge, U.K.: Polity Press.

Gillis, J. (2010). A Scientist, His Work and a Climate Reckoning. *The New York Times*, 21 December. http://www.nytimes.com/2010/12/22/science/earth/22carbon.html

Gladwin, T., Kennelly, J., Krause, T. (1995). Shifting paradigms for sustainable development: Implications for management theory and research. *Academy of Management Review,* 21(4): 874-907.

Gladwin, T., Krause, T. (1997). *Business, nature and society: Toward sustainable enterprise*. Burr Ridge IL: Irwin.

GlobeScan (2006). 2006 GlobeScan Corporate Social Responsibility Monitor. 30-Country Poll Finds Worldwide Consensus that Climate Change is a Serious Problem. http://www.worldpublicopinion.org/pipa/articles/btenvironmentra/187.php?nid=&id=&pnt=187S (13 May 2011).

Gode, J., Hagberg, L., Särnholm, E., Axelsson, U., Fejes, J. (2009). Miljövärden och Miljöprodukter för Fjärrvärme och Fjärrkyla. Rapport 2009:24. Svensk Fjärrvärme. http://www.svenskfjarrvarme.se/Global/Rapporter_och_Dokument/FOU-rapporter/Fj%c3%a4rrsyn/Fj%c3%a4rrsyn%20Omv%c3%a4rld/2009/Rapport%20Milj%c3%b6v%c3%a4rden%20och%20milj%c3%b6produkter.pdf (2 May 2011)

Godfrey, M. (1996). "Documentation". In: Cascio, J. (Ed.): *The ISO 14000 Handbook*, pp. 4-23, Fairfax, VA: Information Services.

Golsorkhi, D., Rouleau, L., Seidl, D., Vaara, E. (2010). Introduction: What is Strategy as Practice? In: Golsorkhi, D., Rouleau, L., Seidl, D., Vaara, E. (Eds.), *Cambridge Handbook of Strategy as Practice,* pp. 1-22, Cambridge: Cambridge University Press.

Goodland, R. (1995). The Concept of Environmental Sustainability. *Annual Review of Ecology and Systematics*, 26: 1-24.

Gore, A. (2010). Sustainable Capitalism. 2nd AP Fund and School of Business, Economics and Law, University of Gothenburg, Gothenburg. 25 October 2010.

Goulding, C. (1998). Grounded theory: the missing methodology on the interpretivist agenda. *Qualitative Market Research: An International Journal*, 1(1): 50-57.

Government Offices of Sweden (2009a). State of the Environment. http://www.sweden.gov.se/sb/d/5400/a/43486 (24 May 2011)

Government Offices of Sweden (2009b). Mål och åtgärder. http://www.sweden.gov.se/sb/d/11759/a/123033 (15 May 2011)

Gow, D. (1992). Poverty and natural resources: principles for environmental management and sustainable development. *Environmental Impact Assessment Review*, 12(1-2): 49-65.

Granovetter, M. (1985). Economic Action and Social Structure: The Problem of Embeddedness. *American Journal of Sociology*, 91(3): 481-510.

Grant, R. (2008). *Contemporary Strategy Analysis*. Malden, U.S.: Blackwell Publishing.

Granzin, K., Olson, J. (1991). Characterizing participants in actitivities protecting the environment: a focus on donating, recycling, and conservation behaviors. *Journal of Public Policy and Marketing*, 10(2): 1-27.

Gray, B. (1989). *Collaborating: Finding Common Ground for Multiparty Solutions.* San Francisco, CA: Jossey-Bass.

Grenness, T. (2003). Scandinavian Managers on Scandinavian Management. *International Journal of Value-Based Management*, 16(1): 9-21.

Grönkvist, S., Sandberg, P. (2006). Driving forces and obstacles with regard to co-operation between municipal energy companies and process industries in Sweden. *Energy Policy*, 34(13): 1508-1519.

Groves, K. S. (2006). Leader emotional expressivity, visionary leadership, and organizational change. *Leadership & Organization Development Journal*, 27(7): 566-583.

Grubb, M. (2004). Technology Innovation and Climate Change Policy: An Overview of Issues and Options. *Keio Economic Studies*, 41(2): 103-132.

Grubb, M., Neuhoff, K. (2006). Allocation and competitiveness in the EU emissions trading scheme: policy overview, *Climate Policy*, 6(1): 7–30.

Hägerhäll, B. (Ed.) (1988). *Vår gemensamma framtid.* Rapport från världskommissionen för miljö och utveckling under ordförandeskap av statsminister Gro Harlem Brundtland. Stockholm: Bokförlaget Prisma och Tidens Förlag.

Hall, R. (1992). The strategic analysis of intangible resources. *Strategic Management Journal*, 13(2): 135-144.

Hall, R. (1993). A framework linking intangible resources and capabilities to sustainable competitive advantage. *Strategic Management Journal*, 14(8): 607-618.

Hall, J. Vredenburg, H. (2003). The Challenges of Innovating for Sustainable Development. *MIT Sloan Review*, 45(1): 61- 68.

Hall, S., Roome, N. (1996). Strategic Choices and Sustainable Strategies. In: Groenewegen, P., Fischer, K., Jenkins, E., Schot, J. (Eds.): *The Greening of Industry Resource Guide and Bibliography*. Washington, D.C.: Island Press.

Hambrick, D. (1980). Operationaliz ing the Concept of Business-Level Strategy in Research. *Academy of Management Review*, 5(4): 567-575.

Hamel, G., Prahalad, C. (1989). Strategic intent. *Harvard Business Review*, 67(3): 63-76.

Hamel, G., Prahalad, C. (1994). *Competing for the future*. Boston, MA: Harvard Business School Press.

Hannan, M., Freeman, J. (1984). Structural Inertia and Organizational Change. *American Sociological Review*, 49(2): 149-164.

Harris, R. A. (1985). Business responses to surface mining regulation. In: Preston, L.E. (Ed.): *Research in corporate social performance and policy* (Vol. 7), pp. 73-101, Greenwich, CT: JAI Press.

Hart, S. (1995). A natural-resource-based view of the firm. *Academy of Management Review,* 20(4): 986-1014.

Hart, S. (1997). Beyond Greening: a strategy for a sustainable world. *Harvard Business Review*, 75(1): 66-76.

Hart, S., (2005). Innovation, creative destruction and sustainability. *Research Technology Management*, 48(5): 21-27.

Hart, S., Ahjua, G. (1996). Does it pay to be green? An empirical examination of the relationship between emission reduction and firm performance. *Business Strategy and the Environment*, 5(1): 30-37.

Hart, S., Dowell, G. (2011). A Natural-Resource-Based View of the Firm: Fifteen Years After. *Journal of Management*, 37(5): 1464-79.

Hart, S., Milstein, M. (2003). Creating sustainable value, *Academy of Management Executive*, 17(2): 56-69.

Hartman, C., Hofman, P., Stafford, E. (1999). Partnerships: A path to Sustainability. *Business Strategy and the Environment*, 8(5): 255-266.

Hastings, M. (1999). A new operational paradigm for oil operations in sensitive environments: An analysis of social pressure, corporate capabilities, and competitive advantage. *Business Strategy and the Environment*, 8(5): 267-280.

Hawken, P. (1993). *The Ecology of Commerce: A declaration of sustainability.* New York: Harper business.

Hedberg, B. (1981). How organizations learn and unlearn. In: Nystrom, P., Starbuck, W. (Eds.): *Handbook of organizational design*. London: Oxford University Press.

Hedström, P., Ylikoski, P. (2010). Causal mechanisms in the social sciences. *Annual Review of Sociology*, 36: 49-67.

Helby, P., Börjesson, P., Hansen, A.C., Roos, A., Rosenqvist, H., Takeuchi, L. (2004). Market development problems for sustainable bio-energy systems in Sweden. (The BIOMARK project) http://www.miljo.lth.se/helby/biomark.pdf (4 May 2011)

Henn, C., Fava, J. (1994). Life-cycle analysis and resource management. In R.V. Kolluru (Ed.): *Environmental Strategies Handbook*, pp. 923-970, New York: McGraw-Hill.

Henneberg, S. C., Pardo, C., Mouzas, S., & Naudé, P. (2005). Value dimensions and strategies in dyadic "key relationship programmes", Dealing with dualities. Proceedings on the 21st IMP Conference, Rotterdam.

Henning, D., Mårdsjö, O. (2009). Fjärrvärme i Europa - Hinder att övervinna för svensk export. Rapport 2009:3. Svensk Fjärrvärme. http://www.svenskfjarrvarme.se/Global/Fjarrsyn/Fj%C3%A4rrsyn%2C%20rapporter/Fj%C3%A4rrsyn%20Omv%C3%A4rld/2009/Fj%C3%A4rrv%C3%A4rme%20i%20Europa.pdf (3 May 2011)

Henriques, I., Sadorsky, P. (1996). The Determinants of an Environmentally Responsive Firm: An Empirical Approach. *Journal of Environmental Economics and Management*, 30(3): 381-395.

Henriques, I., Sadorsky, P. (1999). The Relationship between Environmental Commitment and Managerial Perceptions of Stakeholder Importance. *The Academy of Management Journal*, 42(1): 87-99.

Hess, M. (2004). 'Spatial' relationships? Towards a reconceptualization of embeddedness. Progress in Human Geography, 28(2): 165-186.

Hillary, R. (2000). *Small and Medium-sized Enterprises and the Environment: Business Imperatives*. Sheffield: Greenleaf.

Hillring, B. (2002). Rural development and bioenergy—experiences from 20 years of development in Sweden. *Biomass and Bioenergy*, 23(6): 443–451.

Hitt, M. Hoskisson, R. Kim, H. (1997). International Diversification: Effects on Innovation and Firm Performance in Product-Diversified Firms. *The Academy of Management Journal*, 40(4): 767-798.

Hoffert, M., Caldeira, K., Jain, A.K., Haites, E.F., Danny Harveyk, L.D., Potter, S.D., et al. (1998). Energy implications of future stabilization of atmospheric CO_2 content, *Nature*, 395(6705): 881-884.

Hoffman, A.J. (2002). Examining the Rhetoric: The Strategic Implications of Climate Change Policy. *Corporate Environmental Strategy*, 9(4): 329-337.

Hoffmann, V. (2007). EU ETS and investment decisions: the case of the German electricity industry. *European Management Journal*, 25(6): 464-474.

Hoffmann, V., Trautmann, T. (2008). Three types of impact from the European Emission Trading Scheme: direct cost, indirect cost and uncertainty. In Hansjürgens, B., Antes, R. (Eds.): *Economics and Management of Climate Change - Risks, Mitigation and Adaptation,* pp. 111-124, New York: Springer.

Hofman, P. (2005). Becoming a first mover in green electricity supply – Corporate Change driven by Liberalisation and Climate Change. In: Begg, K., Van der Woerd, F. Levy, D. (Eds): *The Business of Climate Change – Corporate Responses to Kyoto,* pp. 31-46, Sheffield: Greenleaf.

Holmgren, K., Gebremedhin, A. (2004). Modelling a district heating system: Introduction of waste incineration, policy instruments and co-operation with an industry. *Energy Policy*, 32(16): 1807-1817.

Howell, J. M., Higgins, C. A. (1990). Champions of technological innovation. *Administrative Science Quarterly*, 35(2): 317–341.

Huberty, M., Gao, H., Mandell, J., Zysman, J. (2011). Shaping the Green Growth Economy. The Pathways Project, UC Berkeley.

http://greengrowthleaders.org/wp-content/uploads/2011/04/Ex.-Summary-Shaping_the_Green_Growth_Economy_report.pdf (3 May 2011)

Huff, A.S., (2009). *Designing Research for Publication*. Thousand Oaks, CA: Sage Publications, Inc.

Hunt, C. B., Auster, E. R. (1990). Proactive environmental management: Avoiding the toxic trap. *Sloan Management Review*, 31(2): 7-18.

IEA (International Energy Agency) (2007). IEA Energy Technology Essentials – Biomass for Power Generation and CHP.
http://www.iea.org/techno/essentials3.pdf (4 May 2011)

IEA (2008). Sweden Country Report 2008.
http://www.ieabioenergytask31.org/iea_bioenergy_task_31/IEA%20Task%2031%20country%20report%20Sweden%202008.pdf (18 May 2011)

IEA (2009). World Energy Outlook 2009.
http://www.iea.org/textbase/nppdf/free/2009/WEO2009.pdf (13 May 2011)

IEA (2010). CO2 Emissions from fuel combustion – Highlights: http://www.iea.org/co2highlights/ (8 November 2010)

Innovest, WWF (2006). UK Power Giants – Generating Climate Change.
http://www.wwf.org.uk/filelibrary/pdf/uk_power_giants_wwf01.pdf (18 May 2011)

Innovest, WWF (2007a). UK Power Giants – Talking Climate Change.
http://www.wwf.org.uk/filelibrary/pdf/gcciireport-lr.pdf (18 May 2011)

Innovest, WWF (2007b). UK Power Giants – Generating Climate Change.
http://www.wwf.org.uk/filelibrary/pdf/uk_power_giants_innovest.pdf (18 May 2011)

IPCC (Intergovernmental Panel on Climate Change) (2001). Climate Change 2001. The Scientific Basis.
http://www.csun.edu/~hmc60533/CSUN_630E_S2004/climate%20change/climate_change_2001_tech_summary.pdf (23 March 2010)

IPCC (2007a). Summary for Policymakers. In: Climate Change 2007: The Physical Science Basis. Contribution of Working Group I to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change [Solomon, S., D. Qin, M. Manning, Z. Chen, M. Marquis, K.B. Averyt, M.Tignor and H.L. Miller (eds.)]. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA.

IPCC (2007b). Summary for Policymakers. In: Climate Change 2007: Mitigation. Contribution of Working Group III to the Fourth Assessment. Report of the Intergovernmental Panel on Climate Change [B. Metz, O.R. Davidson, P.R. Bosch, R. Dave, L.A. Meyer (eds)], Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA.

IPCC (2007c): Summary for Policymakers. In: Climate Change 2007: Impacts, Adaptation and Vulnerability. Contribution of Working Group II to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change, M.L. Parry, O.F. Canziani, J.P. Palutikof, P.J. van der Linden and C.E. Hanson, Eds., Cambridge University Press, Cambridge, UK, 7-22.

Isaacs, W. (1993). Dialogue: the power of collective thinking. The systems thinker.
http://www.synergos.org/bridgingleadership/04/e_4_c_dialogue_chapter_16_synchronicity_by_joseph_jaworski.pdf (6 October 2009)

ISO (1998). Meet the Whole Family. Geneva: ISO Central Secretariat.
http://elsmar.com/pdf_files/iso14000.pdf (2 september 2009)

ISO (2009). Understand the basics.
http://www.iso.org/iso/iso_catalogue/management_standards/understand_the_basics.htm (2 September 2009)

Itami, H. (1987). *Mobilizing Invisible Assets*. Cambridge, MA: Harvard University Press.

Jabareen, Y. (2004). A knowledge map for describing variegated and conflict domains of sustainable development. *Journal of Environmental Planning and Management*, 47(4): 623-642.

Jabareen, Y. (2008). A new conceptual framework for sustainable development. *Environment, Development and Sustainability*, 10(2): 179-192.

Jabbour, C.J., Santos, F.C. (2006). The evolution of environmental management within organizations: Toward a common taxonomy. *Environmental Quality Management*, 16(2): 43-59.

Jacobsson, S., Bergek, A. (2004). Transforming the energy sector: the evolution of technological systems in renewable energy technology. *Industrial and Corporate Change*, 13(5): 815-849.

Jacobsson, S., Johnson, A. (2000). The diffusion of renewable energy technology: an analytical framework and key issues for research. *Energy Policy,* 28(9): 625-640.

Jacobsson, S., Sandén, B., Bångens, L. (2004). Transforming the Energy System-the Evolution of the German Technological System for Solar Cells. *Technology Analysis & Strategic Management*, 16(1): 3-30.

James, K., Smith, A., Doppelt, B. (2007). Changing organizational ethics and practices toward climate and environment. In: Moser, S., Dilling, L. (Eds.): *Creating a climate for change. Communicating Climate Change and Facilitating Social Change,* pp. 303-318, Cambridge, U.K.: Cambridge University Press.

Jänicke, M. (2005). Trend Setters in Environmental Policy: the Character and Role of Pioneer Countries. *European Environment*, 15(2): 129-142.

Jennings, P., Zandbergen, P. (1995). Ecologically sustainable organizations: An institutional approach. *Academy of Management Review*, 20(4): 1015-1052.

Johansson, A., Kisch, P., Mirata, M. (2005). Distributed economies – A new engine for innovation. *Journal of Cleaner Production,* 13(10-11): 971-979.

Johnson, A. and Jacobsson, S. (2000). "Inducement and Blocking Mechanisms in the Development of a New Industry". In: Coombs, R., Green, K., Walsh, V.. Richards, A. (Eds): *Technology and the Market: Demand, Users and Innovation,* Cheltenham and Northhampton, MA: Edward Elgar.

Johnson, G., Melin, L., and R. Whittington (2003). Guest Editors' Introduction. Micro Strategy and Strategizing: Towards an Activity-Based View. *Journal of Management Studies,* 40(1): 3-22.

Johnsson, F. (2007). http://www.energy-pathways.org/ (23 January 2008)

Johnsson, F. (Ed.) (2011). *European Energy Pathways – Pathways to Sustainable European Energy Systems*, Mölndal: PR-Offset.

Jokinen, P., Malaska, P., & Kaivo-oja, J. (1998). The Environment in an 'Information Society': A transition stage towards more sustainable development? *Futures*, 30(6): 485-498.

Jowit, J., Wintour, P. (2008). Cost of tackling global climate change has doubled, warns Stern. *The Guardian*, 26 June. http://www.guardian.co.uk/environment/2008/jun/26/climatechange.scienceofclimatechange

Judge, W., Douglas, T. (1998). Performance Implications of incorporating Natural Environmental Issues into the Strategic Planning Process: an Empirical Assessment. *Journal of Management Studies*, 35(2): 241-262.

Junginger, M., de Visser, E., Hjort-Gregersen, K., Koornneef, J., Raven, R., Faaij, A., Turkenburg, W. (2006). Technological learning in bioenergy systems. *Energy Policy*, 43(18): 4024-4041.

Kåberger, T. (2002). Swedish nuclear power and economic rationalities. *Energy and Environment*, 13(2): 191-206.

Kåberger, T. (2004). Environmental impacts from bioenergy – a view from Sweden. Proceedings of the Scottish Natural Heritage. http://www.bioenergynoe.org/Resources/user/Kaberger%20Environmental%20Impacts%20from%20Bioenergy%20-%20a%20view%20from%20Sweden.pdf (3 May 2011)

Kallio, T., Nordberg, P., Ahonen, A. (2007). 'Rationalizing Sustainable Development' – a Critical Treatise. *Sustainable Development*, 15(1): 41- 51.

Kellner, D. (1995). *Media culture: Cultural studies, identity and politics between the modern and postmodern.* New York: Routledge.

Kemp, R. (1994). Technology and the transition to environmental sustainability: The problem of technological regime shifts. *Futures*, 26(11): 1023-1046.

Kincheloe, L. (2001). Describing the Bricolage: Conceputalizing a New Rigor in Qualitative Research. *Qualitative Inquiry*, 7(6): 679-692.

King, A., Lennox, M. (2001). Does It Really Pay to Be Green? An Empirical Study of Firm Environmental and Financial Performance. *Journal of Industrial Ecology*, 5(1): 105–116.

Kirkland, L., Thompson, D. (1999). Challenges in designing, implementing and operating an environmental management system. *Business Strategy and the Environment*, 8(2): 128-143.

Klassen, R., McLaughlin, C. (1996). The Impact of Environmental Management on Firm Performance. *Management Science*, 42(8): 1199-1214.

Klassen, R., Whybark, D. (1999). The impact of environmental technologies on manufacturing performance. *Academy of Management Journal*, 42(6): 599-615.

Kleef, J.A., Roome, N.A. (2007). Developing capabilities and competence for sustainable business management as innovation: a research agenda. *Journal of Cleaner Production*, 15(1): 38-51.

Klimatkommunerna (2007). http://www.klimatkommunerna.infomacms.com (July to September 2007)

Kogut, B., Kulatilaka, N. (1994). Operating Flexibility, Global Manufacturing, and the Option Value of a Multinational Network. *Management Science*, 40(1): 123-139.

Kolk, A., Levy, D., Pinkse, J. (2008). Corporate Responses in an Emerging Climate Regime: The Institutionalization and Commensuration of Carbon Disclosure. *European Accounting Review,* 17(4): 719-745.

Kolk, A., Pinkse, J. (2004). Market Strategies for Climate Change. *European Management Journal*, 22(3): 304-314.

Kolk, A., Pinkse, J. (2005). Business Responses to Climate Change: Identifying Emergent Strategies. *California Management Review*, 47(3): 6-20.

Kolk, A., Pinkse, J. (2007). Multinationals' Political Activities on Climate Change. *Business & Society*, 46(2): 201-228.

Kolk, A., Pinkse, J. (2008). A perspective on multinational enterprises and climate change: Learning from ''an inconvenient truth''? *Journal of International Business Studies*, 39(8): 1359-1378.

Korhonen, J., Wihersaari, M., Savolainen, I. (1999). Industrial Ecology of a Regional Energy Supply System – The Case of the Jyväskylä Region, Finland. *Greener Management International*, 26 (Summer 1999): 57-67.

Kraaijenbrink, J., Spender, J., Groen, A. (2010). The Resource-Based View: A Review and Assessment of Its Critiques. *Journal of Management*, 36(1): 349- 372.

Kuhn, T. (1970). *The structure of scientific revolution* (2nd edition). Chicago: University of Chicago Press.

Lafferty, W., Langhelle, O. (1999). *Towards sustainable development: on the goals of development and the conditions of sustainability*. New York, N.Y.: St. Martin's Press.

Lash, J., Wellington, F. (2007). Competitive Advantage on a Warming Planet. *Harvard Business Review*, 85(3): 94-102.

Laughlin, R. (1995). Empirical research in accounting: alternative approaches and a case for "middle-range" thinking. *Accounting, Auditing & Accountability Journal*, 8(1): 63–87.

Laurikka, H., and T. Koljonen (2006). Emissions trading and investment decisions in the power sector – a case study in Finland. *Energy Policy*, 34(9): 1063-1074.

Laverty, K. (1996). Economic "Short-Termism": The Debate, the Unresolved Issues, and the Implications for Management Practice and Research. *Academy of Management Review*, 21(3): 825-860.

Lee, M. (2008). A review of the theories of corporate social responsibility: Its evolutionary path and the road ahead. *International Journal of Management Reviews,* 10(1): 53-73.

Leech, B. (2002). Asking Questions: Techniques for Semistructured Interviews. http://www.apsanet.org (13 November 2008)

Leiblein, M. (2011). What Do Resource- and Capability-Based Theories Propose*? Journal of Management*, 37(4): 909-932.

Leiserowitz, A. (2007). International Public Opinion, Perception, and Understanding of Global Climate Change. Human Development Report 2007/2008. http://hdr.undp.org/en/reports/global/hdr2007-2008/papers/leiserowitz_anthony.pdf (13 May 2011)

Lindkvist, L. (1988). *A Passionate Search for Nordisk Management*, Copenhagen: Institut for Organisation og Arbejdssociologi, August.

Little D. (1998). *Microfoundations, Method, and Causation. On the Philosophy of the Social Science*. New Brunswick, NJ: Transaction.

Litz, R. (1996). A Resource-based-view of the Socially Responsible Firm: Stakeholder Interdependence, Ethical Awareness, and Issue Responsiveness as Strategic Assets. *Journal of Business Ethics*, 15(12): 1355-1363.

Lockett, A., Thompson, S., Morgenstern, U. (2009). The development of the resource-based view of the firm: A critical appraisal. *International Journal of Management Reviews*, 11(1): 9-28.

