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Pension Capital in Cleantech?

A study of factors obstructing Swedish National Pension
Funds from investing in Clean Technology

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Abstract

Prior research on investments in clean technology (cleantech) has mainly focused on issues surrounding investments by venture capitalists. This study instead aims to study issues related to institutional investments in cleantech, specifically those made by the Swedish National Pension Funds – the AP funds. The study has its foundation in the fact that increased investments in clean technologies are vital if the world is going to succeed with realizing the vision of stopping global warming. Bearing this fact in mind, the outlook for the cleantech sector seems optimistic. Due to several reasons though, investors are often reluctant towards investing in cleantech. This study is based on the premise that the investment decisions of the AP funds are affected by two main categories of factors; (i) political factors, and (ii) market factors. These two categories consist of seven sub-factors identified through an abductive process where literature studies and empirical material are alternated. These sub-factors are used as a framework when analyzing the empirical material, which was collected through deep interviews with representatives in leading positions at five of the six AP funds. The results conclude that five out of the seven sub-factors have a negative effect on the AP funds' investments in cleantech. These are; (i) emission reduction targets, (ii) incentive programs, (iii) pension fund governance, (iv) information asymmetry, and (v) innovation and business risks.

Key words: Institutional investor, Pension fund, Swedish AP fund, Cleantech, Investment

Contents

1. INTRODUCTION.....	1
1.1 RESEARCH QUESTION, OBJECTIVE AND CONTRIBUTION.....	3
1.2 DELIMITATIONS.....	3
1.3 OUTLINE.....	3
2. RESEARCH METHOD	5
2.1 RESEARCH DESIGN.....	5
2.1.1 <i>Research Data</i>	5
2.1.2 <i>Analytical Framework</i>	6
2.2 VALIDITY.....	7
2.3 RELIABILITY.....	8
3. THE CLEAN TECHNOLOGY SECTOR	9
3.1 THE CLEANTECH CONCEPT.....	9
3.2 INTERNATIONAL CLEANTECH MARKET TRENDS.....	10
3.3 SWEDISH CLEANTECH MARKET TRENDS.....	11
4. THE SWEDISH NATIONAL PENSION FUNDS – THE AP FUNDS.....	13
4.1. THE SWEDISH PENSION SYSTEM.....	13
4.2 SWEDISH PENSION FUND GOVERNANCE.....	13
4.3 INVESTMENT DIRECTIVES.....	14
5. FACTORS AFFECTING INVESTMENT DECISIONS IN CLEANTECH.....	17
5.1 POLITICAL FACTORS.....	17
5.1.1 <i>Climate Change</i>	17
5.1.2 <i>Emission Reduction Targets</i>	17
5.1.3 <i>Incentive Programs</i>	19
5.1.4 <i>Pension Fund Governance</i>	19
5.2 MARKET FACTORS.....	20
5.2.1 <i>Increased Costs for Fossil Fuel</i>	20
5.2.2 <i>Information Asymmetry</i>	21
5.2.3 <i>Innovation and Business Risk</i>	22
6. EMPIRICAL RESULTS	25
6.1 POLITICAL FACTORS.....	25
6.1.1 <i>Climate Change</i>	25
6.1.2 <i>Emission Reduction Targets</i>	26
6.1.3 <i>Incentive Programs</i>	28
6.1.4 <i>Pension Fund Governance</i>	30
6.2 MARKET FACTORS.....	32
6.2.1 <i>Increased Costs for Fossil Fuel</i>	32
6.2.2 <i>Information Asymmetry</i>	33
6.2.3 <i>Innovation and Business Risk</i>	35
7. CONCLUSION.....	41
7.1 FINDINGS.....	41
7.1.1 <i>Political factors</i>	41

7.1.2 <i>Market Factors</i>	42
7.2 CONCLUDING DISCUSSION.....	43
7.3 CRITIQUE.....	45
7.4 FUTURE RESEARCH.....	45
LIST OF REFERENCES	47
APPENDIX I: INTERVIEW GUIDE	53
APPENDIX II: GLOSSARY & ABBRIVATIONS	55