Löfblad, E., Haralddsson, M. (2011). Public attitudes towards climate change mitigation options. In: Johnsson, F. (Ed.) *European Energy Pathways – Pathways to Sustainable European Energy Systems,* pp. 191-200, Mölndal: PR-Offset.

Lombardo, R., D'Orio, G. (2012). Corporate and State Social Responsibility: A Long-term Perspective. *Modern Economy*, 3(1): 91-99.

Lorenzoni, G., Lipparini, A. (1999). The Leveraging of Interfirm Relationships as a Distinctive Organizational Capability: A Longitudinal Study. *Strategic Management Journal*, 20(4): 317-338.

Lorenzoni, I., Nicholson-Cole, S., Whitmarsh, L. (2007). Barriers perceived to engaging with climate change among the UK public and their policy implications. *Global Environmental Change,* 17(3-4): 445-459.

Luke, T. (2005). Neither Sustainable nor Development: Reconsidering Sustainability in Development. *Sustainable Development,* 13(4): 228-238.

Lund, H. (2007). Renewable Energy Strategies for Sustainable Development. *Energy*, 32(6): 912-919.

Luoranen, M. (2009). *Methods for assessing the sustainability of integrated municipal waste management and energy supply systems*. Dissertation. Lappeenranta University of Technology, Lappeenranta, Finland. https://doria17-kk.lib.helsinki.fi/bitstream/handle/10024/46781/isbn9789522147806.pdf ?sequence=1 (10 August 2012)

Lygnerud, K. (2006). *Value Creating Innovations in the Pipeline – a case study of residential house district heating investments in Sweden*. Licentiate Thesis. Göteborgs universitet. Handelshögskolan. Göteborg: BAS.

Lygnerud, K. (2008). Riskinventering i fjärrvärmeföretag. Rapport 2008:6. Stockholm: Svensk Fjärrvärme.

Lygnerud, K. (2010). *Risk Management in Swedish District Heating Companies*. Dissertation. University of Gothenburg. School of Business, Economics and Law. Gothenburg: BAS Publishing.

MacDonald, D., Hanley, N., Moffatt, I. (1999). Applying the concept of natural capital criticality to regional resource management. *Ecological Economics*, 29(1): 73–87.

Machamer, P., Darden, L., Craver, C.F. (2000). Thinking About Mechanisms. *Philosophy of Science*, 67(1):1-25.

Magnusson, P., Vallstrand, M. (2007). Strategier i lokala energiföretag. Examensarbete, KTH Stockholm.

Mahoney, J. (2001). Beyond Correlational Analysis: Recent Innovations in Theory and Method. *Sociological Forum*, 16(3): 575-593.

Majumdar, S.K., Marcus, A.A. (2001). Rules versus Discretion: The Productivity Consequences of Flexible Regulations. *Academy of Management Journal*, 44(1): 170-179.

Makadok, R. (2001a). Toward a Synthesis of the Resource-Based and Dynamic-Capability Views of Rent Creation. *Strategic Management Journal*, 22(5): 387-401.

Makadok, R. (2001b). Dialogue: A pointed commentary on Priem and Butler. *Academy of Management Review*, 26(4): 498-499.

Mansouri, Z. (2009). Innovationer genom öppna forum. Handelshögskolan vid Göteborgs Universitet.

Marcus, A. A. (2005). Research in strategic environmental management. In: Sharma, S., Aragón-Correa J. A. (Eds.): *Corporate environmental strategy and competitive advantage*, pp. 27-48, Northampton, MA: Edward Elgar.

Marcus, A.A., Geffen, D. (1998). The dialectics of competency acquisition: pollution prevention in electric generation. *Strategic Management Journal*, 19(12): 1145-1168.

Marcus, A.A., Nichols, M.L. (1999). On the Edge: Heeding the Warnings of Unusual Events. *Organization Science*, 10(4): 482-499.

Margolis, R., Kammen, D. (1999). Underinvestment: The Energy Technology and R&D Policy Challenge. *Science*, 285(5428): 690-692.

Markard, J., Truffer, B. (2006). Innovation processes in large technical systems: Market liberalization as a driver for radical change? *Research Policy*, 35(5): 609-625.

Marshall J., Toffel, M. (2005). Framing the Elusive Concept of Sustainability: A Sustainability Hierarchy. *Environmental Science & Technology*, 39(3): 673-682.

Matthews, D. (2003). Environmental management systems for internal corporate benchmarking. Benchmarking: *An International Journal,* 10(2): 95-106.

Maurer, C., Bansal, P., Crossan, M. (2011). Creating Economic Value Through Social Values: Introducting a Culturally Informed Resource -Based View. *Organization Science*, 22(2): 432-448.

McCabe, D. (2002). "Waiting for dead men's shoes": Towards a cultural understanding of management innovation. *Human Relations*, 55(5): 505–536.

McCormick, K., Kåberger, T. (2005). Exploring a pioneering bioenergy system: The case of Enköping in Sweden *Journal of Cleaner Production,* 33(10-11): 1003-1014.

McEvily, W., & Marcus, A. A. (2005). Embeddedness and the acquisition of competitive capabilities. *Strategic Management Journal*, 26(11): 1033-1055.

McGee, J. (1998). Commentary on "Corporate strategies and environmental regulations: An organizing framework," by A. M. Rugman and A. Verbeke. *Strategic Management Journal*, 19(4): 377-387.

McGill, M., Slocum, J. (1993). Unlearning the organization. *Organizational Dynamics*, 22(2): 67-79.

McWilliams, A., Siegel, D. (2001). Corporate Social Responsibility: A Theory of the Firm Perspective. *The Academy of Management Review*, 26(1): 117-127.

Meadow, D., Meadow, D., Randers, J. (1972). *The Limits to Growth*. New York: Universe Books.

Meadow, D., Meadow, D., Randers, J. (1992). *Beyond the Limits: Confronting Global Collapse, Envisioning a Sustainable Future*. White River Junction, VT: Chelsea Green Publishing Co.

Menguc, B., Auh, S., Ozanne, L. (2010). The Interactive Effect of Internal and External Factors on a Proactive Environmental Strategy and its Influence on Firm's Performance. *Journal of Business Ethics*, 94(2): 279-298.

Menguc, B., Ozanne, L. (2005). Challenges of the "green imperative": A natural resource-based approach to the environmental orientation-business performance relationship. *Journal of Business Research*, 58(4): 430-438.

Merriam, S. (1994). *Fallstudien som forskningsmetod*. Lund: Studentlitteratur.

Merton, R.K. (1968). *Social Theory and Social Structure*. New York, NY: Free Press.

Michalisin, M., Stinchfield, B. (2010). Climate change strategies and firm performance: an empirical investigation of the natural resource-based view of the firm. *Journal of Business Strategies*, 27(2): 123-148.

Miller, D., Shamsie, J. (1996). The Resource- based view of the firm in two environments: The Hollywood Film Studios from 1936 to 1965. *The Academy of Management Journal*, 39(3): 519-543.

Milstein, M., Hart, S., York, A. (2002). Coercion Breeds Variation: The differential impact of isomorphic pressures on environmental strategies. In: Hoffman, A.J., Ventrasca, M.J. (Eds.): *Organizations, Policy and the Natural Environment: Institutional and Strategic Perspectives*, pp. 151-172, Stanford: Stanford University Press.

Ministry of the Environment (2007). Sweden and the Challenge of Climate Change. www.sweden.gov.se/content/1/c6/07/46/40/9c793229.pdf (18 January 2010)

Mintzberg, H. (1987). The Strategy Concept I: Five Ps for Strategy, *California Management Review,* Fall 1987: 11-24.

Mintzberg, H., Waters, J. (1985). Of Strategies, Deliberate and Emergent. *Strategic Management Journal*, 6(3): 257-272.

Mitchell, C. (2006). Case and Situation Analysis. In: Evens, T.M.S., Handelman, D. (Eds.): *The Manchester School: Practice and. Ethnographic Praxis in Anthropology,* pp. 23-44, Oxford/New York: Berghahn.

Mizik, N., Jacobson, R. (2003). Trading Off Between Value Creation and Value Appropriation: The Financial Implications of Shifts in Strategic Emphasis. *Journal of Marketing*, 67(1): 63–76.

Morrow, D., Rondinelli, D., (2002). Adopting Corporate Environmental Management Systems: Motivations and Results of ISO 14001 and EMAS Certification. *European Management Journal*, 20(2): 159-171.

Moser, S.C., Dilling, L. (2007). Introduction. In: Moser, S., Dilling, L. (Eds.): *Creating a climate for change. Communicating Climate Change and Facilitating Social Change*, pp. 1-27, Cambridge, U.K.: Cambridge University Press.

MSD (Ministry of Sustainable Development) (2006). National climate policy in global cooperation - Government Bill 2005/06:172. http://www.swedenabroad.com/SelectImage/51404/climatepolicysweden.pdf (17 May 2011)

Munda, G., Nijkamp, P., Rietveld, P. (1994). Qualitative multicriteria evaluation for environmental management, *Ecological Economics*, 10(2): 97-112.

Munksgaard, J., Pade, L., Fristrup, P. (2005). Efficiency gains in Danish district heating.Is there anything to learn from benchmarking? *Energy Policy*, 33(15): 86-97.

Murdoch, J., Marsden, T., Banks, J. (2000). Quality, Nature and Embeddedness: Some theoretical considerations in the context of the food sector. *Economic Geography*, 76(2): 107-125.

Murningham, J. (1994). Game theory and organizational behavior. In: Staw, B.M., Cummings L.L. (Eds.): *Research in organizational behavior*, Vol. 16:83-124. Greenwich, CT: JAI Press.

Najam, A., Cleveland, C. (2008). Energy and sustainable development at global environmental summits. The Encyclopedia of Earth. http://www.eoearth.org/article/Energy_and_sustainable_development_at_global_environmental_summits (10 May 2011)

Naturenews (2011). Political doubt hinders carbon sequestration projects. http://www.nature.com/news/2011/110505/full/news.2011.271.html (11 May 2011)

Nehrt, C. (1996). Timing and Intensity effects of Environmental Investments. *Strategic Management Journal*, 17(7): 535-547.

Nelson, R., Winter, S. (1982). *An Evolutionary Theory of Economic Change*. Cambridge, MA: The Belknap Press of Harvard University Press.

NEP (Nordic Energy Perspectives) (2006). *Lägre CO2-utsläpp och mer förnybart- är vi på väg dit eller inte?* Mölndal: PR-Offset.

Newman L. (2007). The Virtuous Cycle: Incremental Changes and a Process-Based Sustainable Development. *Sustainable Development*, 15(4): 267-274.

Nilsson, M. (2005). Learning, frames, and environmental policy integration: the case of Swedish energy policy. *Environment and Planning C: Government and Policy*, 23(2): 207-226.

Nilsson, M., Persson, A. (2009). Sweden. In: Jordan, A., Lenschow, A. (Eds.). *Innovation in Environmental Policy? Integrating the Environment for Sustainability,* Bodmin, Cornwall: MPG Books Ltd.

NOAA (National Oceanografic & Atmospheric Administration) (2011). Mauna Loa Co2 annual mean data. ftp://ftp.cmdl.noaa.gov/ccg/co2/trends/co2_annmean_mlo.txt (14 march 2011)

Nonaka, I. (1994). A dynamic theory of organizational knowledge creation. *Organization Science*, 5(1): 14-37.

Noteboom, S. (2006). *Adaptive Networks: The Governance for Sustainable Development*. Doctoral Dissertation. Erasmus University, Rotterdam. http://publishing.eur.nl/ir/repub/asset/8140/Adaptive+Networks+16+x+24+PROEFSCHRIFT3.pdf

Nowotny, H., Scott, P., Gibbons, M. (2001). *Re-Thinking Science. Knowledge and the Public in an Age of Uncertainty*. Cambridge: Polity Press.

OECD, IEA (International Energy Agency) (2009). World Energy Outlook. http://www.iea.org/textbase/nppdf/free/2009/weo2009.pdf (11 May 2011)

OECD, IEA (2008). Energy Policies of IEA Countries – Sweden 2008 Review. http://www.iea.org/textbase/nppdf/free/2008/Sweden2008.pdf (28 April 2011)

OECD, IEA (2010). CO2 Emissions from Fossil Fuel Combustion. Highlights. http://www.iea.org/co2highlights/co2highlights.pdf (7 March 2011)

Okereke, Ch. (2007). An Exploration of Motivations, Drivers and Barriers to Carbon Management: The UK FTSE 100. *European Management Journal*, 25(6): 475-486.

Oliver, C. (1990). Determinants of interorganizational relationships: Integration and future directions. *Academy of Management Review*, 15(2): 241-265.

Omer, A.M. (2008). Energy, environment and sustainable development. *Renewable and Sustainable Energy Reviews*, 12(9): 2265–2300.

Orr, D. (1995). A World That Takes its Environment Seriously. In: Knight, R., Bates, S. (Eds.): *A New Century for Natural Resources Managemen*t. Washington D.C.: Island Press.

Pacala, S., Socolow, R. (2004). Stabilization Wedges: Solving the Climate Problems for the Next 50 Years with Current Technology. *Science*, 305(5686): 968-972.

Palmer, J., Cooper, I., van der Vorst, R. (1997). Mapping out fuzzy buzzwords – who sits were on sustainability and sustainable development. *Sustainable Development*, 5(2): 87-93.

Pascale, C. (2011). *Cartographies of Knowledge – Exploring Qualitative Epistemologies*. Thousand Oaks, CA: SAGE.

Pathways (2008). Investering för hållbar utveckling. Newsletter from 'Pathways to Sustainable European Energy Systems No. 2/2008. http://www.energy-pathways.org/pdf/newsletter%202008_2.pdf (27 May 2011)

Penrose, E. (1959). *The Theory of the Growth of the Firm*. Oxford University Press: New York.

Perkins, R. (2003). 'Technological 'lock-in''; http://www.ecoeco.org/pdf/techlkin.pdf (10 November 2010)

Peteraf, M.A. (1993). The cornerstones of competitive advantage: A resource-based view. *Strategic Management Journal*, 14(3): 179-191.

Peteraf, M., Barney, J. (2003). Unraveling the resource-based tangle. *Managerial and Decision Economics*, 24(4): 309-323.

Pettigrew, A. (1988). Longitudinal field research on change: Theory and practice. Paper presented at the National Science Foundation Conference on Longitudinal Research Methods in Organizations, Austin.

Pew Reseach Center (2009). Global Warming Seen as a Major Problem Around the World Less Concern in the U.S., China and Russia. http://pewresearch.org/pubs/1427/global-warming-major-problem-around-world-americans-less-concerned   (6 March 2010)

Pinkse, J., Kolk, A. (2009). *International Business and Global Climate Change*. London: Routledge.

Polanyi, K. (1944). *The Great Transformation*. New York: Holt, Rinehart.

Porter, M.E. (1980). *Competitive Strategy*. New York: The Free Press.

Porter, M.E. (1985). *Competitive Advantage*. Free Press, New York.

Porter, M.E. (1996). *What is Strategy? Harvard Business Review*, 74(6): 61-78.

Porter, M.E., Kramer, M. (2006). Strategy & Society - The Link Between Competitive Advantage and Corporate Social Responsibility. *Harvard Business Review,* 84(12): 78-92.

Porter, M.E., Kramer, M. (2011). Creating Shared Value. *Harvard Business Review*, 89(1/2): 62-77.

Porter, M., Reinhardt, F. (2007). A Strategic Approach to Climate. *Harvard Business Review,* 85(10): 22-26.

Porter, M.E., van der Linde, C. (1995) Toward a New Conception of the Environment-Competitiveness Relationship. *Journal of Economic Perspectives*, 9(4): 97-118.

Post, J. (1991). Managing as if the Earth Mattered. *Business Horizons,* 34(4):32-38.

Prahalad, C.K., Bettis, R.A. (1986). The Dominant Logic: A New Linkage between Diversity and Performance. *Strategic Management Journal*, 7(6): 485-501.

Prahalad, C.K., Hamel, G. (1990). The core competences of the corporation. *Harvard Business Review*, 68(3): 79-91.

Priem R., Butler J. (2001). Is the resource-based 'view' a useful perspective for strategic management research? *Academy of Management Review*, 26(1): 22-40.

Productification (2009). What is productification? http://www.productification.com/2009/01/01/what-is-productification/ (1 January 2009

PWC (PriceWaterhouseCoopers) (2006). The big leap. – Utilities global survey. http://www.pwc.co.uk/eng/publications/utilities_global_survey_2006.html (4 April 2008)

PWC (PriceWaterhouseCoopers) (2009). A world beyond recession – Utilities global survey 2009. http://www.pwc.com/gx/en/energy-utilities-mining/pdf/utilities-global-survey-2009.pdf (18 May 2011)

Radgen, P., Butterfield, J., Rosenow, J. (2011). EPS, ETS, Renewable Obligations and Feed in Tariffs - Critical reflections on the compatibility of different instruments to combat climate change. *Energy Procedia*, 4: 5814-5822.

Regan, K. (2007). A role for dialogue in communication about climate change. In: Moser, S., Dilling, L. (Eds.): *Creating a climate for change. Communicating Climate Change and Facilitating Social Change*. Cambridge, U.K.: Cambridge University Press.

Reidhav, C., Werner, S. (2008). Profitability in sparse district heating. *Applied Energy*, 85(9): 867–877.

Reinhardt, F. (1999). Market Failure and the Environmental Policies of Firms: Economic Rationales for "Beyond Compliance" Behavior. *Journal of Industrial Ecology,* 3(1): 9–21.

Rindova, V., Williamson, I., Petkova, A., Sever, J. (2005). Being Good or Being Known: An Empirical Examination of the Dimensions, Antecedents, and Consequences of Organizational Reputation. *Academy of Management Journal*, 48(6): 1033-1049.

Ring, P., Van de Ven, A., (1994). Developmental Processes of Cooperative Interorganizational Relationships. *Academy of Management Review*, 19(1): 90-118.

Rip, A., Kemp, R. (1998). Technological Change. In: Rayner, S., Malone, E.L. (Eds.): *Human Choice and Climate Change, Volume 2: Resources and Technology*, pp. 327-99, Columbus, OH: Battelle Press.

Rittel, H., Webber, M. (1973). Dilemmas in a General Theory of Planning. *Policy Science*, 4(2): 155-169.

Robèrt, K. (1995). The natural step. *Timeline*, March/April: 1-24.

Robèrt, K. (2000). Tools and concepts for sustainable development, how do they relate to a general framework of sustainable development, and to each other? *Journal of Cleaner Production*, 8(3): 243-254.

Robèrt, K., Daly, H., Hawken, P., Holmberg, J. (1997). A compass for sustainable development. *International Journal of Sustainable Development & World Ecology*, 4(2): 79-92.

Robért, K., Schmidt-Bleek, B., Aloisi de Lardarel, J., Basile, G., Jansel, J., Kuehr, R., Price, T., Suzuki, M., Hawken, P., Wackernagel, M. (2002). Strategic sustainable development: Selection, design and synergies of applied tools. *Journal of Cleaner Production*, 10(3): 197-214.

Roberts, P., Dowling, G. (2002). Corporate reputation and sustained superior financial performance. *Strategic Management Journal*, 23(12): 1077-1093.

Robinson, J. (2004). Squaring the circle? Some thoughts on the idea of sustainable development. *Ecological Economics*, 48(4): 369-384.

Rockström, J., Steffen, W., Noone, K., Persson, Å., Chapin, F., Lambin, E., et al. (2009). A safe operating space for humanity. *Nature*, 461: 472-475.

Rockwell, R. (2004). From a Carbon Economy to a Mixed Economy: A Global Opportunity http://www.gcrio.org/CONSEQUENCES/vol4no1/carbonecon.html (10 November 2010)

Rodriguez, M., Ricart, J., Sanchez, P. (2002). Sustainable Development and the Sustainability of Competitive Advantage: A Dynamic and Sustainable View of the Firm. *Creativity & Innovation Management*, 11(3): 135-146.

Rogge, K., Hoffmann, V. (2010). The impact of the EU ETS on the sectoral innovation system for power generation technologies – Findings for Germany. *Energy Policy*, 38(12): 7639-7652.

Rönnborg, P. (2006). *Finding the right place - The story about an offshore wind power project.* Licentiate Thesis. Göteborgs universitet. Göteborg: Centrum för forskning om offentlig sektor (CEFOS).

Rönnborg, P. (2009). *Det där ordnar marknaden… Investeringspraktik på den avreglerade elmarknaden.* Dissertation. Göteborgs Universitet. Handelshögskolan. Göteborg: BAS.

Roome, N. (1992). Developing environmental management strategies. *Business Strategy and the Environment*, 1(1): 11-24.

Roome, N., Bergin, R. (2000). The challenges of sustainable development: Lessons from Ontario Hydro. *Corporate Environmental Strategy*, 7(1): 8-19.

Rooney, C. (1993). Economics of pollution prevention: How waste reduction pays. *Pollution Prevention Review*, 3: 261-276.

Roos, A., Grahamb, R., Hektora, B., Rakos, Ch. (1999). Critical factors to bioenergy implementation. *Biomass and Bioenergy*, 17(2): 113-126.

Rouse, M., Daellenbach, U. (1999). Rethinking Research Methods for the Resource Based Perspective: Isolating Sources of Sustainable Competitive Advantage. *Strategic Management Journal*, 20(5): 487-494.

Roy, M.J., Boiral, O., Lagacé, D., (2001). Environmental commitment and manufacturing excellence: A company study within Canadian industry. *Business Strategy and the Environment*, 10(5): 257-268.

Roy, M.J., Thérin, F. (2008). Knowledge Acquisition and Environmental Commitment in SMEs. Corporate Social Responsibility and Environmental Management, 15(5): 249-259.

Rugman, A.M., Verbeke, A. (1998). Corporate strategies and environmental regulations: An organizing framework. *Strategic Management Journal*, 19(4): 363-75.

Rumelt, R.P. (1987). Theory, strategy, and entrepreneurship. In: Teece, D. (Ed.): *The Competitive Challenge*, pp. 137-158, Cambridge, MA: Ballinger.

Russell, S., Haigh, N., and A. Griffith (2007) Understanding Corporate Sustainability: Recognizing the Impact of Different Governance Systems. In: Benn S., Dunphy, D. (Eds.): *Corporate Governance and Sustainability,* pp. 36-55, London: Routledge.

Russo, M. (2009). Explaining the Impact of ISO 14001 on Emission Performance: a Dynamic Capabilities Perspective on Process and Learning Business. *Strategy and the Environment*, 18(5): 307–319.

Russo, M., Fouts, P. (1997). A Resource-Based Perspective on Corporate Environmental Performance and Profitability. *The Academy of Management Journal*, 40(3): 534-559.

Sachs, W. (1993). Global ecology and the shadow of development. In: W. Sachs (Ed.), *Global ecology. A new arena of political conflict,* pp. 3-20, London: Zed Books.

Sadler-Smith, E., Badger, B. (1998). Cognitive Style, Learning and Innovation. *Technology Analysis & Strategic Management*, 10(2): 247-265.

Sandberg, J., Tsoukas, H. (2011). Grasping the logic of practice: Theorizing through practical rationality. The Academy of Management Review, 36(2): 338-360.

Sandén, B., Azar, C. (2005). Near-term technology policies for long-term climate targets – economy wide versus technology specific approaches. *Energy Policy*, 33(12): 1557-1576.

Sandoff, A. (2003). Teoretiskt ramverk för analys av aktörernas drivkrafter för investeringar. In: Bo Rydén (Ed.): *Nordleden. Slutrapport för etapp 2*, pp. 237-244, Mölndal: Rondo Grafisk Kommunikation AB.

Sandoff, A. (2006a). The impact of capital budgeting practice in the development of the Nordic energy sector. In: B. Rydén (Ed.): *Ten Perspectives on Nordic Energy*, pp. 191-202, Mölndal: PR-Offset.

Sandoff, A. (2006b). The impact of corporate governance structures in the development of the Nordic energy sector. In: B. Rydén (Ed.): *Ten Perspectives on Nordic Energy*, pp. 365-379, Mölndal: PR-Offset.