List of Tables

TABLE 2.1: INTERVIEW RESPONDENTS	6
TABLE 2.2: ANALYTICAL SCHEME.....	7
TABLE 4.1: INVESTMENT DIRECTIVES 1 ST THROUGH 4 TH AP FUNDS.....	14
TABLE 4.2: INVESTMENT DIRECTIVES 6 TH AP FUND.....	15
TABLE 7.1: POLITICAL FACTOR FINDINGS.....	41
TABLE 7.2: MARKET FACTOR FINDINGS	43

List of Figures

FIGURE 3.1: GLOBAL INVESTMENTS IN RENEWABLE ENERGY 2004-2008	10
FIGURE 3.2: SWEDISH CLEANTECH INVESTMENTS IN 2008 (VENTURE CAPITAL)	11
FIGURE 3.3: SWEDISH CLEANTECH SECTOR (NUMBER OF COMPANIES; %)	12
FIGURE 4.1: THE SWEDISH PENSION SYSTEM	13

1. Introduction

1.1 Problem Context

In order to stop global warming from exceeding an average increase in mean temperature of two degrees Celsius and stabilize the amount of GHGs in the atmosphere to 450 parts per million (ppm), the United Nations Framework Convention on Climate Change (UNFCCC) states that more than \$200 billions of additional investments will be needed annually until 2030 in order to return GHGs to its current level (UNFCCC, 2008). Moreover, the International Energy Agency claim that, between 2010 and 2030, additional investments at a level of \$10.5 trillion is required in the renewable energy sector to stop global warming (IEA, 2009). These reports indicate that in order to reach the goal of not exceeding the two-degree temperature increase, further development towards a low-carbon economy will have to be made. According to the World Watch Institute, the transition away from a high-carbon economy involves a twofold strategy; (i) innovations that reduce the amount energy required through increased energy efficiency, and (ii) innovations in renewable resources (Worldwatch Institute, 2009). The sector that invents as well as produces these innovations is the clean technology sector. Clean Technologies (Cleantech) are new technologies and related business models that “provide superior performance at lower costs, while greatly reducing or eliminating negative ecological impact, at the same time as improving the productive and responsible use of natural resources” (Cleantech Group, Online).

A recent statement from the Swedish Environmental Technology Council (Swentec) and the Swedish Government explicitly states that Sweden intends to take on a leading role in the development and production of clean technologies. The goal of the government is to find solutions to environmental issues that stimulate employment and contribute to increased export (Swentec, 2009a). In accordance with the vision of the Swedish government, the cleantech sector has expanded over the last years. The investments made in Swedish cleantech have increased and reached an all-time high of SEK 1 396 million (solely venture capital) in 2008. Moreover, the total turnover of the Swedish cleantech sector has experienced an increase. In 2004, the total turnover of the sector amounted to SEK 74 million compared to 2008 when the total turnover was SEK 135.5 million (Swentec, 2009b). Additionally, the Swedish Institute for Growth Policy Studies states that Swedish cleantech has a very large export potential (ITPS, 2008). There are thus a number of indicators pointing in the direction that the Swedish cleantech sector has potential to grow and generate high returns for investors in a long-term perspective. As the research program Sustainable Investments puts it: “In a world with more and more environmental and social challenges, companies with the capabilities to turn these challenges into business opportunities are more likely to be the winners of tomorrow” (Sustainable Investments, Online).

While one may certainly get the impression that the Swedish cleantech sector is doing well, cleantech in Sweden has experienced some backlashes lately. As an example, the export in relation to total turnover of Swedish cleantech actually fell from 30 percent in 2007, to 27 percent in 2008, despite the acclaimed growth potential (Swentec, 2009b). Another indication of that Sweden is unsatisfied with the development of the cleantech sector is the recently launched *Action Plan for Swedish Cleantech*, produced by the Swedish Environmental Technology Council by appointment of the Swedish government. The action plan presents 82 bullet points that give a detailed description on how to improve the market conditions for Swedish cleantech enterprises.

One of the cornerstones of the action plan is to increase the investments made in the sector and improve the commercialization process of cleantech innovations (Swentec, 2009a). Dag Angvall, expert at the Swedish Energy Agency, agrees and claims that many companies are experiencing difficulties due to lack of capital (Swedish Energy Agency, 2009).