Sandoff, A. (2008). Ägar- och företagsstyrning i kommunala energibolag . En kartläggning av ägare, styrelse och företagsledning och deras motiv, medel och metoder. Handelshögskolan vid Göteborgs universitet.

Sandoff, A., Rönnborg, P., Schaad, G., Williamsson, J. (2010). Uppföljningsstudie: Företagsstrategier för utsläppshandel och klimatåtaganden. ER 2010:24. Stockholm: Energimyndigheten.

Sayer, A. (1992). *Method in Social Science. A Realist Approach*. 2nd Edition. London: Routledge.

Schaad, G. (2010). *Corporate strategies to mitigate climate change- two essays on practices in Swedish energy-intensive companies*. Licentiate Thesis. Göteborgs universitet. Handelshögskolan.

Schaad, G. (2011). Strategies for environmental sustainability in the stationary energy sector. In: Swiss Federal Institute of Technology (ETH), Zurich. ETH PhD-Academy on Sustainability and Technology 2011. Monte Verità, Switzerland. 16th- 21 January 2011. Zurich: ETH.

Schaad, G., Sandoff, A. (2011). An overview of the carbon strategies of ten of Europe's largest energy companies. In: Johnsson, F. (Ed.) *European Energy Pathways – Pathways to Sustainable European Energy Systems*, pp. 299-304, Mölndal: PR-Offset.

Schein, E. (1993). On Dialogue, Culture and Organizational Learning. *Organizational Dynamics,* 22(2): 40-51.

Schmidheiny, S. (1992). *Changing course*. Cambridge, MA: MIT Press.

Schumann, D.W., Hathcote, J.M., West, S. (1991). Corporate Advertising in America: A Review of Published Studies on Use, Measurement, and Effectiveness. *Journal of Advertising*, 20(3): 35-56.

Schwartz, B. (2009). Environmental Strategies as Automorphic Patterns of Behaviour. *Business Strategy and the Environment*, 18(3): 192-206.

Scott, R. (2003). *Organizations: rational, natural, and open systems*. Upper Saddle River, N.J.: Prentice Hall.

SDHA (Swedish District Heating Association) (2009). Varför Fjärrvärme; http://www.svenskfjarrvarme.se/index.php3?use=publisher&id=1875&lang=1 (18 June 2009)

SDHA (2011). District Heating. http://www.svenskfjarrvarme.se/In-English/District-Heating-in-Sweden/District-Heating/ (2 May 2011)

SDHA (2012). Tillförd energy. http://www.svenskfjarrvarme.se/Statistik--Pris/Fjarrvarme/Energitillforsel/ (21 August 2012)

SEA (Swedish Energy Agency) (1988). *Perspektiv på kommunal energiplanering: en antologi*. Stockholm: Allmäna Förlaget.

SEA (Swedish Energy Agency) (2008). Sweden has the highest proportion of renewable energy in the EU; http://www.energimyndigheten.se/en/Press/Press-releases/Sweden-has-the-highest-proportion-of-renewable-energy-in-the-EU/ (12 February 2009)

SEA (Swedish Energy Agency) (2010a). Energiindikatorer 2010. Uppföljning av Sveriges politiska mål. http://webbshop.cm.se/System/ViewResource.aspx?p=Energimyndigheten&rl=default:/Resources/Permanent/Static/d44e63fca66b4835aec26342a421cfbb/ET2010_24w.pdf (2 May 2011)

SEA (Swedish Energy Agency) (2010b). Energy in Sweden– facts and figures 2010. http://webbshop.cm.se/System/ViewResource.aspx?p=Energimyndigheten&rl=default:/Resources/Permanent/Static/e0a2619a83294099a16519a0b5edd26f/ET2010_46.pdf (23 May 2011)

SEA (Swedish Energy Agency) (2010c). Energiläget 2010. http://www.sero.se/Filer/Startsidan/ET201045.pdf

Sellers, M. (2010). *Corporate Environmental Strategy: Extending the natural-resource-based view of the firm*. PhD Dissertation. University of Calgary, Canada.

Senge, P. (1990). The Leader's New York: Building Learning Organizations. *Sloan Management Review*, 32(1): 7-23.

Senge, P. (1995). *The Fifth Discipline: The Art and Practice of a Learning Organization*. Sydney: Random House.

SEPA (Swedish Environmental Protection Agency) (2005). Förbränningsanläggningar för energiproduktion inklusive rökgaskondensering. http://www.naturvardsverket.se/sv/Start/Om-Naturvardsverket/Vara-publikationer/ISBN1/8100/91-620-8196-9/ (4 July 2012)

Shapiro, C. (1983). Premiums for high quality products as returns to reputations. *Quarterly Journal of Economics*, 98(4): 659-680.

Sharma, S. (2000). Managerial Interpretations and Organizational Context as Predictors of Corporate Choice of Environmental Strategy. *The Academy of Management Journal*, 43(4): 681-697.

Sharma, S., Pablo, A.L., Vredenburg, H. (1999). Corporate Environmental Responsiveness Strategies - The Importance of Issue Interpretation and Organizational Context. *Journal of Applied Behavioral Science*, 35(1): 89-108.

Sharma, S., Ruud, A. (2003). Editorial – On the Path to Sustainability: Integrating Social Dimensions into the Research and Practice of Environmental Management. *Business Strategy and the Environment*, 12(4): 205-214.

Sharma, S., Vredenburg, H. (1998). Proactive Corporate Environmental Strategy and the Development of Competitively Valuable Organizational Capabilities. *Strategic Management Journal*, 19(8): 729-53.

Sheehan, N. (1998). The Roots of Porter's (1985) Activity-Based View: Strategic Management meets Management Science. Working Paper. Norwegian School of Management.

Sheehan, N., Foss, N. (2007). Enhancing the prescriptiveness of the resource-based view through Porterian activity analysis. *Management Decision*, 45(3): 450 – 461.

Shrivastava, P. (1995). The Role of Corporations in Achieving Ecological Sustainability. *The Academy of Management Review*, 20(4): 936-60.

Shrivastava, P. (1996). *Greening business: Profiting the corporation and the environment*. Cincinnati, OH: Thompson Executive Press.

Shrivastava, P., Hart, S. (1995). Creating sustainable corporations. *Business Strategy and the Environment,* 4(3): 154-165.

Sjöberg, J., Sandoff, A. (2010). Pathways towards sustainable electricity generation in the EU – and the case for corporate governance. Paper presented at the 12th Annual SNEE European Integration Conference. May 18-21, 2010.

Smart, B. (Ed.). (1992). *Beyond compliance: A new industry view of the environment*. Washington, DC: World Resources Institute.

Smircich L. (1983a). Concepts of Culture and Organizational Analysis. *Administrative Science Quarterly*, 28(3): 339-358.

Smircich, L. (1983b). Organizations as Shared Meanings. In: Pondy, L. et al. (Eds.): *Organizational Symbolism*. Greenwich: JAI Press.

Smith, K., Caroll, S., Ashford, S. (1995). Intra- and Interorganizational Cooperaton: Toward a Research Agenda. *Academy of Management Journal*, 38(1): 7-23.

Söderberg, M. (2008). *Four essays on efficiency in Swedish electricity distribution.* Dissertation. Göteborgs Universitet. Handelshögskolan. V Frölunda: Intellecta Docusys AB.

Söderholm, P., Wårell, L. (2010). Market opening and third party access in district heating networks. *Energy Policy*, 39(2): 742-752.

Solomon, S., Plattner, G.K., Knutti, R., Friedlingstein, P. (2009). Irreversible climate change due to carbon dioxide emissions, *PNAS*, 106(6): 1704-1709.

SOU 2004:136 (Swedish Government Official Reports), Skäligt pris på fjärrvärme. Delbetänkande av Fjärrvärmeutredningen

SOU 2008:25 (Swedish Government Official Reports), Ett energieffektivare Sverige. Delbetänkande av Energieffektiviseringsutredningen.

Stalk, G., Evans, P., Shulman, L. (1992). Competing on Capabilities: The New Rules of Corporate Strategy. *Harvard Business Review*, 70(2): 57–69.

Stead, J., Stead, W. (2008). Sustainable strategic management: an evolutionary perspective. *International Journal of Sustainable Strategic Management*, 1(1): 62-81.

Stenzel, T., Frenzel, A., (2008). Regulating technological change – The strategic reactions of utility companies towards subsidy policies in the German, Spanish and UK electricity markets. *Energy Policy*, 36(7): 2645-2657.

Stern, N. (2006a). The Economics of Climate Change – the Stern Review. http://www.hm-treasury.gov.uk http://www.wwf.se/source.php/1169158/Stern%20Summary_of_Conclusions.pdf (7 April 2010)

Stern, N. (2006b). What is the Economics of Climate Change? *World Economics*, 7(2): 1-10.

Stjernberg, T. (2006). Interviews as a Source of Knowledge. In: Löwstedt, J., Stjernberg, T. (Eds.): *Producing Management Knowledge – Research as Practice*, pp. 131-147, London: Routledge.

Stoecker, R. (1991). Evaluating and rethinking the case study. *The Sociological Review*, 39(1): 88-112.

Summerton, J. (2004). Do Electrons Have Politics? Constructing User Identities in Swedish Electricity. *Science, Technology, & Human Values*, 29(4): 486-511.

Sustainability (2008). http://www.sustainability.ca/index.cfm?Mid=66&k1=618 (4 January 2008)

Sveriges Ekokommuner (2007). http://www.sekom.nu/ (July to September 2007)

Swedish Government Bill 1996/97:84. En uthållig energiförsörjning (A Sustainable Energy Supply). Stockholm.

Swedish Government Bill 2001/02:143. Samverkan för en trygg, effektiv och miljövänlig energiförsörjning (Collaboration for a secure, efficient and environmentally friendly energy supply), Stockholm.

Swedish Government Bill 2005/06:172 Nationell klimatpolitik i global samverkan (National Climate Policy in Global Cooperation). Stockholm.

SweHeat & Cooling (2010). Why district heating. www.sweheat.com/why-district-heating.aspx (23 February 2010)

Swipa (2011). Snow, water, ice and permafrost in the arctic. http://amap.no/swipa/SWIPA2011ExecutiveSummaryV2.pdf (12 May 2011)

Teece, D. (1980). Contributions and impediments of economic analysis to the study of strategic management. In Frederickson, J.W. (Ed.): *Perspectives on strategic management,* pp. 39-80, New York: Harper Business.

Teece, D. (1986). Profiting from technological innovation: Implications for integration, collaboration, licensing and public policy. *Research Policy*, 15(6): 285-305.

Teece, D., Pisano, G. (1998). The Dynamic Capabilities of Firms: an Introduction. In: Dosi, G., Teece, D., Chytry, J. (Eds.): *Technology, organization, and competitiveness: perspectives on industrial and corporate change*, pp. 17-66, Oxford, N.Y.: Oxford University Press.

Thellbro, C. (2006). *Local Natural Resource Dependency in a Swedish Boreal Municipality Context*. Licentiate thesis. Swedish University of Agricultural Sciences, Umeå.

Thomas, K., Allen, S. (2006). The learning organization: a meta-analysis of themes in literature. *The Learning Organization*, 13(2): 123-139.

Tomer, J., Sadler, T. (2007). Why we need a commitment approach to environmental policy. *Ecological economics*, 62(3-4): 627-636.

Toms, J. (2002). Firm Resources, Quality Signals and the Determinants of Corporate Environmental Reputation: Some UK Evidence. *The British Accounting Review*, 34(3): 257-282.

Tsoutsos, T.D., Stamboulis, Y.A. (2005). The sustainable diffusion of renewable energy technologies as an example of an innovation-focused policy. *Technovation*, 25(7): 753-761.

Tukker, A., de Bruijn, T. (2002). Conclusions: the prospects of collaboration. In: de Bruijn, T., Tucker, A. (Eds.): *Partnership and leadership: building alliances for a sustainable future*. Dordrecht: Kluver.

UN (United Nations) (1992). Agenda 21. http://www.un.org/esa/dsd/agenda21/ (15 August 2011)

UN (United Nations) (2002). *WEHAB Working Group, A framework for action on energy*. New York: UN.

UNEP (United Nations Environment Programme) (1992). Rio Declaration on Environment and Development. http://www.unep.org/Documents.multilingual/Default.asp?DocumentID=78&ArticleID=1163 (26 March 2009)

UNFCCC (United Nation Framework Convention on Climate Change) (2002). Climate Change Information Kit. http://unfccc.int/resource/docs/publications/infokit_2002_en.pdf (21 April 2006)

UNFCCC (2011a). The Cancun Agreements - An assessment by the Executive Secretary of the United Nations Framework Convention on Climate Change. http://cancun.unfccc.int/cancun-agreements/main-objectives-of-the-agreements/#c33 (9 May 2011)

UNFCCC (2011b). The Mechanisms under the Kyoto Protocol: Emissions Trading, the Clean Development Mechanism and Joint Implementation. http://unfccc.int/kyoto_protocol/mechanisms/items/1673.php (13 May 2011)

UNFCCC (2011c). Kyoto Protocol. http://unfccc.int/kyoto_protocol/items/2830.php (11 May 2011)

Unruh, G. (2000). Understanding carbon lock-in. *Energy Policy,* 28(12): 817-830.

Urban Dictionary (2009). Low hanging fruit. http://www.urbandictionary.com/define.php?term=low-hanging%20fruit (25 May 2009)

Van de Ven, A. (1986). Central Problems in the Management of Innovation. *Management Science*, 32(5): 590-607.

Vattenfall (2008). Vattenfall AB elproduktion Nordens Certifierade miljövarudeklaration EPD för el från Vattenfalls vattenkraft i Norden. http://gryphon.environdec.com/data/files/6/7471/08vattenEPD%20reviderad%201.1.pdf (3 June 2011)

Vázquez, C., Rivier, M., Pérez-Arriaga, I. (2002). A market approach to long-term security of supply. *IEEE Transactions on Power Systems*, 17(2): 349-357.

Vera, I., Langlois, L. (2007). Energy indicators for sustainable development. *Energy*, 32(6): 875-882.

Villanueva, C. (1997). Community development and the futures of sustainable communities in the Phillipines. In: Kaoru, Y. (Ed.), *Sustainable global community in the information age: Vision from future studies,* Praeger, CT: Praeger Studies on the 21st Century.

Von Malmborg, F. (2007). Stimulating learning and innovation in networks for regional sustainable development: the role of local authorities. *Journal of Cleaner Production,* 15(17): 1730-1741.

Voss, J., Kemp, R. (2006). Sustainability and reflexive governance: introduction. In: Voss, J., Bauknecht, D., Kemp, R. (Eds.): *Reflexive Governance for Sustainable Development*, pp. 3-28, Cheltenham: Edward Elgar Publishing.

Wagner, M. (2008). Links of corporate energy management strategies in Europe with the European Union emissions trading system and environmental management systems. In: Antes, R., Hansjürgens, B., Letmathe, P. (Eds.): *Emissions Trading: Institutional design, decision making and corporate strategies*. London: Springer.

Wagner, M., Schaltegger, S., Wehrmeyer, W. (2001). The Relationship between the Environmental and Economic Performance of firms, *Greener Management International*, 34: 95-108.

Wahlund, B., Jan, Y., Westermark, M. (2004). Increasing biomass utilisation in energy systems: A comparative study of CO2 reduction and cost for different bioenergy processing options. *Biomass and Bioenergy*, 26(6): 531-544.

Walley, N., Whitehead, B. (1994). It's not easy being green, *Harvard Business Review*, 72(3): 46-52.

Walls, J., Phan, P., Berrone, P. (2011). Measuring Environmental Strategy: Construct Development, Reliability, and Validity. *Business & Society*, 50(1): 71-115.

WCED (World Commission on Environment and Development) (1987). *Our Common Future*. Oxford, UK: Oxford University Press.

WEC (World Energy Council) (2009). World Energy and Climate Policy: 2009 Assessment http://www.worldenergy.org/documents/report_final_3.pdf (2 April 2011)

Weick, K.E. (1976). Educational organizations as loosely coupled systems. *Administrative Science Quarterly*, 21(1): 1–19.

Weick, K. E. (1988). Enacted sensemaking in crisis situations. *Journal of Management Studies*, 25(4): 305-317.

Weick, K.E. (1991). The non-traditional quality of organizational learning. *Organization Science*, 2(1): 116–123.

Weidner, H, Jänicke, M. (Eds.) (2002). *Capacity building in National Environmental Policy. A Comparative Study of 17 Countries.* Berlin: Springer.

Welford, R. (1996). *Corporate Environmental Management – Systems and Strategies*. London: Earthscan Publications Ltd.

Wellington, F., Sauer, A. (2005). *Framing Climate Risk in Portfolio Management*. Washington, DC: World Resources Institute.

Werner, S. (2006). Possibilities with more district heating in Europe. Ecoheatcool project – work package 4. Euroheat & Power, Brussels. http://www.euroheat.org/files/filer/ecoheatcool/documents/Ecoheatcool_WP4_Web.pdf (15 August 2012)

Werner, S. (2010). District Heating in Sweden – Achievements and Challenges. Manuscript for XIV Polish District Heating Forum, Sept 13. 2010. hh.diva-portal.org (15 August 2012)

Werner, S., Spurr, M., Pout, C. (2002). Promotion and Recognition of DHC/CHP Benefits in Greenhouse Gas Policy and Trading Programs. Report 2002:S9. IEA Implementing agreement on District Heating and Cooling, including the integration of CHP.

Wernerfelt, B. (1984). A Resource-Based View of the Firm. *Strategic Management Journal*, 5(2): 171-180.

Westley, P., Vredenburg, H. (1991). Strategic bridging: The collaboration between environmentalists and business in the making of green products. *Journal of Applied Behavioral Science*, 27: 65-90.

Wheeler, D., Elkington, J. (2001). The end of the corporate environmental report? Or the advent of cybernetic sustainability reporting and communication. *Business Strategy and the Environment*, 10(1): 1-14.

Wheeler, D., Sillanpää, M. (1998). Including the stakeholders: the business case. *Long Range Planning,* 31(2): 201–210.

Whetten, D. (1989). What constitutes a theoretical constribution? *Academy of Management Review*, 14(4): 490-495.

Whittington, R. (2006). Completing the Practice Turn in Strategy Research. *Organization Studies*, 27(5): 613-634.

WHRC (Woods Hole Research Center) (2011). The Greenhouse Effect. http://www.whrc.org/resources/primer_greenhouse.html (3 June 2011)

Wiedmann, K. (2005). Measuring brand equity for organizing brand management in the energy sector – A research proposal and first empirical hints. *Brand Management,* 12(3): 207-219.

Wikström, P.A. (2010). Sustainability and organizational activities – three approaches. *Sustainable Development*, 18(2): 99-107.

Wiser, R. (1998). Green Power Marketing: increasing customer demand for renewable energy. *Utilities Policy*, 7(2): 107-119.

Wimmerstedt, R. (1999). Recent advances in biofuel drying. *Chemical Engineering and Processing*, 38(4-6): 441-447.

Winter, S., Szulanski, G. (2001). Replication as Strategy. *Organization Science*, 12(6): 730-743.

Wolff, R. (1998). Bortom miljömanagement. Företagsekonomisk forskning för miljön. In: Czarniawska, B. (Ed.): *Organisationsteori på svenska*. Stockholm: Liber Ekonomi.

Woodside, G., Aurrichio, P. (2000). *ISO 14001 Auditing Manual*. New York: McGraw Hill.

Worthington, I., Patton, D. (2005). Strategic intent in the management of the green environment within SMEs. An analysis of the UK screen-printing sector. Long Range Planning, 38(2): 197-212.

Wüstenhagen, R. (2006). Current Issues in the Greening of Industry. *Business Strategy and the Environment*, 15(4): 289-291.

Yin, R. (2003). *Case Study Research*. London: Sage.

Young, I. (1991). Reducing waste, saving materials. In Brown, L., et al, (Eds.): *State of the World,* pp. 39-55. New York: Norton.

Young, M., Post, J. (1993). Managing to Communicate, Communicating to Manage: How Leading Companies Communicate with Employees. *Organizational Dynamics*, 22(1): 31-43.

Zbaracki, M. J. (1998). The rhetoric and reality of total quality management. *Administrative Science Quarterly*, 43(3): 602–638.

Zysman, J., Huberty, M. (2010). "Governments, Markets, and Green Growth: Energy systems transformation for sustainable prosperity." Working paper 192, Berkeley Roundtable on the International Economy, University of California Berkeley, Berkeley, CA, (2010b). http://brie.berkeley.edu/publications/WP192.pdf (3 May 2011)

Table of Appendices

Appendix 1: Evaluation sheet for case company selection

1. Fact sheet

Company:	
Head office:	
Short description	
Vision/Mission	
No. of employees:	
Customer base:	
Ownership structure:	
Markets active in:	
Business lines	
Type(s) of energy production:	
Main fuels used:	
Financial information:	Revenues 2006: EBITDA 2006: Turnover 2006: Investments 2006:
Technical information:	KWh produced:
Ongoing projects	
Other information	

2. Sustainability-oriented activities

TECHNICAL ACTIVITIES (Renewable and bridging technologies)	Comments	
Biofuel production / distribution		
Biogas recovery from landfills or sludge		
Biomass-fired power production/project		
Biomass gasification plant/project		
Cogeneration (CHP) plants/project (combined heat and power)		
Coal gasification plant/project		
Working on CO2 capture and storage techniques		
District heating extension plans/projects		
Energy efficiency improvements		
Energy recovery from waste		
Fuel cells (hydrogen) projects		
Fuel switching (coal to gas, fossil to renewable, etc.)		
Gas-fired power plants, other gas projects		
Geothermal power/projects		
Hydroelectric power/projects		
Natural gas combustion for electricity or heat production		
Natural gas distribution (as car fuel or to buildings)		
Nuclear power plants		
Solar panels (photovoltaic cells) project		
Upgrading of power plants		
Wave power project		
Wind power/wind farm projects		

BONDING ACTIVITES	Comments	
Ambitious environmental policy		
Carbon emission reduction targets		
CDM/JI project participation		
Certified environmental management system (ISO 14001, EMAS)		
Collaboration with public administration and other stakeholders		
Co-operation with local forest or agricultural industry		
Collaboration with other utility companies (common projects)		
Domestic heating solutions other than district heat		
Energy services to customers		
Environmental awards received / Included in climate index		
Environmental communication		
Environmental reporting (climate specific, e.g. carbon intensity)		
Environmental training (internal)		
Environmental or energy related education (external):		
Internal green research and development		
Promoting energy efficiency measures with customers		
Supports external green research and development		
Taking an active role in climate debate		
Other voluntary measures for sustainability		

Appendix 2: Interview guide

Meeting with X

Date:

Please could you shortly present yourself and your work?

What are company Y's strenghts?

How would you describe company Y's business strategy?

What role does the environment play in the business strategy?

What makes it possible for the company to engage in a large investment such as Z?

What were the driving forces for the choice of a large combined heat and power plant fuelled with biomass?

Which were the main arguments for choosing renewable fuels? Have other fuel alternatives been discussed?

Did the owners influence the planning of the investment, for instance with regard to size or choice of fuels?

How important was the fact that the company is municipally-owned for the realization of the investment?

What calculation method did you use to evaluate the investment? (NPV, payback time, other)

What other factors besides profitability were taken into account when evaluating the investment?

What advantages is the new combined heat and power plant likely to bring to your operations?

What changes will the new investment involve for your business?
For instance, do you intend to produce environmentally-certified green electricity in the future?

What are, according to you, the driving forces for focusing on environmentally-friendly solutions?

How important is it for the company to have an environmentally-friendly profile?
What are your customers' reactions to this? What other reactions do you get?

I read on your webpage that customers can influence how energy is produced by making conscious choices. How have customers' preferences influenced your business activities?

How do you work to make sure that the company adapts to changes happening in your environment?
How can you keep developing your business?

How do you look upon the relationship between business and the natural environment? Is it possible to reconcile economic interests with environmental sustainability?

How are environmental criteria integrated into decisions-making at your company?