In order to facilitate the expansion of the Swedish cleantech sector, an increased access to external capital is consequently a must. The report *Swedish Cleantech – A Mapping of Players, Markets and Competitors* (2008) states three main ways for smaller cleantech enterprises to raise external capital in order to grow; (i) venture capital, (ii) bank loans, (iii) and institutional investors. Institutional investments are considered to be an alternative to venture capital in sectors that are in line with the interests of society, i.e. investments that is considered to be beneficial, not only to the companies, but to the society as a whole. The cleantech sector should certainly be seen as such as sector (ITPS, 2008), and could thus be considered as an investment suitable for an institutional investor. Several previous studies (e.g. Jansson & Wågström, 2008; Wüstenhagen & Teppo, 2004; Reid & Smith 2003; Dealflower, 2003) made on cleantech focus exclusively on venture capitalists and the way they regard the cleantech sector. However, venture capitalists manage a relatively small portion of the capital on the financial market compared to institutional investors, implying that huge amounts of the world's financial capital is in the possession of institutional investors (Useem & Mitchell, 2000). Among the largest institutional investors in Sweden are the Swedish National Pension Funds - the AP funds. The AP funds are public authorities with the mission to manage a majority of the pension capital of Swedish citizens with as high return as possible without taking excessive risk (The National Pension Insurance Funds Act SFS 2000:192). In 2008, the AP funds represented a total capital of SEK 772 billion (Swedish Ministry of Finance, 2009), which is equal to about 22 percent of the Swedish GDP (Confederation of Swedish Enterprise, Online). However, only a small portion of these SEK 772 billion is invested in cleantech enterprises. As an example, only 2 percent of the total 1st through 4th AP funds' investments in the energy sector during 2008 were in renewable energy (Flood, 2009).

Considering the intentions of the Swedish government, as well as the important role that cleantech plays in the process of solving the global climate crisis, there are clearly political incentives for investing in cleantech. Moreover, the expected long-term growth and export potential of the companies that constitute the cleantech sector increases the demand for cleantech on the financial market. Hence, the nature of the incentives for investing in cleantech is twofold; they exist both on a political and on a market level. Then, why is not more Swedish pension capital being invested in a sector that is considered to be of national interest, show great future potential, and is responsible for creating the tools that are necessary for solving the global climate crisis? The fact that the AP funds exist in between the political sphere and the market that they are investing in implies that if something is obstructing the Swedish National Pension Funds from investing capital in the cleantech sector, such an obstruction would exist either in a market or political context. That is to say, either there are problems with the cleantech companies themselves or there are political obstructions hindering their development. Using these two contexts, this study aims to contribute to present research by highlighting the Swedish National Pension Funds and the way that they regard the cleantech sector. Thus, the study exposes an

institutional investor dimension of the problems with capital supply and development in the cleantech sector.

1.2 Research Question and Objective

This study intends to identify factors that obstruct the Swedish National Pension Funds from investing capital in cleantech enterprises, without weighing or in any other way trying to individually rank them. The study uses two main categories of factors; (i) political factors and (ii) market factors, in order to answer the research question:

- *What factors have a negative effect on AP fund investments in cleantech?*

The objective of this study is to describe the perspective of the Swedish AP funds on the cleantech sector and its investment potential. The findings of the study may be of interest to the cleantech sector when applying for funding as well as by the Swedish authorities when reviewing the law currently regulating the investments of the AP funds.

1.4 Outline

The outline of the remaining part of this study is as follows. Firstly, the research method used in the study is presented. Secondly, to give a better understanding of context of the study, a brief description of the cleantech sector and the AP funds is given. Thirdly, the theoretical framework is demonstrated, i.e. factors that are considered to affect the AP funds' investments in cleantech. Fourthly, the empirical result is presented and analyzed within an analytical scheme based on the theoretical framework. Lastly, conclusions are drawn and results are submitted as well as discussed.

2. Research Method

2.1 Research Design

The study uses a case study design to examine factors that have a negative effect on the Swedish AP funds' investments in clean technology. It employs a qualitative approach, implying that it is based on interpreted empirical data collected through deep interviews. A qualitative approach is considered to be appropriate, due to the fact that the purpose is to study the underlying factors and trends (Patel & Davidson, 2003).