What does the fact that you are a small energy company entail in terms of challenges for the changeover to renewables?
How do you work with these challenges? What are the focus areas?

How does the local embeddedness of the firm influence the direction of your energy production?
To what extent is it important for a small, municipal energy company to switch to renewables?

What is the owners' and the board of directors' role in this development?
What position do environmental issues have in the discussions?

The owners and the board of directors, to what extent are they knowledgeable about energy issues and related environmental problems?

How would you describe the cooperation between the management and the board of directors?

To what extent would you regard your owners to be actively involved in the development of the company?

What are the common interests between the owners (the municipality) and your company as the local energy provider?

What kind of collaborations do you have with the municipality?

Seen from a ten-year perspective: Are there any business areas that you would like to venture in that could contribute to the sustainable development of society? Which ones?

Thank you for your time!

Appendix 3: Analysis 3

Environmental integration / Emissions Reduction

SouthEnGroup: As a result of its long-term systematic work with environmental issues, the company has integrated environmental concerns into all relevant aspects of the organization. Looking at the production system, carbon emissions were substantially reduced over the past two years. Due concern is given to supply-chain issues, given that good environmental performance is important for the choice of suppliers and sub-contractors. A multitude of small non-production related improvements are in the implementation stage. The recent decision by the company to head towards climate neutrality makes sure that emission reductions are worked with systematically throughout the group once guidelines and routines have been established and implemented. Due to the limitations to achieve substantial further improvements within the current production system at an adequate cost level, the implementation of the Gravel Site project is a necessity.

LocalEnCo: Technical measures have led to reduced emissions but the current production system has largely come to its limits and only an investment into a new plant can produce more radical improvements. With regard to management systems, the role of the environmental controller seems to be pivotal to managing the environmental aspects of the company successfully. Having an advocate for the environment who puts personal engagement and zeal into her work appears vital for driving the environmental work forward and anchor commitment for emission reductions at both the management level and the ‘shop floor’ level.

WestEnCo: The many examples show that the company has worked intensely with the main components of technical integration to reduce emissions, i.e. improving energy efficiency and replacing fossil fuels. Substantial resources have been committed to fuel switching, for example by converting boilers, which allows running them on bio-fuels in the future. Optimization further means fine-tuning of processes and scheduling plant start-ups and shut-downs in the most efficient way. The optimization of such large-scale production system requires expert knowledge, which WestEnCo disposes of. Technical improvements require that new components or processes are integrated into the existing system without deteriorating the functioning of the current system. It seems thus to lie in the nature of these improvements that they are incremental, otherwise current operations might be put at risk. One word of caution worth addressing is that the flexibility imperative shifts the focus from environmental concerns to resource efficiency concerns, which sometimes but not always stand in conflict. Subject to economic rationality, environmentally sustainable production is not always prioritized. It competes with fossil-based production depending on the temporary needs and conditions for electricity and heat production. With regard to the management of environmental issues, the knowledgeable and experienced environmental organisation is a strength of the company. Its engagement in systematic environmental management combined with regular coordination with the production unit ensures continuous improvements. The company has also set up standards for the environmental performance of its subcontractors, thus encouraging environmental management throughout its supply-chain.

Sub-theme		Capabilities & resources	Company S=SouthEnGroup L=LocalEnCo W=WestEnCo			Value creation for the firm			Shared value creation		
			S	L	W	Cost Savings	Repu-tation	Future position	Transfer-ability	Co-ordination	Far-sighted-ness
Technical integration	1	Technical capabilities for continuous improvement of environmental performance of the production system.	X		X	X	X				
	2	Capability to integrate renewable fuels into technical systems.	X	X	X	X	X				
	3	Capability to continuously improve resource efficiency throughout the whole production system and the production-related value chain.			X	X				X	
	4	Capability to make use of low quality energy or local waste resources	X		X	X		X		X	
	5	Capability to build flexibility into the production system (fuel or system flexibility)	X	X	X	X		X			
	6	Capability to mitigate (price) risks from fossil fuel dependency	X	X	X	X					
Processual integration	7	Capability for continuous environmental improvements due to systematic environmental management (e.g. setting ambitious goals)	X	X	X	X	X				
	8	Capability to embed continuous improvement of environmental behavior with employees (with the help of routines, incentive system)	X	X	X	X	X	X			
	9	Capability for integration of environmental concerns into steering documents and performance measurement (policies, integrated business & env. plans, BSC)	X					X			
Supply chain measures	10	Capability to foster good environmental behavior with suppliers.	X	X	X		X		X		
	11	Resource: Environmental manager acts as environ-mental champion, committed to continuously improving environmental performance & negotiating goals and opportunities for improvement with internal stakeholders. They own the environmental issues of the companies.	X	X							

	12	Resource: long-standing experience with certified environmental management system (ISO 14001)	X		X						

Environmental integration / Product Stewardship

SouthEnGroup: Changing from fossil oil to bio-oil as input fuel led to a more environmentally friendly production of district heat. These changes are, however, seen as interim solutions by the company. The changes in the production system towards environmentally-friendly fuels do currently not result in a more overarching product stewardship strategy.

LocalEnCo: Fuel switching measures have had an important impact on the product stewardship strategy, as will become evident in the section on innovations. It is argued that fuel switching opened up for further activities that ultimately resulted in a product stewardship strategy. It was the first step of an incremental strategy developing over time, although the intention originally was to cut costs as replacing part of the peat freed resources in the form of emissions allowances no longer required for compliance. Hence, serendipity played a role in the product stewardship strategy.

WestEnCo: The on-going conversion to bio-fuels of large parts of the production system contributes to a more environmentally-friendly production mix or district heating, which is necessary to keep demanding customers. These improvements pave the way for a product stewardship strategy that embraces green district heat offerings.

Sub-theme		**Capabilities & resources**	**Company** S=SouthEnGroup L=LocalEnCo W=WestEnCo			**Value creation for the firm**			**Shared value creation**		
			S	**L**	**W**	**Cost Savings**	**Repu-tation**	**Future position**	**Transfer-ability**	**Co-ordination**	**Far-sighted-ness**
Processual integration	13	Capability to think in terms of green products	X	X	X		X	X			
	14	Capability to translate process improvements into green products		X				X			X

Environmental integration / Clean Technology

SouthEnGroup: Technical measures focused on incremental changes to the production system, leading to efficiency improvements that yield cost savings and environmental gains. For example, the investment in a connecting pipeline improved flexibility, leading to a better utilization rate of existing renewable production resources. However, many investments are held up due to uncertainty if and when the Gravel Site plant can be built. Moreover, a different set of investment criteria is applied for strategic investments compared to commercial investments, creating better conditions for a transition to clean technologies.

LocalEnCo: Environmental aspects have influenced the choice of the technology although the dominant drivers have not been the environmental aspects themselves but other characteristics associated with making environmentally sound investments, such as lower risk exposure and financial incentives. Furthermore, ethical and legitimacy aspects have played a role given that a fossil fuel solution was considered inconsistent with corporate image.

WestEnCo: Environmental sustainability is a central parameter that has to be observed when planning new investments at the company. The environmental consequences of an investment project are important decision criteria next to financial payoff; hence they are carefully evaluated. The strategic importance of some clean technology ventures gives room to a more generous allocation of funds than would be motivated if purely financial motives lie behind these investments.

Sub-theme		**Capabilities & resources**	**Company** S=SouthEnGroup L=LocalEnCo W=WestEnCo			**Value creation for the firm**			**Shared value creation**		
			S	**L**	**W**	**Cost Savings**	**Repu-tation**	**Future position**	**Transfer-ability**	**Co-ordination**	**Far-sighted-ness**
Processual integration	15	Capability to integrate environmental criteria in investment processes and decisions	X	X	X		X	X			
	16	Capability for a holistic assessment of pros and cons of Clean Technology investments		X			X	X			X
	17	Capability to mitigate business risks from fossil fuel based technologies	X	X	X	X		X			
	18	Capability to plan for the long run and take long-term consequences of investments into account	X	X	X		X	X			X
	19	Capability to take a long-term perspective on environmentally beneficial investments due to lower demands for financial returns from owners.	X					X			X
	20	Resource: Acceptance of lower rates of return for environmentally benign investments that are considered as strategic (Recognition of CT as a strategic issue leads to prioritization of CT investments despite lower return rates)	X		X			X			X

Environmental integration / Sustainability Vision

SouthEnGroup: The commitment to climate neutrality is a major step that will lead to systematic efforts to mitigate the environmental impact from the entire business beyond ISO 14001 standards. It can be seen as a strong force to align the group's environmental efforts behind a common goal and create a roadmap for the future. Again, for the vision to be realized, it is crucial that Gravel Site can be built.

LocalEnCo: The triple certification of the business ensures high standards in strategically important areas and can be seen as a sign of resource commitment to continuous improvements in various areas of importance to the company. Nevertheless, the fact that symbolic measures, such as replacing the existing car fleet systematically, meets resistance, shows that the environmental commitment does not fully permeate the company. The dominant understanding currently seems to be that environmental measures need to have a positive effect on the Income Statement, which is, however, often hard to prove. Accordingly, as long as this notion (that no one wants to pay for environmental improvements) persists, there is at least some conflict between business and the environment.

WestEnCo: The company's explicit vision of 'a sustainable Western society' raises the question how this is integrated into the operational core business. The most salient operationalization of the vision is the resource efficiency focus (maximum use of low quality energy). It seems however debatable if resource efficiency is a righteous standard to measure sustainability against. In any case, given that this sustainability vision is institutionalized within the company, this is the generally accepted working definition of sustainable development for the company that is postulated in different contexts.

Sub-theme		**Capabilities & resources**	**Company** S=SouthEnGroup L=LocalEnCo W=WestEnCo			**Value creation for the firm**			**Shared value creation**		
			S	**L**	**W**	**Cost Savings**	**Repu-tation**	**Future position**	**Transfer-ability**	**Co-ordination**	**Far-sighted-ness**
Processual integration	21	Capability to envision a future with significantly lower environmental impact from corporate activities.	X	X	X			X			
	22	Capability to operationalize the sustainability vision	X	X	X		X	X			
	23	Capability to embed the vision in the corporation (create alignment behind common goal)	X		X	X	X	X			
	24	Resource: Environment as a core value	X	X	X		X	X			

Communication & Learning / Emissions Reduction

SouthEnGroup: Communication and learning facilitate emissions reductions for example through knowledge exchange within a community of practice. Inputs from other professionals facing similar challenges allow the environmental manager to develop the environmental work of the group further. Regular face to face meetings with environmental coordinators are held to ensure that central knowledge is disseminated and environmental standards implemented throughout the group. Considering that learning is a necessity to accomplish change, regular environmental training is essential to support the green culture, engage employees in the task to cut emissions and activate their creativity to find ways to conduct business in a more environmentally-friendly way. To conclude, the group seems to have created a good environment for employee involvement in environmental improvements.

LocalEnCo: According to von Malmborg (2002:312), an environmental management system can serve as "a tool for communicative action and organizational learning". LocalEnCo's case shows that communication is important to embed environmental considerations into the day-to-day work of employees and get the environmental work done (i.e. comply with requirements of the certified management system). Without the continuous efforts of the environmental controller to engage and encourage employees, the environmental management system could not be developed further and would not be more than a paper exercise. Hence communication is the lubricant in the environmental management machinery.

WestEnCo: Several decades of working with environmental issues have led to that the environment is an authentic part of corporate values and culture. Naturally, this facilitates the implementation of more sustainable working practices at the company. The environmental work is geared towards continuous improvements and, given that the company has been certified for more than ten years, environmental management has undoubtedly reached high standards. However, there is the risk of 'business as usual' that could prevent the company from being receptive to the shifting requirements from its environment due to for example global warming concerns which would require double-loop learning rather than single-loop.

Sub-theme		**Capabilities & resources**	**Company** S=SouthEnGroup L=LocalEnCo W=WestEnCo			**Value creation for the firm**			**Shared value creation**		
			S	**L**	**W**	**Cost Savings**	**Repu-tation**	**Future position**	**Transfer-ability**	**Co-ordination**	**Far-sighted-ness**
Internal communication	25	Capability to foster environmental awareness and commitment with employees related to their working tasks (with the help of environmental training)	X	X	X	X		X			
	26	Capability for close communication and cooperation between the environmental staff and plant operators	X	X	X	X					
Open communication climate	27	Capability to foster change thanks to an open communication climate facilitating employee involvement	X			X		X			
Organizational learning	28	Capability to coordinate environmental management throughout the organization (or group)	X	X	X	X		X			
	29	Capability to continuously develop environmental management through internal and external learning (through networks and communities of practice)	X	X	X	X		X	X		
	30	Resource: employees who are knowledgeable and committed with regard to environmental issues	X		X						
	31	Resource: Green organizational culture	X		X	X	X	X			

Communication & Learning / Product Stewardship

SouthEnGroup: Learning related to product stewardship is in its initial phase. Here accepted norms are challenged by asking oneself if the mission of energy companies has changed from energy provider to a provider of environmental services. This thinking needs to develop further before a full-fledged concept can be developed as to how these insights impact the current business model (comparable to the cognitive process of double-loop learning, where problem-defining skills are required). Frequent communication about corporate environmental performance and projects as well as publications and events related to the environment potentially improves the relation with stakeholders and contributes to creating a green profile.

LocalEnCo: In line with Hart (1997), creating preference for sustainable products and educate customers is part of LocalEnCo's product stewardship strategy. It involves giving guidance to customers as to what product to choose. To have customers make 'the right choice' is part of a learning process and an achievement as such. Hence, connecting the wider problems of climate change and environmental degradation to the consumer and his choice of products is a delicate task which requires communication skills and a convincing rhetoric.

WestEnCo: Communication and learning is important for sustaining and extending business. If commercial district heating customers are dissatisfied, they might leave despite high switching costs. It is therefore important to keep a constant dialogue about the customers' wants and needs and 'synchronize world views'. The company's communication with stakeholders via environmental reports seems rather fragmented; it is difficult to gain a picture of the overall impact from the documentation. A comprehensive environmental report is only available for the district heating business, which is required for the EMAS certification. It should however be mentioned that in situations where environmental incidents could harm corporate image, the company shows that it takes full responsibility irrespective of costs.

Sub-theme		**Capabilities & resources**	**Company** S=SouthEnGroup L=LocalEnCo W=WestEnCo			**Value creation for the firm**			**Shared value creation**		
			S	**L**	**W**	**Cost Savings**	**Repu-tation**	**Future position**	**Transfer-ability**	**Co-ordination**	**Far-sighted-ness**
Dialogue	32	Capability to educate customers to chose environ-mentally friendly products and/or pay attention to resource efficiency issues (Stakeholder dialogue)		X	X		X	X	X		
	33	Resource: Strong ties and a shared worldview regarding efficient energy use with major customers (thanks to continuous dialogue).			X		X	X	X		
External environmental communication	34	Capability for environmental communication with stakeholders	X	X	X		X	X	X		
Learning types	35	Capability to find new business models based on energy services and/or green (environmentally-friendly or certified) products.		X	X		X	X			X

Communication & Learning / Clean Technology

SouthEnGroup: Interviewees emphasize that competencies in different areas are required to make a valid risk assessment for the large CHP investment project, making learning-by-doing a risky approach. Failure to thoroughly assess the risks of such investment can result in sunk costs and delay the planned transition to cleaner production technology substantially. Communication is a necessity for creating acceptance for new projects, be it with the owners of the group or with other parties involved. Large investment projects such as the Gravel Site plant are often perceived as a threat by the local community. Informing and communicating on the benefits of such clean technology investment can at the very least open up for a constructive dialogue with opponents. The issuance of a leaflet to locals shows that resources have been allocated to mitigate the risk of litigation. However, this did not suffice to appease the local opposition. In connection with the financing of clean technology, it is particularly important that the group can convey a favourable picture of themselves to financial market players, resulting in a good credit rating and consequently beneficial financing conditions. This can also be seen as a negotiating and learning process.

LocalEnCo: Communication in relation to clean technology involves making stakeholders understand what the Grove Hill investment means to them, to the community, the environment etc. In much, the investment has a symbolic significance standing for the determination of the company to contribute to sustainable development within the range of its activities. Creating awareness about the company's green strategy is important for it to succeed. Hence, communication with all available means is a necessity, which the company seems to be well aware of. This is also why the plant is well exposed; it has a glass front allowing for the installations to be illuminated at night, so the plant is well visible for motorists passing by on the nearby highway. It seems sensible to 'cash in' on the investment by communicating this clean technology achievement in various ways, thereby strengthening the company profile.

WestEnCo: For the biogas ventures not only specialist competencies need to be acquired on biological and chemical processes, but also more general knowledge is needed on how biogas ventures are best developed. These are continuous learning processes that evolve simultaneously with the growing practical experience with such ventures. It is also essential to reach out to a larger public and inform about on-going projects at workshops and seminaries, which allows for gaining trust and creating new opportunities for biogas development. Lobbying activities have been central to create acceptable conditions for sustainable technology deployment. Although the main goal of lobbying assumingly is to establish rules and regulations that benefit the firm, also follower firms can benefit from WestEnCo's achievements, if the company succeeds in removing some of the obstacles for disseminating clean technologies.

Sub-theme		**Capabilities & resources**	**Company** S=SouthEnGroup L=LocalEnCo W=WestEnCo			**Value creation for the firm**			**Shared value creation**		
			S	**L**	**W**	**Cost Savings**	**Repu-tation**	**Future position**	**Transfer-ability**	**Co-ordination**	**Far-sighted-ness**
Dialogue	36	Capability to play a leading role in lobbying for better conditions for the development of a sustainable energy system.			X		X	X		X	
	37	Capability to disseminate knowledge and experience on new development areas for Clean Technology.			X		X		X		
	38	Resource: Knowledgeable board committed to environmentally sustainable solutions.	X	X	X			X			

	39	Resource: Alignment with owners on strategy for environmental sustainability for municipality or region.	X	X	X			X		X	X
External environmental communication	40	Capability to obtain favorable financing conditions for Clean Technology investments thanks to green profile, amongst others.	X	X	X	X		X			
	41	Capability to work for public acceptance for Clean Technology projects.	X		X		X	X	X		
	42	Capability to use Clean Technology as a marketing device to strengthen the green profile.		X			X	X			
Organizational learning	43	Capability to accumulate knowledge about various renewable technologies and assess their relevance for the corporate strategy for environmental sustainability.	X		X			X			
Cognitive & behavioral development	44	Capability for learning by doing (and by sharing experience) as to the biological and chemical processes in biogas ventures. (being a forerunner)			X	X		X		X	X
Interfirm learning	45	Capability to coordinate new biogas ventures (prime mover).			X		X	X		X	

Communication & Learning / Sustainability Vision

SouthEnGroup: Communication is essential to making employees and external stakeholders understand the challenges the group faces and connect them to the related goals and vision. Communicating a development trajectory leading towards this vision may lead to committed employees, loyal customers and more collaborative stakeholders. The critical reflections about the purpose of the company as shifting from being an energy company to being an environmental company indicate that a paradigm shift in business model understanding is underway.

LocalEnCo: Environmental training seems the most important activity to create a sustainability vision that is shared by all employees (as well as the board), in particular when large changes occur under a short time period as in LocalEnCo's case. The 'base' of the company needs to be attuned to the sustainability vision that took form as a consequence of the green opportunities arising from the Grove Hill investment.

WestEnCo: Several aspects unite communication and learning with the sustainability vision. Internally, a complex planning process determines the strategy that should lead towards the corporate sustainability vision. Furthermore, the CEO's commitment to environmental issues is an important factor for embedding the company's sustainability vision internally and in the numerous bodies he is active within. Lastly, the company is involved in the political dialogue on the climate debate. Lobbying work is a prominent example of communication and learning that aims at establishing the company's sustainability vision with external stakeholders. Given the battle over 'ideological territory' at an EU level with different competing views how the energy system should develop, it is valuable that the company assumes the responsibility to brings in its views in order to avert legal discrimination of typical features of the Swedish energy system.

Sub-theme		Capabilities & resources	Company S=SouthEnGroup L=LocalEnCo W=WestEnCo			Value creation for the firm			Shared value creation		
			S	L	W	Cost Savings	Repu-tation	Future position	Transfer-ability	Co-ordination	Far-sighted-ness
Internal communication	46	Capability to foster a green mindset with employees, aligned with corporate sustainability vision.	X	X	X	X		X			
External environmental communication	47	Capability to communicate sustainability vision to stakeholders.	X	X	X		X	X	X		
	48	Resource: External network activities on various organizational levels	X	X	X		X	X		X	
Cognitive & behavioral development	49	Capability to question and redefine business models and move beyond the traditional energy business (double-loop learning)	X		X			X			X
	50	Capability to manage a complex (creative) planning process regarding strategy making that should lead towards the sustainability vision (POMS)			X			X			
	51	Resource: The strong leader has the capability to embed the sustainability vision internally and externally.			X		X	X	X		
	52	Capability to engage in the political dialogue on the climate debate and the future of the energy system.			X		X	X		X	
	53	Resource: Commitment to assume the responsibility to embed a Swedish sustainability vision abroad regarding energy system development.			X		X	X		X	

Innovation / Emissions Reduction

SouthEnGroup: Innovations related to demand side management could have a large impact on the amount of emissions if they effectively lead to lower consumption. Such innovations potentially influence the design of the production-consumption system. Here open system innovation in an industry forum would seem particularly adequate to join resources and create common platforms. Besides, innovations at the production company can also lead to further emission reductions through system redesign.

LocalEnCo: Interpreting innovations broadly as the implementation of new ideas, the concept that LocalEnCo wants to help customers in their environmental work and assist them to strengthen their environmental profile can be considered a business model innovation promoting emission reductions. Notable is also the fact that the company does not add a profit margin to its 'environmentally labelled green district heat'; rather it is seen as a service to customers, giving them the choice to reduce their emissions from heat consumption at virtually no extra cost.

WestEnCo: The company's broad range of innovative activities that aim at reducing emissions show that there are still a large number of cheap or profitable measures to be taken. WestEnCo also seems to possess appropriate structures and competencies to deploy these emission reductions in diverse industry contexts, which might point at a well-developed absorptive capacity within the firm. It can also be observed that innovations connected to emission reductions are increasingly systemic and directed towards customer behaviour (e.g. related to demand-side management and energy services). Furthermore, the engagement in a CDM/JI project at such an early stage signals that the company wants to lie at the forefront even with regard to environmental policy innovations.

Sub-theme		**Capabilities & resources**	**Company** S=SouthEnGroup L=LocalEnCo W=WestEnCo			**Value creation for the firm**			**Shared value creation**		
			S	**L**	**W**	**Cost Savings**	**Repu-tation**	**Future position**	**Transfer-ability**	**Co-ordination**	**Far-sighted-ness**
Management innovation	54	Capability to integrate energy saving incentives in product and service offerings (innovative pricing models & demand side management).			X		X	X	X		
	55	Capability for business model innovation (increase product quality through certifications, aid commercial customers to improve their env. performance).		X			X	X			X
Absorptive capacity	56	Capability of detecting opportunities and providing emission reducing solutions to a wide range of industries.			X			X	X		
Degree of innovation	57	Capability to integrate emission reducing innovations in the larger production and consumption system (vertical integration of activities in the value chain, integrate on raw material side and customer side, e.g. biogas into fuelgas = system innovation)			X	X		X	X		

Innovation / Product Stewardship

SouthEnGroup: The innovation to build renewable power into the pricing model by default for those customers who failed to make an active choice is a good way to increase the volume of renewable electricity consumed. This way, customers have to make an active choice to reject renewable power which might be a bigger step than taking the decision to pay extra for renewable power under other pricing schemes. Generally, the small margins in the power market seem to leave little room for innovations. With regard to the demand for climate-neutral district heat, the current model to sell this product on request is seen as an interim solution. The fact that this eventually might result in a new product shows that product stewardship strategies are incremental and based on a learning process. This might also be a consequence of the need for systemic innovations across different organizational units.