Through an initial literature study, a first set of factors affecting investments in cleantech were identified. These constituted the basis for a preliminary interview guide and theoretical framework for the study. During the first set of interviews a number of additional factors were discovered and a second round of literature studies was thereby initiated. These new factors were thus incorporated into an enlarged theoretical framework and discussed during the following interviews. The theoretical framework and the interview guide went through a number of similar expansions as a result of discovering new dimensions of the problem. At last, the factors were divided in two main categories: (i) political factors and (ii) market factors. The premise of these two categories of factors, as well as the sub-factors constituting them, forms the final theoretical framework of the study. This way of combining deductively testing predefined theories and inductively constructing new theories based on empirical material, is known as abduction (Patel & Davidson, 2003). This method was employed since no single definitive theory can be said to describe all aspects of the research question.

The empirical data was collected through interviews with the AP funds. The reason for conducting this study through an AP fund perspective is that it is reasonable to argue that it is the AP funds that, to the largest extent, have the ability to identify what might obstruct them from investing in cleantech. The analysis of the empirical material from the interviews was done by sorting and interpreting the material in a way that corresponded with the sub-factors in the analytical scheme (see table 2.2). Quotations are used to a large extent in the analysis in order to strengthen the trustworthiness of the study. Conclusions about whether or not a sub-factor is considered to obstruct AP fund investments in cleantech are drawn based on the analysis of the empirical material.

2.1.1 Research Data

The *primary data* of the study consists of a set of deep interviews. Interviews were used as data collection method due to the fact that it is a suitable and common method when collecting data for both theory-developing studies and theory-testing studies (Esaiasson et al., 2007). Alternatively, the empirical data of this study could have been collected through surveys. However, since the purpose was to acquire a deep understanding of the research problem, interviews were considered to be the better tool. The respondents were required to have substantial insight into the research objective. The respondents were thereby chosen in accordance with the concept of centrality, i.e. the intention was to interview centrally located sources (Esaiasson et al., 2007). Sources considered as central in this case were mainly representatives from the AP funds (table 2.1). One other respondent were added to get a more comprehensive view and several perspectives on the research topic. The risk for biased or twisted results is thereby less than if only respondents from the AP funds had been chosen. More

respondents from outside the AP funds were asked to participate but the requests were either denied or being responded to too late.

Table 2.1: Interview Respondents

Organization	Name	Profession
The 1 st AP fund	Olof Jonasson	Head of European Equities
The 2 nd AP fund	Christina Olivecrona	Analyst Sustainability
The 3 rd AP fund	Christina Kusoffsky Hillesöy	Head of Communication and Sustainable Investments
The 6 th AP fund	Christina Brinck	Investment Manager
The 7 th AP fund	Per Olofsson	Manager of Alternative Investments
Swesif, Durable Vision Invest	Henrik Malmsten	Former Head of Investments of the 6 th AP fund, Board Member of the Swedish Forum for Sustainable Investments (Swesif), having over ten years of cleantech investment experience

The respondents were contacted via e-mail or phone and a personal meeting or a phone interview was arranged. We initially set out to interview all of the six AP funds but the 4th AP fund was unwilling to participate. Furthermore, another representative from the 2nd AP fund was initially scheduled to participate but unfortunately had to cancel. However, we consider the selected respondents to be representative for their respective roles in the Swedish pension system and thus see no major implications for the validity of the study because of this. During the interviews with the respondents from the AP funds, a semi-structured interview guide (attached in Appendix I) was used, focusing on the respondents' approach towards cleantech investments. The interview with the respondent from Durable Vision Invest was more of an informative character and treated his view on the cleantech sector in general. All of the interviews lasted for approximately 30-60 minutes and were held in Swedish. The interviews were recorded and transcribed and the empirical material does thus consist of printed interviews. The original intention was to physically meet all of the AP fund respondents and conduct face-to-face interviews, but due to geographical conditions only three of the interviews were performed that way. The remaining two AP fund interviews, as well as the interview with Henrik Malmsten of Durable Vision Invest were conducted via telephone. The fact that these interviews were conducted via telephone is not considered to have any severe effects on their quality. In total, 6 interviews were conducted including respondents from the 1st AP fund, the 2nd, AP fund, the 3rd AP funds, the 6th AP fund, the 7th AP fund, and Durable Vision Invest.

The *secondary data* used in this study consists of academic journals, reports, legal acts, newspapers, and textbooks. Since the cleantech sector is experiencing rapid development, it has been the intention of the study to use as new data as possible.

2.1.2 Analytical Framework

The analysis of the empirical data is performed in order to identify what political and market factors that have a negative effect on AP fund investments in cleantech. The analytical framework is built upon the sub-factors identified by studying previous research. The framework is structured as an analytical scheme in which the results are presented – a common way to

structure empirical results (Patel & Davidson, 2003). The analytical scheme is demonstrated in table 2.2.

Table 2.2: Analytical Scheme

Negative Impact on AP fund Investments in Cleantech		
Political Factors	YES	NO
Climate Change		
Emission Reduction Targets		
Incentive Programs		
Pension Fund Governance		
Market Factors	YES	NO
Increased Costs for Fossil Technologies		
Information Asymmetry		
Innovation and Business Risk		

The criteria for conclusion, i.e. whether a factor is affecting the AP funds’ investments in cleantech in a negative way or not, is determined by a single aspect: A factor is presumed to affect AP fund investments in cleantech negatively when one out of the six respondents believes so. This implies that a factor does not affect cleantech investments in a negative way only when there is consensus among the respondents.

2.2 Validity

A study is considered as valid if the used method generates the result that the research question intended to respond (Jacobsen, 2002). The validity of this study is largely related to the extent of which the identified factors are able to encompass all dimensions of the specific problem. The method employed in this study, where factors are being discovered through an abductive process, can to some extent be said to prevent important factors from being overlooked. If other important factors had existed, these would likely have been identified through this process. Thus, it is reasonable to argue that selected method for this study generates a valid result. However, an increased amount of interviews conducted within each of the organizations would have given a stronger correspondence between the answers from the individual respondents and the aggregated approach of the organization that the study investigates, as well as further decreased the chance of overlooking additional dimensions of the problem. The fact that the case of the study is specific to the Swedish National Pension Funds and their investments in cleantech limits the possibility to generalize the result. However, only the factor concerning pension fund governance can be said to be specific to the AP funds. Seen only from a cleantech perspective, all of the other factors have equal potential to affect their possibility to find funding. Thus, the result concerning all factors except pension fund governance can be generalized, in various degrees, to other types of investors.

2.3 Reliability

The concept of reliability is related to the trustworthiness of the material and the possibility to replicate the study using the same research method (Jacobsen, 2002). In the *primary data* of this study there are a few issues that are considered to affect the reliability. The first issue concerns whether the interviewed respondents really are the respondents who holds the best information on the subject of this study in their organization. It is possible that there could be other individuals within the organization with information that could give a higher reliability and thereby a more accurate result. The second issue concerns the fact that the AP fund respondents have different professions within their organizations. This implies that the answers come from different levels in the organizations and thereby are of different relative importance. Thirdly, the fact that the interviews were conducted in Swedish and thus have been translated to English could imply reliability issues, since some things, such as jargon, slang and proverbs etc. are easily lost in the translation. Furthermore, regard has to be taken to the fact that it could be in the interest of the respondents to promote their own work and their own opinion on the subject, which could result in biased empirical material.

Concerning the *secondary data* it has not always been possible to use the newest data available since several databases require membership to access its material. An example of such a database is that of the Cleantech Group. This implies that the secondary data used in the section treating the cleantech sector is, to some extent, dated. Further, reports have been used to a large extent, as a complement to academic literature. An implication related to using reports is that they are often written for an organization with a specific agenda, increasing the risk for biased information. Furthermore, it is important to state that the interpretation of the answers from the respondents is colored by our own prejudice on the subject. The analysis and the result of this study should thus be read bearing these issues in mind.