LocalEnCo: The company hatched a number of innovations related to their products. Firstly, the idea to create a niche for the electricity produced at Grove Hill and market it as 'locally-produced electricity' labelled 'Good Environmental Choice' is a new approach to overcoming the obstacle of a homogenous product with little opportunities for diversification (marketing innovation). Furthermore, the development of 'environmentally labelled green district heat' is a product innovation, in particular given that the company was an early mover at launching the product. Both innovations are based on a productification of a homogenous good that is based on adding distinct qualities to the products that create additional customer value. Hence sustainable products are in many ways a matter of quality improvements that can, under certain circumstances, lead to innovations. Clearly, much has to fall into place in order to make singular (process) innovations into a finished product (referring to green heat), alternatively a large resource commitment is needed to get at the more radical innovations with the potential to change the production-consumption system.

WestEnCo: The company's product stewardship strategy revolves around quality improvements and new products, developed in collaboration with customers and consultants. Consequently, the innovation process resembles Van de Ven's definition of developing and implementing new ideas resulting from a lengthy engagement with others within an institutional context. The demand for climate-friendly district heating resulted in two new products offered as add-ons at an extra cost. Energy services, built on the idea of reducing customers' consumption, are also a line of business with a high potential to contribute to sustainable development and growth since they are seen to create many deep customer relations.

Sub-theme		**Capabilities & resources**	**Company** S=SouthEnGroup L=LocalEnCo W=WestEnCo			**Value creation for the firm**			**Shared value creation**		
			S	**L**	**W**	**Cost Savings**	**Repu-tation**	**Future position**	**Transfer-ability**	**Co-ordination**	**Far-sighted-ness**
Open innovation	58	Capability to translate customer concerns into product improvements.	X	X	X		X	X		X	
Type of innovation	59	Capability for phasing-in more sustainable products	X	X	X			X			X
	60	Capability for energy service innovations			X		X	X	X	X	
	61	Capability for systemic innovation across organi-zational units, leading to environmentally certified products.		X			X	X			X
	62	Resource: Service-mindedness, providing environmentally beneficial products at little extra cost (green product 'philantrophy').		X			X	X			X

Innovation / Clean Technology

SouthEnGroup: The uncertainty whether or not the Gravel Site project can be realized keeps current innovation activities on hold. The realization of the investment would involve a radical change of the production system, resulting in a system re-design. In the gas business, efforts are undertaken to phase-in clean technology and produce own biogas. Although based on tested technology, this represents an innovation from the group's point of view. It integrates a further element into the value chain and takes the group one step closer to making its fuel gas business sustainable, evidently strengthening the viability of the product.

LocalEnCo: As indicated, large resource commitments are necessary to contribute to the transition towards a more sustainable energy system. The company has however made this commitment and has paved the way to accommodate more radical innovations. These take the form of for example district cooling, a new product for industrial customers, reducing their electricity consumption. This innovation simultaneously allows for a better utilization of Grove Hill, increasing efficiency. The innovations are not so much technical (not depending on the latest technology), but conceptual and systemic. So it is the combination of different small innovations (product, process, marketing) that allow for the optimal use of clean technology. Hence innovations and clean technology are intertwined and support each other.

WestEnCo: There is a perceived need for pioneering approaches requiring clean technology innovations in both the biogas business and district heating. This involves taking substantial risks as the techniques used are not yet fully tested. Taking such risks is, however, necessary to develop the competencies of the future for the company, broadening its business beyond traditional fields of energy production into adjacent areas that are more sustainable in the long term. Clean technology innovations are the building blocks of a proactive corporate strategy that is adapted to an anticipated carbon-restrained economy.

Sub-theme		**Capabilities & resources**	**Company** S=SouthEnGroup L=LocalEnCo W=WestEnCo			**Value creation for the firm**			**Shared value creation**		
			S	**L**	**W**	**Cost Savings**	**Repu-tation**	**Future position**	**Transfer-ability**	**Co-ordination**	**Far-sighted-ness**
Absorptive capacity	63	Capability to phase-in Clean Technology (based on renewables) to improve the environmental performance of products (referring to biogas).	X		X		X	X			X
	64	Capability to venture into adjacent fields and new technologies.			X			X			
	65	Capability to promote the development of cutting-edge Clean Technology in collaborative settings.			X			X		X	
Type of innovation	66	Capability for systemic innovations, redesigning the production-consumption system.		X	X			X		X	
	67	Resource: R & D involvement with external parties			X		X	X		X	

Innovation / Sustainability Vision

SouthEnGroup: The corporate vision to become climate neutral is a management innovation to align corporate activities behind a common goal and motivate employees throughout the group. A number of further innovations is obviously required if the company is to follow this vision. The vision is expressed in internal policies and management approaches that strive towards reducing the environmental impact of business. Regarding the environmental impact of operations, innovations are mostly of the autonomous type, aiming at system optimization. Currently, there is a gap between the vision and practices, mainly due to the delayed investment in the large biomass-fired CHP plant. However, various ways to achieve the goal are considered and innovations are in the pipeline.

LocalEnCo: The business model is built on a well-developed sustainability vision of which product stewardship and clean technology are building blocks. The idea is to reduce emissions at the producer and the consumer end and contribute to embed resource efficiency based on sustainable production methods into production and consumption systems. The sustainability vision hence stretches to customers and their production systems.

WestEnCo: The company wants to lie at the front edge and contribute to shaping the energy system of the future. Its firm belief and extensive ventures in biogas will undoubtedly have an impact on the future energy system. Also the company's openness and contributions to research and development are likely to make a difference. Through collaborative research drawing on the competencies within the larger socio-technical system, the company sets the direction for technology development and secures the resources and competencies that are required to work towards its sustainability vision.

Sub-theme		**Capabilities & resources**	**Company** S=SouthEnGroup L=LocalEnCo W=WestEnCo			**Value creation for the firm**			**Shared value creation**		
			S	**L**	**W**	**Cost Savings**	**Repu-tation**	**Future position**	**Transfer-ability**	**Co-ordination**	**Far-sighted-ness**
Management innovation	68	Capability to align employee efforts behind an ambitious vision.	X					X			
	69	Resource: Ambitious vision that works as a roadmap for the change process.	X				X	X			
Degree of innovation	70	Capability to extend the sustainability vision beyond the corporation.	X	X	X		X	X	X		
	71	Capability to work on a broad front and engage many actors in finding solutions that contribute to moving towards the sustainability vision.	X		X			X		X	
	72	Resource: Vision to lie at the technological front edge.			X			X			X

Cooperation / Emissions Reduction

SouthEnGroup: The cooperation with external heat suppliers based on bio-fuels is an innovative form of collaboration leading to a better production mix and lower emissions. It has led to a redesign of the production system, phasing in local renewable resources. An important characteristic of the cooperation is a pricing model that emphasizes fairness. Furthermore, cooperation with industry to make use of waste heat is an important piece of the puzzle to make district heating more sustainable.

LocalEnCo: Other things equal, cooperation in the form of a connection of the district heating system with a neighbouring district heating company contributes to emission reductions thanks to a better utilization of the combined system. As suggested by Grönkvist and Sandberg (2006), the total need for primary energy can be reduced, resulting in cost cuts and environmental benefits. The absence of direct competition as well as shared norms and values, for example the common belief that companies should reduce their environmental impact and use resources efficiently, seems to legitimize this form of cooperation.

WestEnCo: Besides the direct emission reductions from the connection with a neighbouring district heating system, indirect links between cooperation and emission reductions can be found. The company’s broad competence in emission reductions makes it a suitable partner to implement far-reaching changes in large industrial companies. Similarly, the energy service department passes on knowledge about product development to other companies, enabling them to adopt similar practices and accomplish emission reductions with their customers. If resource efficiency can be strengthened in the housing sector and similar sectors where the concept of energy services can be relevant, a significant contribution to sustainable development can be made.

Sub-theme		**Capabilities & resources**	**Company** S=SouthEnGroup L=LocalEnCo W=WestEnCo			**Value creation for the firm**			**Shared value creation**		
			S	**L**	**W**	**Cost Savings**	**Repu-tation**	**Future position**	**Transfer-ability**	**Co-ordination**	**Far-sighted-ness**
Cooperative IOrs	73	Capability to enter into cooperative IORs for the purpose of integrating external sources of renewables or resource-efficient energy.	X		X	X		X		X	
Determinants of cooperation	74	Resource: Reputation for trustworthiness and fairness, which facilitates entering into new cooperations.	X				X	X			X
Cooperation related to the operational business of energy companies	75	Capability to cooperate with competitors for the efficient use of resources.	X	X	X	X				X	

Cooperation / Product Stewardship

SouthEnGroup: Cooperation is important for the promotion of fuel gas and district heating. District heat has become more sustainable thanks to cooperations which could eventually lead to strengthening the position of district heat as a product in relation to competing technologies. The emerging product 'strategy' is also based on the belief that climate-neutral district heat is a must if this heating alternative is to stay competitive. Generally, the company is heavily dependent on external resources to make its existing products (especially district heating and fuel gas) more sustainable or diversify its product portfolio. Different forms of cooperation are an effective tactics to tie resources to the company without requiring a large financial commitment.

LocalEnCo: Cooperation and a constant dialogue with the Swedish Society for Nature Conservation was a precondition for the development of the product 'Good Environmental Choice' district heating. Thanks to the cooperation, company representatives gained a more sophisticated understanding of the challenges and opportunities an energy company is exposed to and were better able to define their role, including their products' role, in working towards sustainable development. Cooperating with an organization that possesses broad knowledge and competence in the field arguably enabled the company to better define challenges and refine the product stewardship strategy accordingly. In the case of energy services, cooperation also enables the company to give its customers access to a wider product range than it can sustain on its own, resulting in satisfied customers despite limited resources.

WestEnCo: Cooperation is an important element of the product strategy for energy services, aiming at establishing a common standard of good practice for the business. Since this institutionalizes the company's practices while offering a learning opportunity to other companies, there is a win-win situation. In the biogas business, a variety of cooperations ensure access to raw materials that form the base of a product stewardship strategy attempting to rapidly increase biogas production volumes. Cooperation is a prerequisite for managing the complexity inherent in such ventures, given the involvement of many vastly different parties that have to interact in coordinated ways.

Sub-theme		**Capabilities & resources**	**Company** S=SouthEnGroup L=LocalEnCo W=WestEnCo			**Value creation for the firm**			**Shared value creation**		
			S	**L**	**W**	**Cost Savings**	**Repu-tation**	**Future position**	**Transfer-ability**	**Co-ordination**	**Far-sighted-ness**
Shared understanding	76	Capability to develop products in cooperation with stakeholders (customers, NGOs).	X	X	X		X	X		X	
	77	Capability to institutionalize own working practices within the industry through cooperation and knowledge sharing (energy services).			X		X	X	X		
Cooperative IOrs	78	Capability to strengthen the sustainability of products by way of cooperations.	X		X	X		X		X	
	79	Capability to build up a new, growing business line (biogas) based on cooperations.			X			X		X	X

Cooperation / Clean Technology

SouthEnGroup: In the case of wind farms, a cooperative business model involving stakeholders led to a stronger acceptance of the technology, thereby strengthening the position of this clean technology. Cooperation seems an important means to develop an economically and socially viable wind farm business. Biogas ventures almost by definition require cooperation among different players due to the nature of the raw materials that lie at the base of biogas production. The cooperation between SouthEnCo and the municipal sewage plant allows the company to develop competencies that are vital for the transition to renewable fuels.

LocalEnCo: As argued by Hart (1995), collaboration between public and private organizations creates beneficial conditions for clean technology deployment. In LocalEnCo's case, cooperation with the municipality facilitated the expansion of clean technologies. This is not only the case for district heating, but also regarding the Grove Hill plant.

WestEnCo: Cooperative efforts are an absolute must to strengthen clean technologies, be it for electric vehicles, biogas development or large-scale clean technology developments. The types of cooperation, WestEnCo's role in them, as well as the nature of cooperation partners cover a wide spectrum. Cooperation is seen as the very basis for development, particularly when it comes to biogas. Overall, the challenges of transforming the energy system simply can't be tackled by single actors; hence, a large player like WestEnCo can assume an important role as a cooperation partner for the development and diffusion of clean technologies. Assuming the role of a 'prime mover' (Johnson & Jacobsson, 2000) it can initiate and contribute to the diffusion of new technologies.

Sub-theme		**Capabilities & resources**	**Company** S=SouthEnGroup L=LocalEnCo W=WestEnCo			**Value creation for the firm**			**Shared value creation**		
			S	**L**	**W**	**Cost Savings**	**Repu-tation**	**Future position**	**Transfer-ability**	**Co-ordination**	**Far-sighted-ness**
Cooperative IOrs	80	Capability to initiate and coordinate cooperative ventures with a wide range of actors in complex settings (acting as a prime mover).			X		X	X		X	
Formal & informal coop. relationship	81	Capability to engage in various types of cooperations to promote Clean Technology investments.	X		X			X		X	
	82	Capability to transform informal cooperations into formal and lasting arrangements (biogas business).			X			X		X	
Determinants of cooperation	83	Resource: Municipal support for Clean Technology development	X	X	X	X		X			
	84	Resource: Reputation as a trustworthy cooperation partner for Clean Technology ventures within the region	X				X	X			

Cooperation / Sustainability Vision

SouthEnGroup: Cooperation is part of the vision for sustainable growth of the group. Actual and potential cooperation partners are seen as resources that can be leveraged for growth and sustainable development goals. A corporate sustainability vision that explicitly embraces cooperation is well in line with the central idea held by academia (e.g. Hart, 1995) and other bodies that many societal actors need to get engaged if systemic changes towards sustainable development are to be achieved. Cooperation could also lead to that the sustainability vision is spread within the sphere of cooperation partners and in general lead to better possibilities to develop the region in a sustainable direction energy-wise.

LocalEnCo: Cooperation seems to be part of the business philosophy. The company wants to be a partner for customers, helping them to choose suitable products and use them in an appropriate way, furthering their own goals and values. Furthermore, the willingness to form part of a living community of energy companies requires openness for cooperation. This does not necessarily mean that the company's sustainability vision mirrors the industry's ideas on sustainability. Rather it enables the company to make a more sophisticated choice as to its sustainability vision and strategy, as it is better able to benchmark with other companies and identify opportunities.

WestEnCo: Cooperation enables the company to realize its vision to alter the system design towards a biogas society. Clear goals for biogas development have been established, whereas fossil gas should be phased out by 2050. It is therefore vital to achieve growth in this business line, for which cooperation is the development formula.

Sub-theme		**Capabilities & resources**	**Company** S=SouthEnGroup L=LocalEnCo W=WestEnCo			**Value creation for the firm**			**Shared value creation**		
			S	**L**	**W**	**Cost Savings**	**Repu-tation**	**Future position**	**Transfer-ability**	**Co-ordination**	**Far-sighted-ness**
Shared understanding	85	Capability to systematically seek cooperations in working towards a system transition.	X		X		X	X		X	
	86	Capability for cooperation within the energy sector	X	X	X	X		X	X	X	
Cooperative IOrs	87	Capability to leverage outside resources in promotion of organizational goals.	X			X		X			
	88	Resource: Open and receptive attitude towards entering into cooperations.	X	X	X			X			
	89	Resource: Cooperation as part of the vision for sustainable growth.	X					X			

Local Embeddedness / Emissions Reduction

SouthEnGroup: Local embeddedness shows in the use of local fuels and waste heat that results in a better utilization of local resources and less transportation. An additional benefit of local resource use is that the group can better control its risks attached to fuel purchases (compared to purchasing palm acid oil, which can give rise to potentially harmful environmental concerns with stakeholders). Moreover, being locally embedded gives better possibilities to influence customers' and stakeholders' behaviour towards reducing their environmental footprint. The close connection between politics and energy planning goals promotes locally beneficial solutions.

LocalEnCo: The company is the trump card for municipal energy planning aiming at emission reductions within community borders. This can be achieved both through the owner's directive and by agreeing on strategies and actions to reach the municipality's environmental goals. Another aspect of local embeddedness related to emission reductions is the use of local fuels, which obviously is preferable over transporting fuels over long distances, wasting energy for transportation.

WestEnCo: A number of aspects give relevance to local embeddedness in regards to emission reductions. The fact that the company's environmental goals are firmly anchored in the municipality's goals makes sure that the company's emission reduction efforts are locally embedded. Long-range engagement in emission reducing technology, e.g. district heating, has substantially contributed to better air quality locally. Furthermore, offering products that are produced and consumed locally, as is the case for biogas, naturally creates fewer emissions than importing fossil fuels. Besides, it helps the agricultural sector to reduce its emissions of methane from manure.

Sub-theme		**Capabilities & resources**	**Company** S=SouthEnGroup L=LocalEnCo W=WestEnCo			**Value creation for the firm**			**Shared value creation**		
			S	**L**	**W**	**Cost Savings**	**Repu-tation**	**Future position**	**Transfer-ability**	**Co-ordination**	**Far-sighted-ness**
Territorial embeddedness	90	Capability to take advantage of local renewable fuel resources.	X	X	X	X		X		X	
	91	Capability to improve the local environment.	X	X	X		X	X		X	X
Promotion of green energy at community level	92	Capability to motivate customer behavior towards renewable energy and efficiency.	X	X	X		X	X	X		
Embeddedness at municipal level	93	Resource: Goal alignment between municipality & company.	X	X	X	X		X		X	
Regional sustainable development	94	Capability to create infrastructure that facilitates emission reductions by others.	X	X	X			X		X	X
	95	Capability to achieve systemic emission reductions in other sectors (regional industries).			X			X	X		

Local Embeddedness / Product Stewardship

SouthEnGroup: A large part of the company products are embedded in the local production and consumption structure, for example the gas filling stations and infrastructure. The marketing strategy is to be close to consumers which involves that emphasis is put on service and quality which should add value that compensates for possibly slightly higher prices. The local focus and a reputation as a good corporate citizen with a strong community engagement should increase the possibilities for the group to reach out to the targeted customers and market its products. However, so far little efforts have been made to market the products more specifically with the help of environmental arguments.

LocalEnCo: Local embeddedness is a natural consequence of having district heating as an important line of business and the company mission to contribute to local welfare. It seems beneficial that local embeddedness, which could be seen as a limitation for business, is turned into an active strategy to strengthen the company profile and gain customer trust in its niche market. The company has initiated this journey by developing 'locally-produced electricity' labelled 'good environmental choice' as a new product. Local embeddedness allows the company to leverage its products and create a niche market that is inaccessible to competitors. Emphasizing the company's local embeddedness in several dimensions seems a valid strategy for the company.

WestEnCo: Infrastructural projects allow for a smooth deployment of the product strategy in the future. For example once biogas has the potential to replace natural gas it can be transported in the existing pipelines. An infrastructure that facilitates sustainable solutions enables other industries to become less polluting, e.g. shipping. At the same time LNG technology might become an interesting niche for WestEnCo to broaden its competencies.

Sub-theme		**Capabilities & resources**	**Company** S=SouthEnGroup L=LocalEnCo W=WestEnCo			**Value creation for the firm**			**Shared value creation**		
			S	**L**	**W**	**Cost Savings**	**Repu-tation**	**Future position**	**Transfer-ability**	**Co-ordination**	**Far-sighted-ness**
Territorial embeddedness	96	Capability to build up local infrastructure to deploy the product strategy	X	X	X			X		X	X
	97	Capability to form a product strategy based on local opportunities (niche-strategy/gas business/LNG).		X	X			X			X
Local identity as strategic asset	98	Capability to gain customer trust through local focus	X	X			X	X			
	99	Resource: Ambition to be a good corporate citizen	X	X	X		X	X			
	100	Capability to translate Clean Technology investments into new sustainable products.		X				X			X

Local Embeddedness / Clean Technology

SouthEnGroup: A locally embedded strategy is important for clean technology development as companies with a long history and track record of contributing to social welfare supposedly have better chances to get acceptance for new investment projects. There is, however, a risk for reputational damage from set-backs or disputes related to clean technology investments. If the Gravel Site plant can be built, it could make a considerable contribution to sustainable energy production in the Southern region. An additional effect of the project is that it would create a regional market for straw and hence an extra income for regional farmers (Simmons, 2008).

LocalEnCo: The local embeddedness of the clean technology investment Grove Hill creates opportunities for the municipality and local industry to develop their profile towards environmental sustainability. Moreover, local corporate ownership created favourable conditions for the financing of clean technology. Local embeddedness seems to offer a dimension of trust opening up possibilities for long-term sustainable solutions for the company and its customers alike.

WestEnCo: Carrying through investments in clean technology meets many challenges and getting support from the owner evidently is beneficial to solve the equation. As mentioned, political acceptance is key to the realization of clean technology investments. Naturally, also the financial back-up from the owner creates favourable conditions for the company to make the large investments required.

Sub-theme		**Capabilities & resources**	**Company** S=SouthEnGroup L=LocalEnCo W=WestEnCo			**Value creation for the firm**			**Shared value creation**		
			S	**L**	**W**	**Cost Savings**	**Repu-tation**	**Future position**	**Transfer-ability**	**Co-ordination**	**Far-sighted-ness**
Territorial embeddedness	101	Capability to transform the local energy system towards renewables.	X	X	X	X	X	X		X	X
Embeddedness at municipal level	102	Capability to involve local stakeholders in Clean Technology development.	X	X	X	X	X	X	X		
	103	Capability to gain political acceptance and support for Clean Technology projects.	X	X	X	X		X		X	
	104	Resource: Trust capital at the local level thanks to past social welfare contributions.	X	X		X	X	X			

Local Embeddedness / Sustainability Vision

SouthEnGroup: Being locally embedded is an established and important part of the group's sustainability vision. This vision comes closest to the notion of distributed economies where the power over the production system is exerted locally rather than determined externally. This results in that local or regional interests for the development of the energy system prevail instead of special interests of a non-local actor. The local government can through its influence over the energy company steer the development in a desirable direction, for example by setting other goals for the group than the maximization of returns. For instance stable workplaces could be a desirable aim or pursuing strategic expansion opportunities that benefit regional development. The group can add value to the region by offering complementary benefits (for example contributing with innovative energy solutions to attract the state of the art research site to the region). Despite essentially being an independent economic actor, it is important that the group and its business are firmly grounded in the local political environment in order to create a consensus over the development path for the region energy-wise.

LocalEnCo: The focus on sustainable returns and community benefits on commercial grounds is firmly anchored in the firm. Serving the community and being close to customers is a part of the company philosophy. The symbiosis between the company and the municipality seemed to open up for the realization of the sustainability vision through the investment in the Grove Hill plant which lies at its base. This required the alignment of the vision between the management, the board of directors and the municipal executive board. It is hypothesized that this is an outcome of lengthy social processes, whereas trust is built up as a result of long-standing mutual positive experience. Naturally, a company with a long history and firm roots in the community stands good chances of building up this trust.

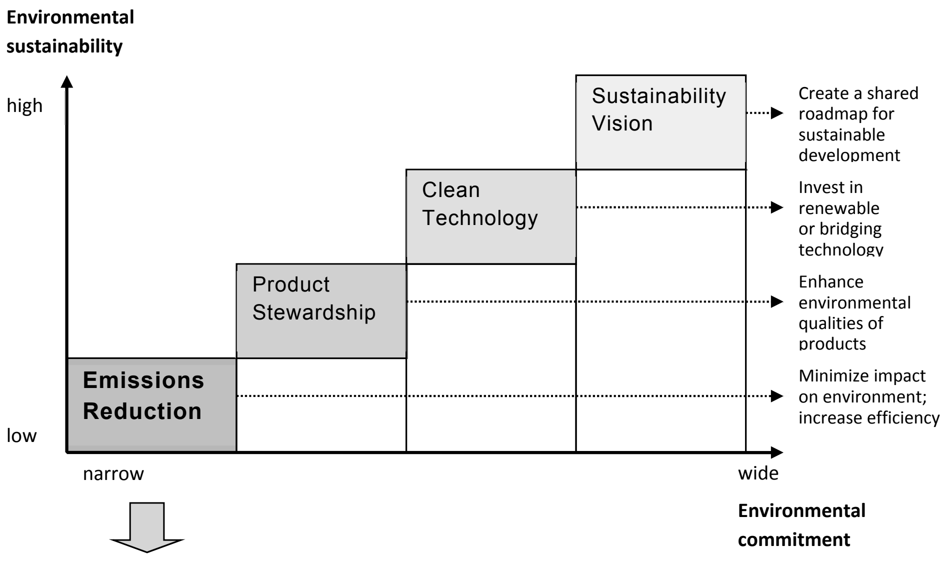
WestEnCo: The company's sustainability vision is embedded in the local context in many ways, which is expressed in a multitude of sustainability initiatives. Besides explicitly aiming at 'a sustainable Western society' the vision is anchored in the municipality's ambition to make Western Sweden a leading region for biogas.