Lastly, cleantech does not have a single definition that is employed by all parties (this is being discussed further in section 3.1). Many of the respondents in this study seemed to define cleantech mainly as technologies focusing on renewable energy or energy efficiency. This gives the study a focus on climate cleantech, i.e. solar and wind power. The fact that many of the respondents referred almost solely to energy production and/or efficiency results in that other areas of cleantech, such as water purification and waste management was somewhat overlooked. This may originate in that we ourselves were primarily interested in that aspect of cleantech from the beginning and it may have created a biased conversation with the respondents. Another problem stemming from the multitude of available definitions of cleantech is that many of the statistics used in this study refer to cleantech in different ways, making them hard to compare with each other.

3. The Clean Technology Sector

3.1 The Cleantech Concept

A study conducted in 2008 by NUTEK (now incorporated into the Swedish Agency for Economic and Regional Growth) investigated how various players on the venture capital market and other central players regard and define the cleantech concept. The study indicates that cleantech can, in principle, exist in any industry and that there is a general confusion among concerned parties about what the meaning of the cleantech concept is. There were also mixed views on whether or not a precise definition is necessary. Some of the respondents in this study expressed a need for a precise definition, in order to allow statistical calculations and facilitate comparisons. Others considered a distinct definition redundant (NUTEK, 2008). The concept of cleantech was originally coined in 2002 by the American commercial organization Cleantech Group LLC, preciously known as the Cleantech Network and the Cleantech Venture Network, in order to distinguish it from concepts such as greentech or envirotech, which were popularized in the 70's and 80's. As opposed to the end-of-pipe approach that these concepts were associated with, the concept of cleantech refers to the new breed of proactive companies that addresses the root of environmental problems (Cleantech Group, Online).

According to the Cleantech Group themselves, cleantech is defined as new technologies and related business models that:

(...) provide superior performance at lower costs, while greatly reducing or eliminating negative ecological impact, at the same time as improving the productive and responsible use of natural resources. (Cleantech Group, Online)

In addition, the Cleantech Group identifies eleven industry segments that define cleantech (Cleantech Group, Online):

- | | |
|--------------------------|-----------------------------|
| 1. Energy Generation | 7. Air & Environment |
| 2. Energy Storage | 8. Materials |
| 3. Energy Infrastructure | 9. Manufacturing/Industrial |
| 4. Energy Efficiency | 10. Agriculture |
| 5. Transportation | 11. Recycling & Waste |
| 6. Water & Wastewater | |

Another often-used definition is the one established by the European Union document ETAP (European Union Environmental Technology Action Plan). The ETAP presents a broader definition, encompassing:

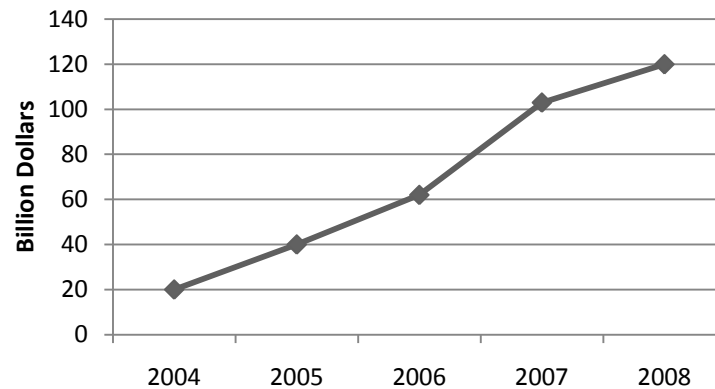
(...) technologies whose use is less environmentally harmful than relevant alternatives. They encompass technologies and processes to manage pollution (e.g. air pollution control, waste management), less polluting and less resource-intensive products and services and ways to manage resources more efficiently (e.g. water supply, energy-saving technologies). (Commission of the European Communities, 2004, p. 2).

This definition is the one employed by the cleantech database managed by Statistics Sweden and the Swedish Environmental Technology Council, as well as the one used in this study.

3.2 International Cleantech Market Trends

Overall, the cleantech market is a growing market. On a global level, investments made in the renewable energy part of the cleantech sector have increased rapidly over the last years. As seen in figure 3.1, the global investments in renewable energy were \$20 billion in 2004 compared to \$120 billion in 2008 (REN21, 2009).

Figure 3.1: Global Investments in Renewable Energy 2004-2008



Source: REN21 (2009)

The biggest producer and consumer of clean technology in the world is assumed to be The United States of America (Swedish Trade Council, Online). In 2007, about 122 000 companies were considered as active within the cleantech sector but this number has most likely increased since then, considering the rapid development of the sector (ITPS, 2008). The amount of venture capital invested in the cleantech sector has also increased over the past years. In 2006, \$2.9 billion of venture capital was invested in the sector, implying that cleantech was the third biggest area of venture capital investments in the US this year, with a growth rate of 88 percent. Another clear trend during 2007 was that the size of each investment made in cleantech sector increased. However, the capital tends to be invested in follow-on stage deals, i.e. rather late in a company's development phase. The huge increase of investments in this phase has not resulted in an equal growth when it comes to seed financing and many small companies do still have financing problems. Overall, the current market conditions for cleantech in the US are considered as strong and a continued expansion of the cleantech sector is expected (ITPS, 2008).

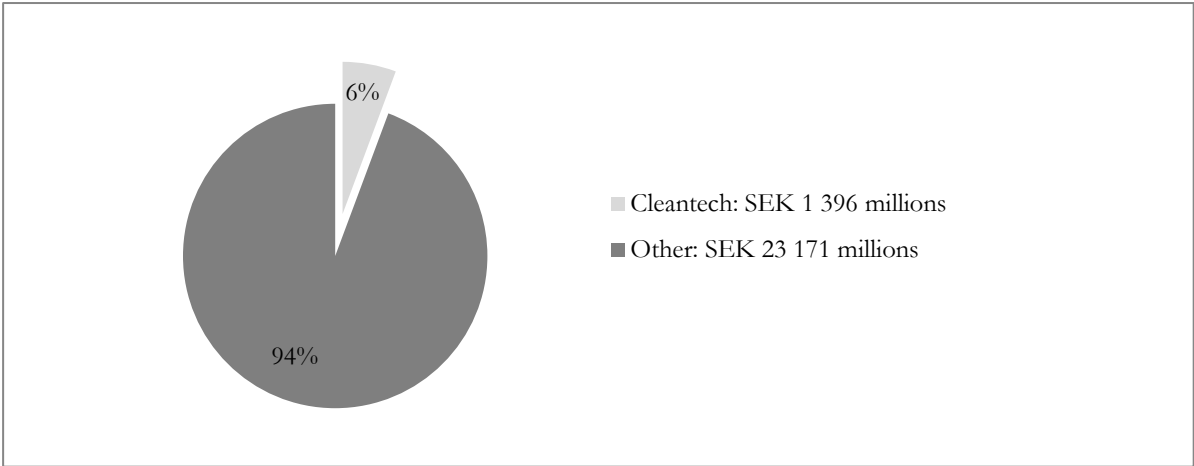
The rising star on the global cleantech market is most likely China. The combination of high economic growth rates and a long tradition of environmental unconsciousness make the need for increased investments enormous. However, it is hard to estimate the market for cleantech in China but according to estimations done in 2007 the total value of sold products in 2010 is considered to be about \$146 billion (ITPS, 2008). China became the world's largest producer of wind power in 2008 and following year they claimed the title of being the world's largest producer of solar cells. Moreover, 1.1 million Chinese citizens work within the cleantech sector and the amount increases with about 100 000 people per year according to the Chinese Renewable Industries Association (Hällén, 2010). There are no indications of that this development will slow down and the Chinese cleantech sector will thereby most likely continue to grow over the coming years.

Another important actor on the international cleantech market is the European Union. In conformity with China and the US, the cleantech sector is identified as a sector with huge potential in the EU, both in terms of economic growth and from an environmental perspective. Seen from a global point of view, the EU25 has a successful cleantech sector and had an estimated total turnover of €227 billion in 2004. This accounts for about 2.2 percent of the EU25 GDP and the sector employs 3.4 million people (ITPS, 2008). The European Commission did in 2004 establish an Environmental Technology Action Plan (ETAP) that stresses the importance of a number of actions that stimulate clean technology in different phases (Commission of the European Communities, 2004). This action plan does, together with the EU’s climate targets, make the European Union cleantech sector a sector with great promise. Or as the Swedish Prime Minister, Fredrik Reinfeldt, and the President of the European Commission, José Manuell Barroso, put it: “The climate could be extremely profitable for European Union in the future“ (Reinfeldt & Barroso, 2008).