Sub-theme		**Capabilities & resources**	**Company** S=SouthEnGroup L=LocalEnCo W=WestEnCo			**Value creation for the firm**			**Shared value creation**		
			S	**L**	**W**	**Cost Savings**	**Repu-tation**	**Future position**	**Transfer-ability**	**Co-ordination**	**Far-sighted-ness**
Territorial embeddedness	105	Resource: Local embeddedness is part of the sustainability vision.	X	X			X	X			
	106	Resource: Strong public welfare orientation	X	X			X	X			X
Regional sustainable development	107	Capability to create public welfare by contributing to local and regional sustainable development.	X	X	X		X	X		X	X
	108	Capability to embrace a vision that is firmly grounded in the development goals for the municipality or region.	X	X	X		X	X		X	

Appendix 4 – Capabilities according to conceptual area and greening mechanism

Conceptual area/ greening mechanism	Environmental integration	Communication & learning	Innovation	Cooperation	Local embeddedness	**Total number**
Emissions Reduction	12	7	4	3	6	**32**
Product Stewardship	2	4	5	4	5	**20**
Clean Technology	6	10	5	5	4	**30**
Sustainability Vision	4	8	5	5	4	**26**
Total number	**24**	**29**	**19**	**17**	**19**	**108**

Capabilities under Emissions Reduction



Environmental integration

- Technical capabilities for continuous improvement of environmental performance of the production system (S/W).
- Capability to integrate renewable fuels into technical systems (all).

- Capability to make use of low quality energy and local waste resources (S/W)
- Capability to continuously improve resource efficiency throughout the whole production system and the production-related value chain (W).
- Capability to build flexibility into the production system (fuel & system flexibility) (all)
- Capability to mitigate (price) risks from fossil fuel dependency (all)
- Capability for continuous environmental improvements due to systematic environmental management (all).
- Capability to embed continuous improvement of environmental behavior with employees (with the help of routines, incentive system) (all).
- Capability for integration of environmental concerns into steering documents and performance measurement (S).
- Capability to foster good environmental behavior with suppliers (all).
- Resource: Environmental manager as environmental champion (S/L).
- Resource: long-standing experience with certified environmental management system (ISO 14001) (S/W).

Communication & learning

- Capability to foster environmental awareness and commitment with employees related to their working tasks (with the help of environmental training) (all)
- Capability for close communication and cooperation between the environmental staff and plant operators (all)
- Capability to foster change thanks to an open communication climate facilitating employee involvement (S)
- Capability to coordinate environmental management throughout the organization (or group) (all)
- Capability to continuously develop environmental management through internal and external learning (community of practice) (all)
- Resource: employees who are knowledgeable and committed with regard to environmental issues (S/W)
- Resource: Green organizational culture (S/W)

Innovation

- Capability to integrate energy saving incentives in product and service offerings (innovative pricing models & demand side mgmt) (W)
- Capability for business model innovation (business idea to aid commercial customers to improve their env. performance) (L)
- Capability of detecting opportunities and providing emission reducing solutions to a wide range of industries (W)
- Capability to integrate emission reducing innovations in the larger production and consumption system = vertical integration of activities in the value chain (W)

Cooperation

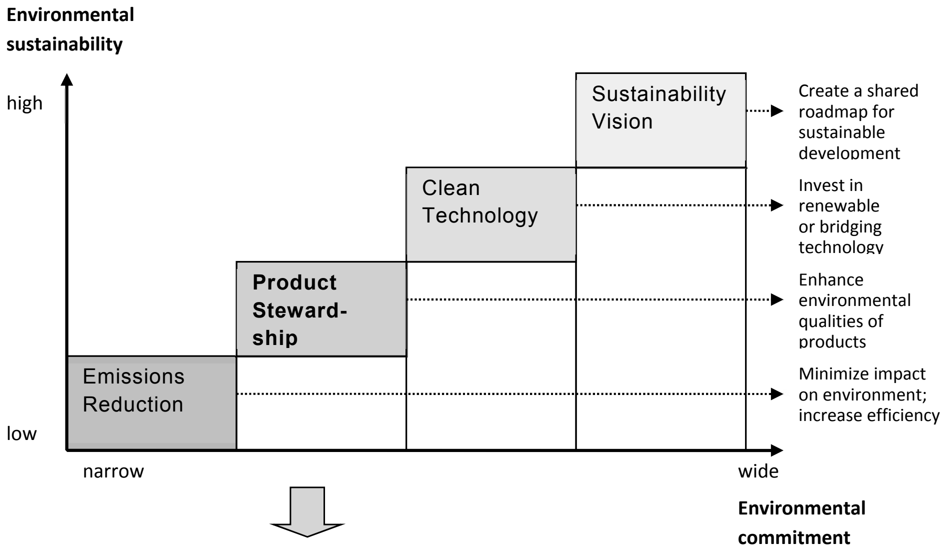
- Capability to enter into cooperative IORs for the purpose of integrating external sources of renewable or resource-efficient energy (S/W)
- Capability to cooperate with competitors for the efficient use of resources.(all)
- Resource: Reputation for trustworthiness and fairness, which facilitates entering into new cooperations (S)

Local Embeddedness

- Capability to take advantage of local renewable fuel resources (all)
- Capability to motivate customer behavior towards renewable energy and efficiency (all)
- Capability to improve the local environment (all)

- Capability to create an infrastructure that facilitates emission reductions by others (all)
- Capability to achieve systemic emission reductions in other sectors (regional industries) (W)
- Resource: Goal alignment between the municipality and the company (all)

Capabilities under Product Stewardship



Environmental integration

- Capability to think in terms of green products (all)
- Capability to translate process improvements into green products (L)

Communication & learning

- Capability to educate customers to chose environmentally friendly products and/or pay attention to resource efficiency issues (Stakeholder dialogue) (L/W)
- Resource: Strong ties and a shared worldview regarding efficient energy use with major customers (thanks to continuous dialogue) (W)
- Capability for environmental communication with stakeholders (all)
- Capability to find new business models based on energy services and/or green (environmentally-friendly or certified) products (L/W)

Innovation

- Capability to translate customer concerns into product improvements (all)
- Capability for phasing-in more sustainable products (all)
- Capability for systemic innovation across organizational units, leading to environmentally certified products (L)
- Resource: Service-mindedness, providing environmentally beneficial products at little extra cost (green product 'philantrophy') (L)
- Capability for energy service innovations (W)

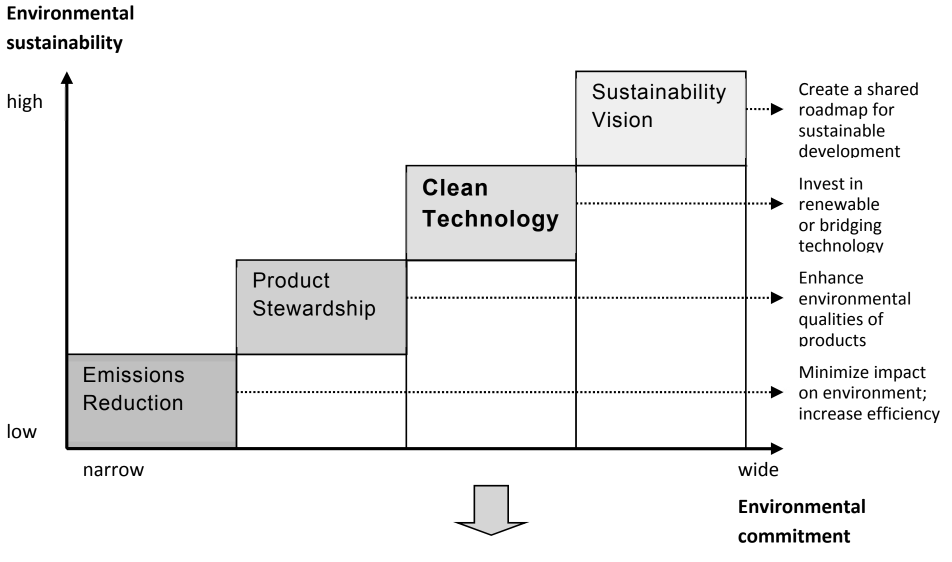
Cooperation

- Capability to develop products in cooperation with stakeholders (customers, NGOs) (all)
- Capability to institutionalize own working practices within the industry through cooperation and knowledge sharing (energy services) (W)
- Capability to strengthen the sustainability of products by way of cooperations (S/W)
- Capability to build up a new, growing business line (biogas) based on cooperations (W)

Local Embeddedness

- Capability to build up local infrastructure to deploy the product strategy (all)
- Capability to form a product strategy based on local opportunities (L/W)
- Capability to gain customer trust through local focus (S/L)
- Capability to translate Clean Technology investments into new sustainable products (L)
- Resource: Ambition to be a good corporate citizen (all)

Capabilities under Clean Technology



Environmental integration

- Capability to integrate environmental criteria in investment processes and decisions (all)
- Capability for a holistic assessment of pros and cons of Clean Technology investments (L)
- Capability to mitigate business risks from fossil fuel dependency (all)
- Capability to plan for the long run and take long-term consequences of investments into account (all)
- Capability to take a long-term perspective on environmentally beneficial investments due to lower demands for financial returns from owners (S)
- Resource: Acceptance of lower rates of return for environmentally benign investments that are considered as strategic (S/W)

Communication & learning

- Capability to play a leading role in lobbying for better conditions for the development of a sustainable energy system (W)
- Capability to disseminate knowledge and experience on new development areas for Clean Technology (W)
- Resource: Knowledgeable board committed to environmentally sustainable solutions (all)
- Resource: Alignment with owners on strategy for environmental sustainability for municipality or region (all)
- Capability to obtain favorable financing conditions for Clean Technology investments thanks to green profile, amongst others (all)
- Capability to work for public acceptance for Clean Technology projects (S/W)
- Capability to use Clean Technology as a marketing device to strengthen the green profile (L)
- Capability to accumulate knowledge about various renewable technologies and assess their relevance for the corporate strategy for environmental sustainability (S/W)
- Capability for 'learning by doing' (and by sharing experience) as to the biological and chemical processes in biogas ventures (being a forerunner) (W)
- Capability to coordinate new biogas ventures (prime mover) (W)

Innovation

- Capability to phase-in Clean Technology (based on renewables) to improve the environmental performance of products (referring to biogas) (S/W)
- Capability to venture into adjacent fields and new technologies (W)
- Capability to promote the development of cutting-edge Clean Technology in collaborative settings (W)
- Capability for systemic innovations, redesigning the production-consumption system (L/W)
- Resource: R & D involvement with external parties (W)

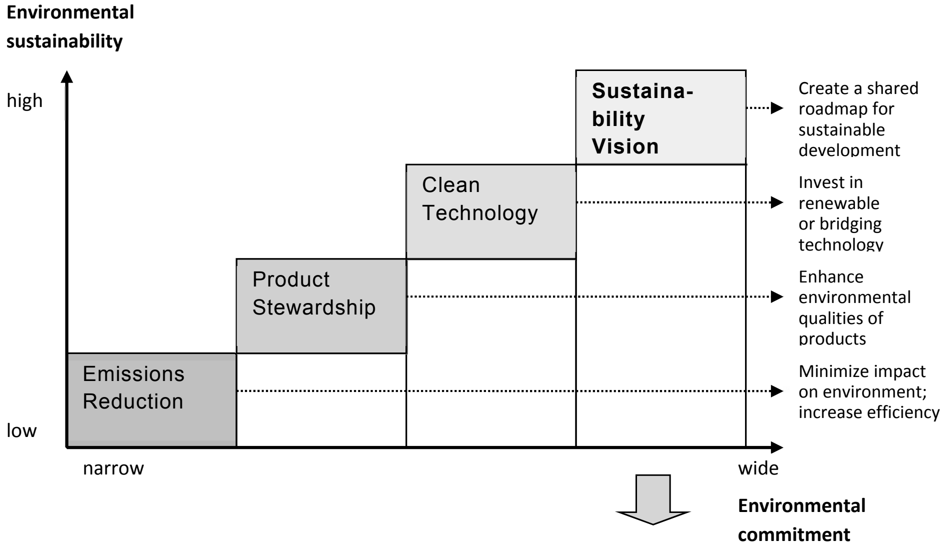
Cooperation

- Capability to initiate and coordinate cooperative ventures with a wide range of actors in complex settings (acting as a prime mover) (W)
- Capability to engage in various types of cooperations to promote Clean Technology investments (S/W)
- Capability to transform informal cooperations into formal and lasting arrangements (biogas business) (W)
- Resource: Municipal support for Clean Technology development (all)
- Resource: Reputation as a trustworthy cooperation partner for Clean Technology ventures within the region (S)

Local Embeddedness

- Capability to transform the local energy system towards renewables (all)
- Capability to involve local stakeholders in Clean Technology development (all)
- Capability to gain political acceptance and support for Clean Technology projects (all)
- Resource: Trust capital at the local level thanks to past social welfare contributions (S/L)

Capabilities under Sustainability Vision



Environmental integration

- Capability to envision a future with significantly lower environmental impact from corporate activities (all)
- Capability to operationalize the sustainability vision (all)
- Capability to embed the vision in the corporation (create alignment behind common goal) (S/W)
- Resource: Environment as a core value (all)

Communication & learning

- Capability to foster a green mindset with employees, aligned with corporate sustainability vision (all)
- Capability to communicate the sustainability vision to stakeholders (all)
- Resource: External network activities on various organizational levels (all)
- Capability to question and redefine business models and move beyond the traditional energy business (double loop learning) (S/W)
- Capability to manage a complex (creative) planning process regarding strategy making that should lead towards the vision (POMS) (W)
- Resource: The strong leader has the capability to embed the sustainability vision internally and externally (W)
- Capability to engage in the political dialogue on the climate debate and the future of the energy system (W)
- Resource: Commitment to assume the responsibility to embed a Swedish sustainability vision abroad regarding energy system development (W)

Innovation

- Capability to align employee efforts behind an ambitious vision (S)
- Capability to extend the sustainability vision beyond the corporation (all)

- Capability to work on a broad front and engage many actors in finding solutions that contribute to moving towards the sustainability vision (S/W)
- Resource: Vision to lie at the technological front edge (W)
- Resource: Ambitious vision that works as a roadmap for the change process (S)
- Preparedness to question and redefine business models and move beyond the traditional energy business (double loop learning) (S/W)

Cooperation

- Capability to systematically seek cooperations in working towards a system transition (S/W)
- Capability for cooperation within the energy sector (all)
- Capability to leverage outside resources in promotion of organizational goals and vision (S)
- Resource: Open and receptive attitude towards entering into cooperations (all)
- Resource: Cooperation as part of the vision for sustainable growth (S)

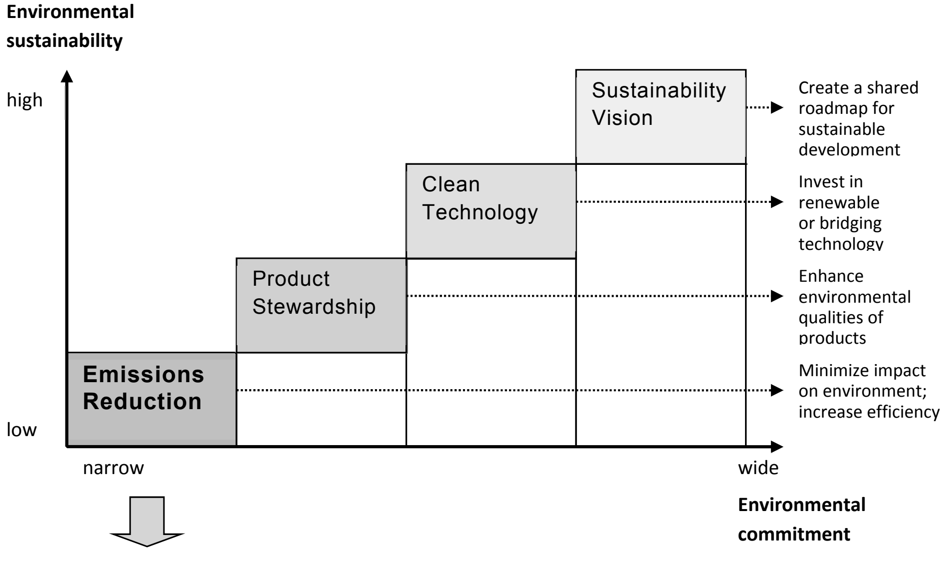
Local Embeddedness

- Resource: Local embeddedness is part of the sustainability vision (S/L)
- Resource: Public welfare orientation (S/L)
- Capability to create public welfare by contributing to local and regional sustainable development (all)
- Capability to enact a vision that is firmly grounded in the development goals for the municipality or region (all)

Appendix 5 - Capabilities SouthEnGroup

Conceptual area/ greening mecha-nism	Environmental integration	Communication & learning	Innovation	Cooperation	Local embeddedness	**Total number**
Emissions Reduction	10	7	-	3	5	**25**
Product Stewardship	1	1	1	2	3	**8**
Clean Technology	5	5	1	3	4	**18**
Sustainability Vision	4	3	4	5	4	**20**
Total number	**20**	**16**	**6**	**13**	**16**	**71**

Capabilities under Emissions Reduction



Environmental integration

- Technical capabilities for continuous improvement of environmental performance of the production system (S/W).
- Capability to integrate renewable fuels into technical systems (all).
- Capability to make use of low quality energy and local waste resources (S/W)

- Capability to build flexibility into the production system (fuel & system flexibility) (all)
- Capability to mitigate (price) risks from fossil fuel dependency (all)
- Capability for continuous environmental improvements due to systematic environmental management (all).
- Capability to embed continuous improvement of environmental behavior with employees (with the help of routines, incentive system) (all).
- Capability for integration of environmental concerns into steering documents and performance measurement (S).
- Capability to foster good environmental behavior with suppliers (all).
- Resource: Environmental manager as environmental champion (S/L).
- Resource: long-standing experience with certified environmental management system (ISO 14001) (S/W).

Communication & learning

- Capability to foster environmental awareness and commitment with employees related to their working tasks (with the help of environmental training) (all)
- Capability for close communication and cooperation between the environmental staff and plant operators (all)
- Capability to foster change thanks to an open communication climate facilitating employee involvement (S)
- Capability to coordinate environmental management throughout the organization (or group) (all)
- Capability to continuously develop environmental management through internal and external learning (community of practice) (all)
- Resource: employees who are knowledgeable and committed with regard to environmental issues (S/W)
- Resource: Green organizational culture (S/W)

Innovation

none

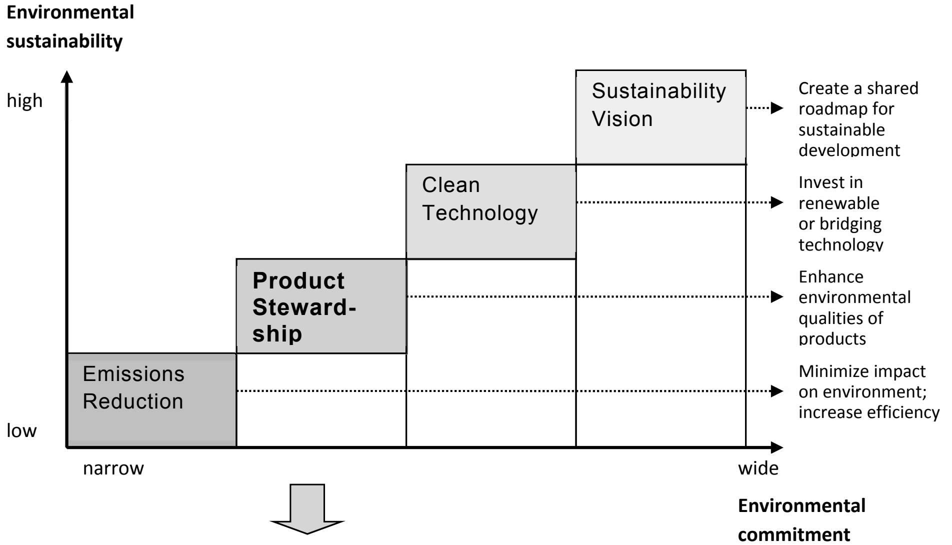
Cooperation

- Capability to enter into cooperative IORs for the purpose of integrating external sources of renewable or resource-efficient energy (S/W)
- Capability to cooperate with competitors for the efficient use of resources.(all)
- Resource: Reputation for trustworthiness and fairness, which facilitates entering into new cooperations (S)

Local Embeddedness

- Capability to take advantage of local renewable fuel resources (all)
- Capability to motivate customer behavior towards renewable energy and efficiency (all)
- Capability to improve the local environment (all)
- Capability to create an infrastructure that facilitates emission reductions by others (all)
- Resource: Goal alignment between the municipality and the company (all)

Capabilities under Product Stewardship



Environmental integration

- Capability to think in terms of green products (all)

Communication & learning

- Capability for environmental communication with stakeholders (all)

Innovation

- Capability to translate customer concerns into product improvements (all)
- Capability for phasing-in more sustainable products (all)

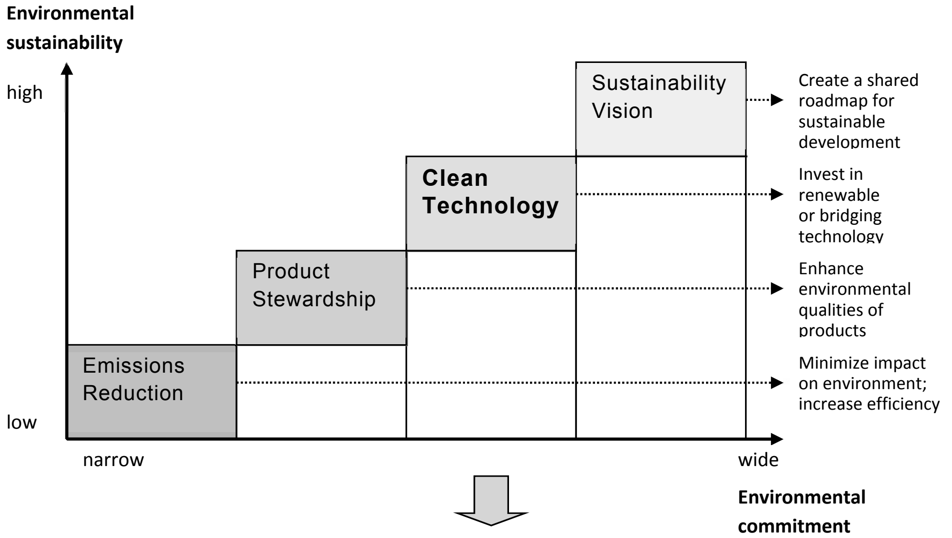
Cooperation

- Capability to develop products in cooperation with stakeholders (customers, NGOs) (all)
- Capability to strengthen the sustainability of products by way of cooperations (S/W)

Local Embeddedness

- Capability to build up local infrastructure to deploy the product strategy (all)
- Capability to gain customer trust through local focus (S/L)
- Resource: Ambition to be a good corporate citizen (all)

Capabilities under Clean Technology



Environmental integration

- Capability to integrate environmental criteria in investment processes and decisions (all)
- Capability to mitigate business risks from fossil fuel based technologies (all)
- Capability to plan for the long run and take long-term consequences of investments into account (all)
- Capability to take a long-term perspective on environmentally beneficial investments due to lower demands for financial returns from owners (S)
- Resource: Acceptance of lower rates of return for environmentally benign investments that are considered as strategic (S/W)

Communication & learning

- Resource: Knowledgeable board committed to environmentally sustainable solutions (all)
- Resource: Alignment with owners on strategy for environmental sustainability for municipality or region (all)
- Capability to obtain favorable financing conditions for Clean Technology investments thanks to green profile, amongst others (all)
- Capability to work for public acceptance for Clean Technology projects (S/W)
- Capability to accumulate knowledge about various renewable technologies and assess their relevance for the corporate strategy for environmental sustainability (S/W)

Innovation

- Capability to phase-in Clean Technology (based on renewables) to improve the environmental performance of products (referring to biogas) (S/W)

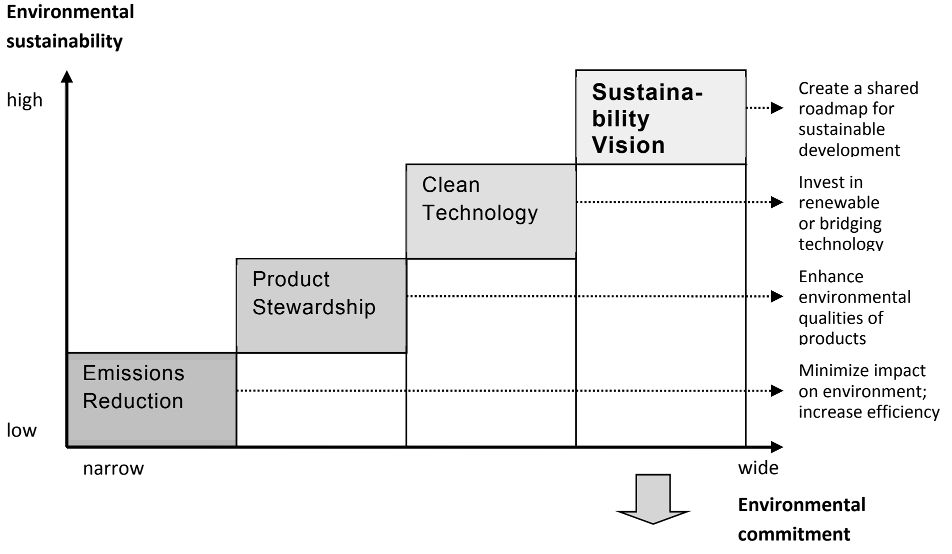
Cooperation

- Capability to engage in various types of cooperations to promote Clean Technology investments (S/W)
- Resource: Municipal support for Clean Technology development (all)
- Resource: Reputation as a trustworthy cooperation partner for Clean Technology ventures within the region (S)

Local Embeddedness

- Capability to transform the local energy system towards renewables (all)
- Capability to involve local stakeholders in Clean Technology development (all)
- Capability to gain political acceptance and support for Clean Technology projects (all)
- Resource: Trust capital at the local level thanks to past social welfare contributions (S/L)

Capabilities under Sustainability Vision



Environmental integration

- Capability to envision a future with significantly lower environmental impact from corporate activities (all)
- Capability to operationalize the sustainability vision (all)
- Capability to embed the vision in the corporation (create alignment behind common goal) (S/W)
- Resource: Environment as a core value (all)

Communication & learning

- Capability to foster a green mindset with employees, aligned with corporate sustainability vision (all)
- Capability to communicate the sustainability vision to stakeholders (all)
- Resource: External network activities on various organizational levels (all)

Innovation

- Capability to align employee efforts behind an ambitious vision (S)
- Capability to extend the sustainability vision beyond the corporation (all)
- Capability to work on a broad front and engage many actors in finding solutions that contribute to moving towards the sustainability vision (S/W)
- Resource: Ambitious vision that works as a roadmap for the change process (S)
- Preparedness to question and redefine business models and move beyond the traditional energy business (double loop learning) (S/W)

Cooperation

- Capability to systematically seek cooperations in working towards a system transition (S/W)
- Capability for cooperation within the energy sector (all)
- Capability to leverage outside resources in promotion of organizational goals and vision (S)
- Resource: Open and receptive attitude towards entering into cooperations (all)
- Resource: Cooperation as part of the vision for sustainable growth (S)

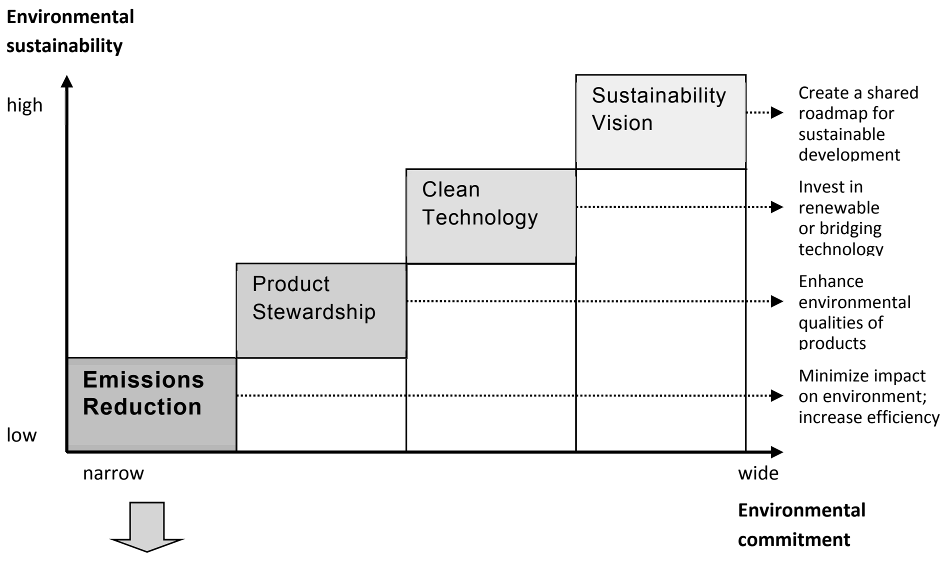
Local Embeddedness

- Resource: Local embeddedness is part of the sustainability vision (S/L)
- Resource: Public welfare orientation (S/L)
- Capability to create public welfare by contributing to local and regional sustainable development (all)
- Capability to enact a vision that is firmly grounded in the development goals for the municipality or region (all)

Appendix 6 – Capabilities LocalEnCo

Conceptual area/ greening mechanism	Environmental integration	Communication & learning	Innovation	Cooperation	Local embeddedness	**Total number**
Emissions Reduction	7	4	1	1	5	**18**
Product Stewardship	2	3	4	1	5	**15**
Clean Technology	4	4	1	1	4	**14**
Sustainability Vision	3	3	1	2	4	**13**
Total number	**16**	**14**	**7**	**5**	**18**	**60**

Capabilities under Emissions Reduction



Environmental integration

- Capability to integrate renewable fuels into technical systems (all).
- Capability to build flexibility into the production system (fuel & system flexibility) (all)
- Capability to mitigate (price) risks from fossil fuel dependency (all)

- Capability for continuous environmental improvements due to systematic environmental management (all).
- Capability to embed continuous improvement of environmental behavior with employees (with the help of routines, incentive system) (all).
- Capability to foster good environmental behavior with suppliers (all).
- Resource: Environmental manager as environmental champion (S/L).

Communication & learning

- Capability to foster environmental awareness and commitment with employees related to their working tasks (with the help of environmental training) (all)
- Capability for close communication and cooperation between the environmental staff and plant operators (all)
- Capability to coordinate environmental management throughout the organization (or group) (all)
- Capability to continuously develop environmental management through internal and external learning (community of practice) (all)

Innovation

- Capability for business model innovation (business idea to aid commercial customers to improve their environmental performance) (L)

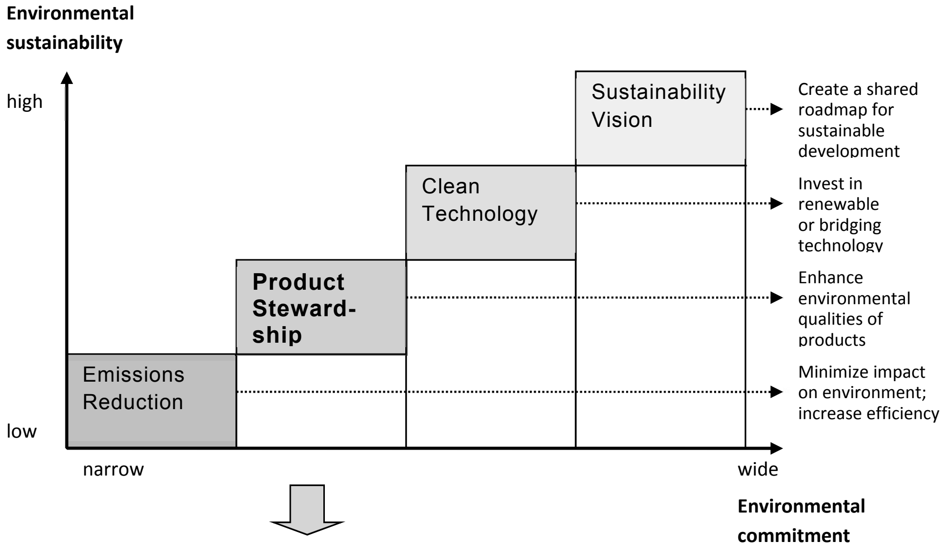
Cooperation

- Capability to cooperate with competitors for the efficient use of resources.(all)

Local Embeddedness

- Capability to take advantage of local renewable fuel resources (all)
- Capability to motivate customer behavior towards renewable energy and efficiency (all)
- Capability to improve the local environment (all)
- Capability to create an infrastructure that facilitates emission reductions by others (all)
- Resource: Goal alignment between the municipality and the company (all)

Capabilities under Product Stewardship



Environmental integration

- Capability to think in terms of green products (all)
- Capability to translate process improvements into green products (L)

Communication & learning

- Capability to educate customers to chose environmentally friendly products and/or pay attention to resource efficiency issues (Stakeholder dialogue) (L/W)
- Capability for environmental communication with stakeholders (all)
- Capability to find new business models based on energy services and/or green (environmentally-friendly or certified) products (L/W)

Innovation

- Capability to translate customer concerns into product improvements (all)
- Capability for phasing-in more sustainable products (all)
- Capability for systemic innovation across organizational units, leading to environmentally certified products (L)
- Resource: Service-mindedness, providing environmentally beneficial products at little extra cost (green product 'philantrophy') (L)

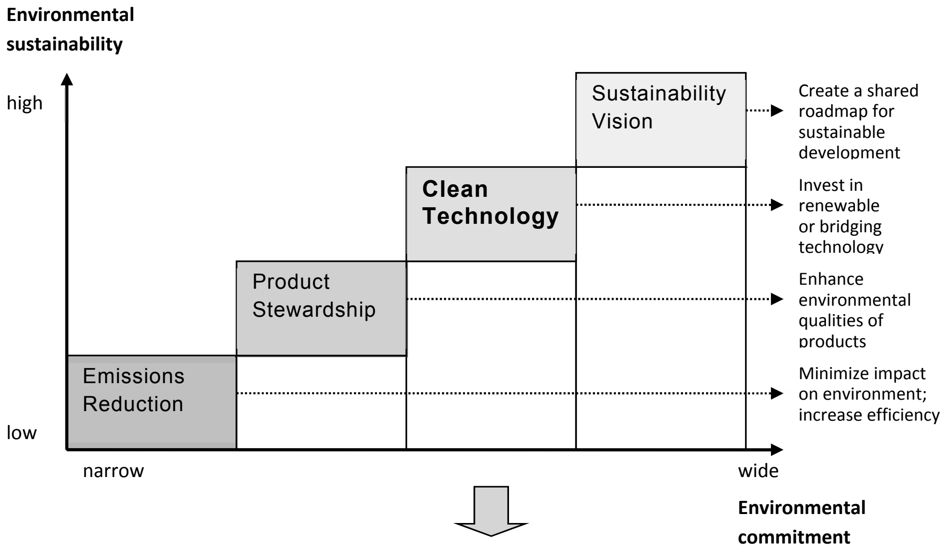
Cooperation

- Capability to develop products in cooperation with stakeholders (customers, NGOs) (all)

Local Embeddedness

- Capability to build up local infrastructure to deploy the product strategy (all)
- Capability to form a product strategy based on local opportunities (L/W)
- Capability to gain customer trust through local focus (S/L)
- Resource: Ambition to be a good corporate citizen (all)
- Capability to translate Clean Technology investments into new sustainable products (L)

Capabilities under Clean Technology



Environmental integration

- Capability to integrate environmental criteria in investment processes and decisions (all)
- Capability for a holistic assessment of pros and cons of Clean Technology investments (L)
- Capability to mitigate business risks from fossil fuel based technologies (all)
- Capability to plan for the long run and take long-term consequences of investments into account (all)

Communication & learning

- Resource: Knowledgeable board committed to environmentally sustainable solutions (all)
- Resource: Alignment with owners on strategy for environmental sustainability for municipality or region (all)
- Capability to obtain favorable financing conditions for Clean Technology investments thanks to green profile, amongst others (all)
- Capability to use Clean Technology as a marketing device to strengthen the green profile (L)

Innovation

- Capability for systemic innovations, redesigning the production-consumption system (L/W)

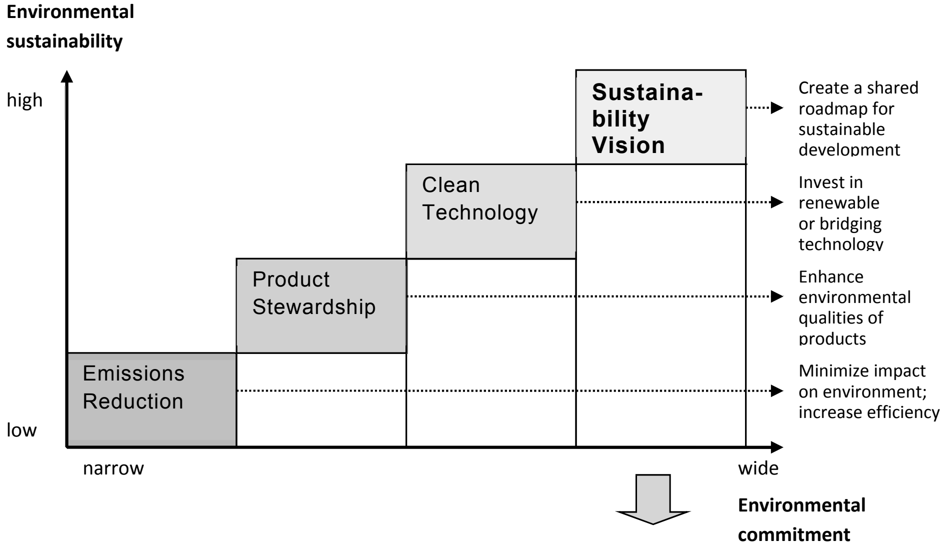
Cooperation

- Resource: Municipal support for Clean Technology development (all)

Local Embeddedness

- Capability to transform the local energy system towards renewables (all)
- Capability to involve local stakeholders in Clean Technology development (all)
- Capability to gain political acceptance and support for Clean Technology projects (all)
- Resource: Trust capital at the local level thanks to past social welfare contributions (S/L)

Capabilities under Sustainability Vision



Environmental integration

- Capability to envision a future with significantly lower environmental impact from corporate activities (all)
- Capability to operationalize the sustainability vision (all)
- Resource: Environment as a core value (all)

Communication & learning

- Capability to foster a green mindset with employees, aligned with corporate sustainability vision (all)
- Capability to communicate the sustainability vision to stakeholders (all)
- Resource: External network activities on various organizational levels (all)

Innovation

- Capability to extend the sustainability vision beyond the corporation (all)

Cooperation

- Capability for cooperation within the energy sector (all)
- Resource: Open and receptive attitude towards entering into cooperations (all)

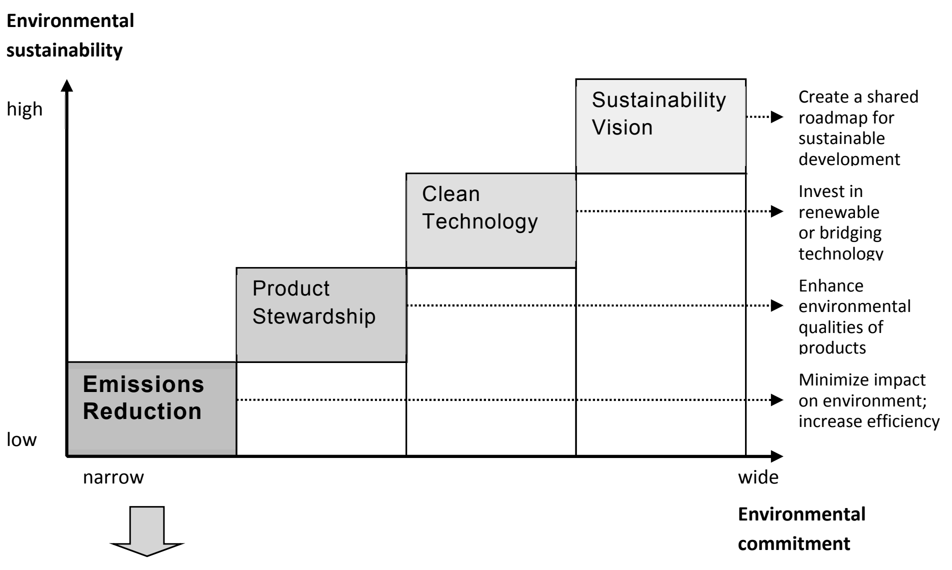
Local Embeddedness

- Resource: Local embeddedness is part of the sustainability vision (S/L)
- Resource: Public welfare orientation (S/L)
- Capability to create public welfare by contributing to local and regional sustainable development (all)
- Capability to enact a vision that is firmly grounded in the development goals for the municipality or region (all)

Appendix 7 – Capabilities WestEnCo

Conceptual area/ greening mechanism	Environmental integration	Communication & learning	Innovation	Cooperation	Local embeddedness	**Total number**
Emissions Reduction	9	6	3	2	6	**26**
Product Stewardship	1	4	3	4	3	**15**
Clean Technology	4	9	5	4	3	**25**
Sustainability Vision	4	7	4	3	2	**20**
Total number	**18**	**26**	**15**	**13**	**14**	**86**

Capabilities under Emissions Reduction



Environmental integration

- Technical capabilities for continuous improvement of environmental performance of the production system (S/W).
- Capability to integrate renewable fuels into technical systems (all)
- Capability to make use of low quality energy and local waste resources (S/W)
- Capability to continuously improve resource efficiency throughout the whole production system and the production-related value chain (W).
- Capability to build flexibility into the production system (fuel & system flexibility) (all)
- Capability to mitigate (price) risks from fossil fuel dependency (all)
- Capability for continuous environmental improvements due to systematic environmental management (all)
- Capability to embed continuous improvement of environmental behavior with employees (with the help of routines, incentive system) (all).
- Capability to foster good environmental behavior with suppliers (all)
- Resource: long-standing experience with certified environmental management system (ISO 14001) (S/W).

Communication & learning

- Capability to foster environmental awareness and commitment with employees related to their working tasks (with the help of environmental training) (all)
- Capability for close communication and cooperation between the environmental staff and plant operators (all)
- Capability to coordinate environmental management throughout the organization (or group) (all)
- Capability to continuously develop environmental management through internal and external learning (community of practice) (all)
- Resource: employees who are knowledgeable and committed with regard to environmental issues (S/W)
- Resource: Green organizational culture (S/W)

Innovation

- Capability to integrate energy saving incentives in product and service offerings (innovative pricing models & demand side mgmt) (W)
- Capability of detecting opportunities and providing emission reducing solutions to a wide range of industries (W)
- Capability to integrate emission reducing innovations in the larger production and consumption system = vertical integration of activities in the value chain (W)

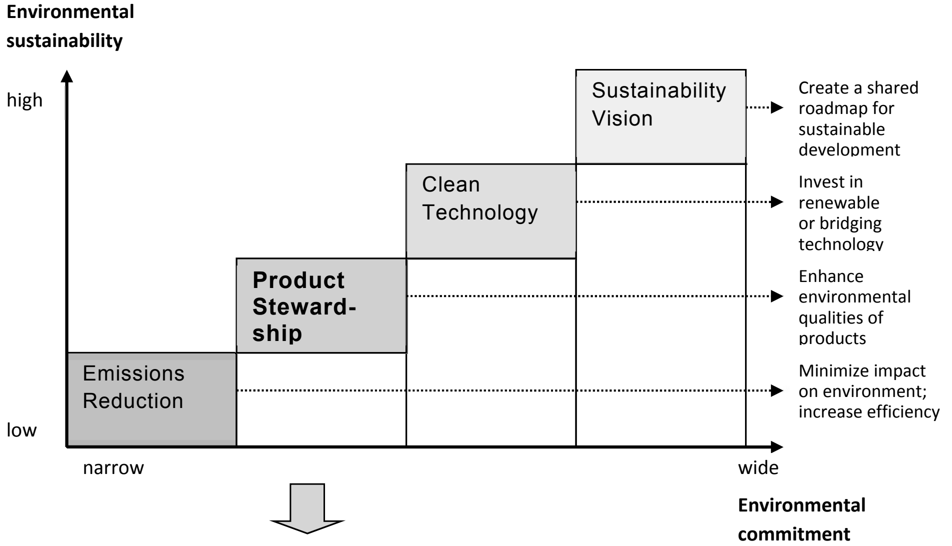
Cooperation

- Capability to enter into cooperative IORs for the purpose of integrating external sources of renewable or resource-efficient energy (S/W)
- Capability to cooperate with competitors for the efficient use of resources (all)

Local Embeddedness

- Capability to take advantage of local renewable fuel resources (all)
- Capability to motivate customer behavior towards renewable energy and efficiency (all)
- Capability to improve the local environment (all)
- Capability to create an infrastructure that facilitates emission reductions by others (all)
- Capability to achieve systemic emission reductions in other sectors (regional industries) (W)
- Resource: Goal alignment between the municipality and the company (all)

Capabilities under Product Stewardship



Environmental integration

- Capability to think in terms of green products (all)

Communication & learning

- Capability to educate customers to chose environmentally friendly products and/or pay attention to resource efficiency issues (Stakeholder dialogue) (L/W)
- Resource: Strong ties and a shared worldview regarding efficient energy use with major customers (thanks to continuous dialogue) (W)
- Capability for environmental communication with stakeholders (all)
- Capability to find new business models based on energy services and/or green (environmentally-friendly or certified) products (L/W)

Innovation

- Capability to translate customer concerns into product improvements (all)
- Capability for phasing-in more sustainable products (all)
- Capability for energy service innovations (W)

Cooperation

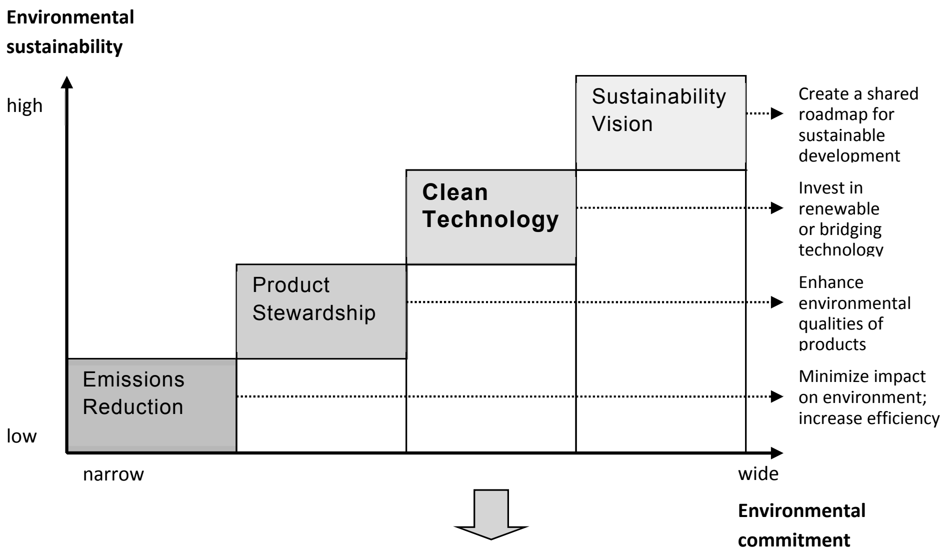
- Capability to develop products in cooperation with stakeholders (customers, NGOs) (all)
- Capability to institutionalize own working practices within the industry through cooperation and knowledge sharing (energy services) (W)
- Capability to strengthen the sustainability of products by way of cooperations (S/W)
- Capability to build up a new, growing business line (biogas) based on cooperations (W)

Local Embeddedness

- Capability to build up local infrastructure to deploy the product strategy (all)

- Capability to form a product strategy based on local opportunities (L/W)
- Resource: Ambition to be a good corporate citizen (all)
- Capability to translate Clean Technology investments into new products (L)

Capabilities under Clean Technology



Environmental integration

- Capability to integrate environmental criteria in investment processes and decisions (all)
- Capability to mitigate business risks from fossil fuel based technologies (all)
- Capability to plan for the long run and take long-term consequences of investments into account (all)
- Resource: Acceptance of lower rates of return for environmentally benign investments that are considered as strategic (S/W)

Communication & learning

- Capability to play a leading role in lobbying for better conditions for the development of a sustainable energy system (W)
- Capability to disseminate knowledge and experience on new development areas for Clean Technology (W)
- Resource: Knowledgeable board committed to environmentally sustainable solutions (all)
- Resource: Alignment with owners on strategy for environmental sustainability for municipality or region (all)
- Capability to obtain favorable financing conditions for Clean Technology investments thanks to green profile, amongst others (all)
- Capability to work for public acceptance for Clean Technology projects (S/W)
- Capability to accumulate knowledge about various renewable technologies and assess their relevance for the corporate strategy for environmental sustainability (S/W)
- Capability for 'learning by doing' (and by sharing experience) as to the biological and chemical processes in biogas ventures (being a forerunner) (W)
- Capability to coordinate new biogas ventures (prime mover) (W)

Innovation

- Capability to phase-in Clean Technology (based on renewables) to improve the environmental performance of products (referring to biogas) (S/W)
- Capability to venture into adjacent fields and new technologies (W)
- Capability to promote the development of cutting-edge Clean Technology in collaborative settings (W)
- Capability for systemic innovations, redesigning the production-consumption system (L/W)
- Resource: R & D involvement with external parties (W)

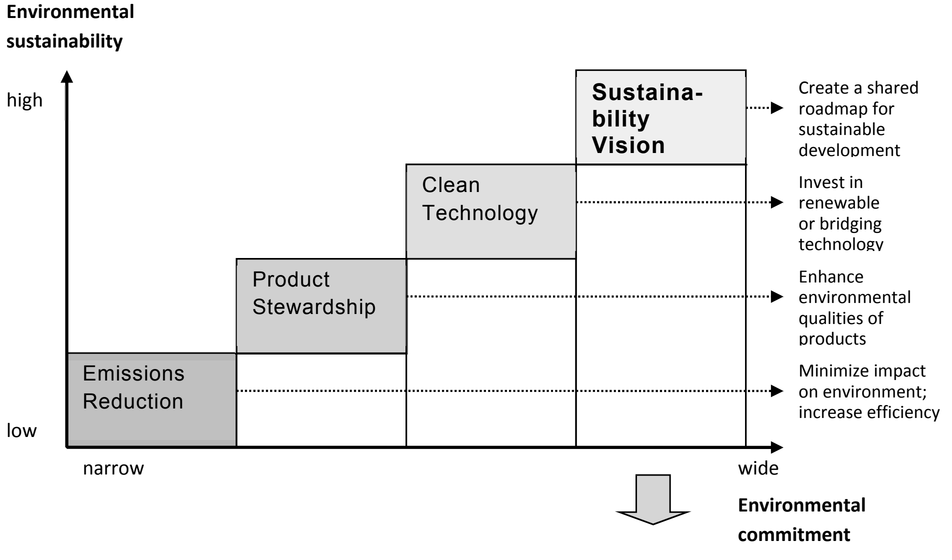
Cooperation

- Capability to initiate and coordinate cooperative ventures with a wide range of actors in complex settings (acting as a prime mover) (W)
- Capability to engage in various types of cooperations to promote Clean Technology investments (S/W)
- Capability to transform informal cooperations into formal and lasting arrangements (biogas business) (W)
- Resource: Municipal support for Clean Technology development (all)

Local Embeddedness

- Capability to transform the local energy system towards renewables (all)
- Capability to involve local stakeholders in Clean Technology development (all)
- Capability to gain political acceptance and support for Clean Technology projects (all)

Capabilities under Sustainability Vision



Environmental integration

- Capability to envision a future with significantly lower environmental impact from corporate activities (all)
- Capability to operationalize the sustainability vision (all)

- Capability to embed the vision in the corporation (create alignment behind common goal) (S/W)
- Resource: Environment as a core value (all)

Communication & learning

- Capability to foster a green mindset with employees, aligned with corporate sustainability vision (all)
- Capability to communicate the sustainability vision to stakeholders (all)
- Resource: External network activities on various organizational levels (all)
- Capability to manage a complex (creative) planning process regarding strategy making that should lead towards the vision (POMS) (W)
- Resource: The strong leader has the capability to embed the sustainability vision internally and externally (W)
- Capability to engage in the political dialogue on the climate debate and the future of the energy system (W)
- Resource: Commitment to assume the responsibility to embed a Swedish sustainability vision abroad regarding energy system development (W)

Innovation

- Capability to extend the sustainability vision beyond the corporation (all)
- Capability to work on a broad front and engage many actors in finding solutions that contribute to moving towards the sustainability vision (S/W)
- Resource: Vision to lie at the technological front edge (W)
- Preparedness to question and redefine business models and move beyond the traditional energy business (double loop learning) (S/W)

Cooperation

- Capability to systematically seek cooperations in working towards a system transition (S/W)
- Capability for cooperation within the energy sector (all)
- Resource: Open and receptive attitude towards entering into cooperations (all)

Local Embeddedness

- Capability to create public welfare by contributing to local and regional sustainable development (all)
- Capability to enact a vision that is firmly grounded in the development goals for the municipality or region (all)

Appendix 8 – Capabilities primarily creating firm value

(S=SouthEnGroup, L=LocalEnCo, and W=WestEnCo)

Greening mechanism / sub-theme	Capability/resource	S	L	W	Cost saving	Repu-tation	Future posit-ion
Environmental integration							
Technical integration	Technical capabilities for continuous improvement of environmental performance of the production system.	X		X	X	X	
	Capability to integrate renewable fuels into technical systems.	X	X	X	X	X	
	Capability to build flexibility into the production system (fuel & system flexibility)	X	X	X	X		X
	Capability to mitigate (price) risks from fossil fuel dependency	X	X	X	X		
Processual integration	Capability for continuous environmental improvements due to systematic environmental management (e.g. setting ambitious goals)	X	X	X	X	X	
	Capability to embed continuous improvement of environmental behavior with employees (with the help of routines, incentive system)	X	X	X	X	X	X
	Capability for integration of environmental concerns into steering documents and performance measurement (policies, integrated business & env. plans, BSC)	X					X
	Resource: Environmental manager acts as environmental champion, committed to continuously improving environmental performance & negotiating goals and opportunities for improvement with internal stakeholders. They own the environmental issues of the companies.	X	X		X		X
	Resource: long-standing experience with certified environmental management system (ISO 14001)	X		X	X		
	Capability to think in terms of green products	X	X	X		X	X
	Capability to integrate environmental criteria in investment processes and decisions	X	X	X		X	X
	Capability to mitigate business risks from fossil fuel based technologies	X	X	X	X		X
	Capability to envision a future with significantly lower environmental impact from corporate activities.	X	X	X			X
	Capability to operationalize the sustainability vision	X	X	X		X	X
	Capability to embed the vision in the corporation (create alignment behind common goal)	X		X	X	X	X
	Resource: Environment as a core value	X	X	X		X	X
Communication & learning							
Internal communication	Capability to foster environmental awareness and commitment with employees related to their working tasks (with the help of environmental training)	X	X	X	X		X
	Capability for close communication and cooperation between the environmental staff and plant operators	X	X	X	X		
	Capability to foster a green mindset with employees, aligned with corporate sustainability vision.	X	X	X	X		X

Open communication climate	Capability to foster change thanks to an open communication climate facilitating employee involvement	X			X		X
Dialogue	Resource: Knowledgeable board committed to environmentally sustainable solutions.	X	X	X			X
External environ-mental communi-cation	Capability to use Clean Technology as a marketing device to strengthen the green profile.		X			X	X
	Capability to obtain favorable financing conditions for Clean Technology investments thanks to green profile, amongst others.	X	X	X	X		X
Cognitive & behavioral development	Capability to manage a complex (creative) planning process regarding strategy making that should lead towards the sustainability vision (POMS)			X			X
Organizational learning	Capability to coordinate environmental management throughout the organization (or group)	X	X	X	X		X
	Resource: employees who are knowledgeable and committed with regard to environmental issues	X		X	X		X
	Resource: Green organizational culture	X		X	X	X	X
	Capability to accumulate knowledge about various renewable technologies and assess their relevance for the corporate strategy for environmental sustainability.	X		X			X
Innovation							
Management innovation	Capability to align employee efforts behind an ambitious vision.	X					X
	Resource: Ambitious vision that works as a roadmap for the change process.	X				X	X
Absorptive capacity	Capability to venture into adjacent fields and new technologies.			X			X
Cooperation							
Determinants of cooperation	Resource: Municipal support for Clean Technology development	X	X	X	X		X
	Resource: Reputation as a trustworthy cooperation partner for Clean Technology ventures within the region	X				X	X
Cooperative IOrs	Capability to leverage outside resources in promotion of organizational goals.	X			X		X
	Resource: Open and receptive attitude towards entering into cooperations.	X	X	X			X
	Resource: Cooperation as part of the vision for sustainable growth.	X					X
Local embeddedness							
Territorial embeddedness	Resource: Local embeddedness is part of the sustainability vision.	X	X			X	X
Local identity as strategic asset	Capability to gain customer trust through local focus	X	X			X	X
	Resource: Ambition to be a good corporate citizen	X	X	X		X	X
Embeddedness at municipal level	Resource: Trust capital at the local level thanks to past social welfare contributions.	X	X		X	X	X

Appendix 9 – Capabilities creating shared value

(S=SouthEnGroup, L=LocalEnCo, and W=WestEnCo)

Greening mechanism / sub-theme	Capability/resource	S	L	W	Trans-ferabi-lity	Coor-dina-tion	Far-sightedn.
Environmental integration							
Technical integration	Capability to continuously improve resource efficiency throughout the whole production system and the production-related value chain			X		X	
	Capability to make use of low quality energy and local waste resources	X		X		X	
Processual integration	Capability to translate process improvements into green products		X				X
	Capability for a holistic assessment of pros and cons of Clean Technology investments		X				X
	Capability to plan for the long run and take long-term consequences of investments into account	X	X	X			X
	Capability to take a long-term perspective on environmentally beneficial investments due to lower demands for financial returns from owners.	X					X
	Resource: Acceptance of lower rates of return for environmentally benign investments that are considered as strategic.	X		X			X
Supply chain measures	Capability to foster good environmental behavior with suppliers.	X	X	X	X		
Communication & learning							
External environmental communication	Capability for environmental communication with stakeholders	X	X	X	X		
	Capability to work for public acceptance for Clean Technology projects.	X		X	X		
	Capability to communicate sustainability vision to stakeholders.	X	X	X	X		
	Resource: External network activities on various organizational levels	X	X	X		X	
Dialogue	Capability to educate customers to chose environmentally friendly products and/or pay attention to resource efficiency issues (Stakeholder dialogue)		X	X	X		
	Resource: Strong ties and a shared worldview regarding efficient energy use with major customers (thanks to continuous dialogue).			X	X		
	Capability to play a leading role in lobbying for better conditions for the development of a sustainable energy system.			X		X	
	Capability to disseminate knowledge and experience on new development areas for Clean Technology.			X	X		

	Resource: Alignment with owners on strategy for environmental sustainability for municipality or region.	X	X	X		X	X
Organizational learning	Capability to continuously develop environmental management through internal and external learning (through networks and community of practice)	X	X	X	X		
Cognitive & behavioral development	Capability for learning by doing (and by sharing experience) as to the biological and chemical processes in biogas ventures (being a forerunner).			X		X	X
	Capability to question and redefine business models and move beyond the traditional energy business (double loop learning)	X		X			X
	Resource: The strong leader has the capability to embed the sustainability vision internally and externally.			X	X		
	Capability to engage in the political dialogue on the climate debate and the future of the energy system.			X		X	
	Resource: Commitment to assume the responsibility to embed a Swedish sustainability vision abroad regarding energy system development.			X		X	
Learning types	Capability to find new business models based on energy services and/or green (environmentally-friendly or certified) products.		X	X			X
Interfirm learning	Capability to coordinate new biogas ventures (prime mover).			X		X	
Innovation							
Mgmt innovation	Capability to integrate energy saving incentives in product and service offerings (innovative pricing models & demand side management).			X	X		
	Capability for business model innovation (increase product quality through certifications, aid commercial customers to improve their env. performance).		X				X
Open innovation	Capability to translate customer concerns into product improvements.	X	X	X		X	
Absorptive capacity	Capability of detecting opportunities and providing emission reducing solutions to a wide range of industries.			X	X		
	Capability to phase-in Clean Technology (based on renewables) to improve the environmental performance of products (referring to biogas).	X		X			X
Type of innovation	Capability for phasing-in more sustainable products	X	X	X			X
	Capability for energy services innovations			X	X	X	
	Capability for systemic innovation across organizational units, leading to environmentally certified products.		X				X

	Resource: Service-mindedness, providing environmentally beneficial products at little extra cost (green product 'philantrophy').		X				X
	Capability to promote the development of cutting-edge Clean Technology in collaborative settings.			X		X	
	Capability for systemic innovations, redesigning the production-consumption system.		X	X		X	
	Resource: R & D involvement with external parties			X		X	
Degree of innovation	Capability to integrate emission reducing innovations in the larger production and consumption system = vertical integration of activities in the value chain (integrate at raw material side & customer side, e.g. biogas into fuelgas = system innovation)				X		
	Capability to extend the sustainability vision beyond the corporation.	X	X	X	X		
	Capability to work on a broad front and engage many actors in finding solutions that contribute to moving towards the sustainability vision.	X		X		X	
	Resource: Vision to lie at the technological front edge.			X			X
Cooperation							
Shared understanding	Capability to develop products in cooperation with stakeholders (customers, NGOs).	X	X	X		X	
	Capability to institutionalize own working practices within the industry through cooperation and knowledge sharing (energy services).			X	X		
	Capability to systematically seek cooperations in working towards a system transition.	X		X		X	
	Capability for cooperation within the energy sector	X	X	X	X	X	
Cooperative IOrs	Capability to enter into cooperative IORs for the purpose of integrating external sources of renewables or resource-efficient energy.	X		X		X	
	Capability to strengthen the sustainability of products by way of cooperations.	X		X		X	
	Capability to build up a new, growing business line (biogas) based on cooperations.			X		X	X
	Capability to initiate and coordinate cooperative ventures with a wide range of actors in complex settings (acting as a prime mover).			X		X	
Formal & informal cooperative relation-ship	Capability to engage in various types of cooperations to promote Clean Technology investments	X		X		X	
	Capability to transform informal cooperations into formal and lasting arrangements (biogas business).			X		X	

Determinants of cooperation	Resource: Reputation for trustworthiness and fairness, which facilitates entering into new cooperations.	X					X
Cooperation related to the operational business of energy companies	Capability to cooperate with competitors for the efficient use of resources.	X	X	X		X	
Local embeddedness							
Territorial embeddedness	Capability to take advantage of local renewable fuel resources.	X	X	X		X	
	Capability to improve the local environment.	X	X	X		X	X
	Capability to build up local infrastructure to deploy the product strategy	X	X	X		X	X
	Capability to form a product strategy based on local opportunities (niche-strategy/gas business/LNG).		X	X			X
	Resource: Public welfare orientation	X	X				X
	Capability to transform the local energy system towards renewables.	X	X	X		X	X
Promotion of green energy at community level	Capability to motivate customer behavior towards renewable energy and efficiency.	X	X	X	X		
Local identity as strategic asset	Capability to translate Clean Technology investments into new sustainable products.		X				X
Embeddedness at municipal level	Resource: Goal alignment between municipality & company.	X	X	X		X	
	Capability to achieve systemic emission reductions in other sectors (regional industries).			X			X
	Capability to involve local stakeholders in Clean Technology development.	X	X	X	X		
	Capability to gain political acceptance and support for Clean Technology projects.	X	X	X		X	
Regional sustain-able development	Capability to create infrastructure that facilitates emission reductions by others.	X	X	X		X	X
	Capability to create public welfare by contributing to local and regional sustainable development.	X	X	X		X	X
	Capability to embrace a vision that is firmly grounded in the development goals for the municipality or region.	X	X	X		X	

Appendix 10: Generic capabilities

Greening mechanism / sub-theme	Generic capability/resource
Environmental integration	
Technical integration	Capability to integrate renewable fuels into technical systems.
	Capability to build flexibility into the production system (fuel & system flexibility)
	Capability to mitigate (price) risks from fossil fuel dependency
Processual integration	Capability for continuous environmental improvements due to systematic environmental management (e.g. setting ambitious goals)
	Capability to embed continuous improvement of environmental behavior with employees (routines, incentive system)
	Resource: Environment as a core value
	Capability to think in terms of green products
	Capability to integrate environmental criteria in investment processes and decisions
	Capability to take long-run considerations and effects of investments into account
	Capability to mitigate business risks from fossil fuel based technologies
	Capability to envision a future with significantly lower environmental impact from corporate activities
	Capability to operationalize the sustainability vision
Supply chain measures	Capability to foster good environmental behavior with suppliers.
Communication & learning	
Internal communication	Capability to foster environmental awareness and commitment with employees related to their working tasks
	Capability for close communication and cooperation between the environmental staff and plant operators
	Capability to foster a green mindset with employees, aligned with corporate sustainability vision.
External environmental communication	Capability for environmental communication with stakeholders
	Resource: External network activities on various organizational levels
	Resource: Knowledgeable board committed to environmentally sustainable solutions.
	Resource: Alignment with owners on strategy for environmental sustainability for municipality or region.
	Capability to obtain favorable financing conditions for Clean Technology investments thanks to green profile, amongst others.
	Capability to communicate sustainability vision to stakeholders.
Organizational learning	Capability to coordinate environmental management throughout the organization (or group)
	Capability to continuously develop environmental management through internal and external learning (community of practice)
Innovation	
Open innovation	Capability to translate customer concerns into product improvements.
Degree of innovation	Capability to extend the sustainability vision beyond the corporation.
Type of innovation	Capability for phasing-in more sustainable products.
Cooperation	
Shared understanding	Capability to develop products in cooperation with stakeholders (customers, NGOs).
	Capability for cooperation within the energy sector
	Resource: Open and receptive attitude towards entering into cooperations.
Determinants of cooperation	Resource: Municipal support for Clean Technology development

Cooperation related to the operational business of energy companies	Capability to cooperate with competitors for the efficient use of resources.
Local embeddedness	
Territorial embeddedness	Capability to take advantage of local renewable fuel resources.
	Capability to improve the local environment.
	Capability to build up local infrastructure to deploy the product strategy
	Capability to transform the local energy system towards renewables.
Promotion of green energy at community level	Capability to motivate customer behavior towards renewable energy and efficiency.
Local identity as strategic asset	Resource: Ambition to be a good corporate citizen
Embeddedness at municipal level	Resource: Goal alignment between municipality & company.
	Capability to involve local stakeholders in Clean Technology development.
	Capability to gain political acceptance and support for Clean Technology projects.
Regional sustainable development	Capability to create infrastructure that facilitates emission reductions by others.
	Capability to create public welfare by contributing to local and regional sustainable development.
	Capability to embrace a vision that is firmly grounded in the development goals for the municipality or region.

Appendix 11: Firm-specific capabilities

(S=SouthEnGroup, L=LocalEnCo, and W=WestEnCo).

Greening mechanism / sub-theme	Firm-specific capability/resource	Com-pany
Environmental integration		
Technical integration	Capability to continuously improve resource efficiency throughout the whole production system and the production-related value chain (system perspective).	W
Processual integration	Capability for integration of environmental concerns into steering documents and performance measurement (policies, integrated business & environmental plans, BSC)	S
	Capability to translate process improvements into green products	L
	Capability for a holistic assessment of pros and cons of Clean Technology investments	L
	Capability to take a long-term perspective on environmentally beneficial investments due to lower demands for financial returns from owners.	S
Communication & learning		
Internal communication	Capability to foster change thanks to an open communication climate facilitating employee involvement	S
Dialogue	Resource: Strong ties and a shared worldview regarding efficient energy use with major customers (thanks to continuous dialogue).	W
	Capability to play a leading role in lobbying for better conditions for the development of a sustainable energy system.	W
	Capability to disseminate knowledge and experience on new development areas for Clean Technology.	W
External environmental communicaiton	Capability to use Clean Technology as a marketing device to strengthen the green profile.	L
	Capability for learning by doing (and by sharing experience) as to the biological and chemical processes in biogas ventures. (being a forerunner)	W
Interfirm learning	Capability to coordinate new biogas ventures (prime mover).	W
Cognitive & behavioral development	Capability to manage a complex (creative) planning process regarding strategy making that should lead towards the sustainability vision (POMS)	W
	Resource: The strong leader has the capability to embed the sustainability vision internally and externally.	W
	Capability to engage in the political dialogue on the climate debate and the future of the energy system.	W
	Resource: Commitment to assume the responsibility to embed a Swedish sustainability vision abroad regarding energy system development.	W
Innovation		
Management innovation	Capability to integrate energy saving incentives in product and service offerings (innovative pricing models & demand side mgmt).	W
	Capability for business model innovation (increase product quality through certifications, aid commercial customers to improve their environmental performance).	L
	Capability to align employee efforts behind an ambitious vision.	S
	Resource: Ambitious vision that works as a roadmap for the change process.	S
Absorptive capacity	Capability of detecting opportunities and providing emission reducing solutions to a wide range of industries.	W
Degree of innovation	Capability to integrate emission reducing innovations in the larger production and consumption system = vertical integration of activities in the value chain (integrate at raw material side & customer side, e.g. biogas into fuelgas = system innovation)	W

	Resource: Vision to lie at the technological front edge.	W
Type of innovation	Capability for energy service innovations	W
	Capability for systemic innovation across organizational units, leading to environmentally certified products.	L
	Resource: Service-mindedness, providing environmentally beneficial products at little extra cost (green product 'philantrophy').	L
	Resource: R & D involvement with external parties	W
Absorptive capacity	Capability to venture into adjacent fields and new technologies.	W
	Capability to promote the development of cutting-edge Clean Technology in collaborative settings.	W
Cooperation		
Shared understanding	Capability to institutionalize own working practices within the industry through cooperation and knowledge sharing (energy services).	W
Determinants of cooperation	Resource: Reputation for trustworthiness and fairness, which facilitates entering into new cooperations.	S
	Resource: Reputation as a trustworthy cooperation partner for Clean Technology ventures within the region	S
Cooperative IORs	Capability to build up a new, growing business line (biogas) based on cooperations.	W
	Capability to initiate and coordinate cooperative ventures with a wide range of actors in complex settings (acting as a prime mover).	W
	Capability to leverage outside resources in promotion of organizational goals.	S
	Resource: Cooperation as part of the vision for sustainable growth.	S
Formal & informal cooperative relationship	Capability to transform informal cooperations into formal and lasting arrangements (biogas business).	W
Local embeddedness		
Regional sustainable development	Capability to achieve systemic emission reductions in other sectors (regional industries).	W
Local identity as strategic asset	Capability to translate Clean Technology investments into new sustainable products.	L