3.3 Swedish Cleantech Market Trends

According to the Cleantech Group, Sweden is amongst the top countries in the world when it comes to cleantech and sustainable innovations (Swedish Energy Agency, 2009). In conformity with the global figures, the investments made in Swedish cleantech have also increased over the past years and, as mentioned previously, reached a venture capital all-time high in 2008.. As figure 3.2 demonstrates, that accounted for about 6 percent of the total venture capital investments in 2008.

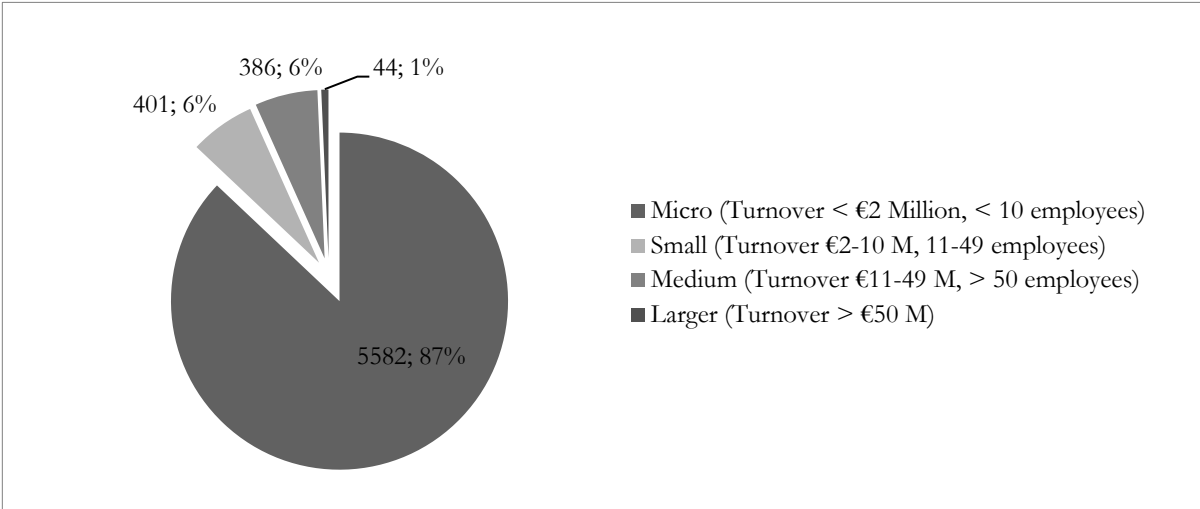
Figure 3.2: Swedish Cleantech Venture Capital Investments, 2008



Source: SVCA (2008)

The number of cleantech companies has also increased over the past years, from 5683 in 2003 to 6542 in 2008. However, only 44, or 1 percent, of these companies are large and 87 percent are micro (Eberhardson, Department of Environmental Accounts, Statistics Sweden). In figure 3.3 below, the Swedish cleantech sector is exhibited in accordance with the EU definition of small to medium-sized enterprises (European Commission, 2003):

Figure 3.3: Swedish Cleantech Sector (Number of companies; %)



Source: Eberhardson, Department of Environmental Accounts, Statistics Sweden

Furthermore, the fact Sweden constitutes such a small domestic market for cleantech makes export very important in early stages for Swedish cleantech companies. Since export is expensive, more capital is often needed for the Swedish cleantech companies than for their foreign competitors (Swedish Energy Agency, 2009). Since export is of big importance for the Swedish cleantech sector, the numbers stating that the export increase was less in 2007 (2.7 percent) than in 2006 (4.3 percent) could thus be seen as an indicator of that the Swedish cleantech sector have lost some of its pace (Swentec, 2009b). Another trend related to this fact, as well as mentioned in several reports, is the problem for Swedish cleantech companies to find external and venture capital (ITPS, 2008). The reason for this is most likely that many Swedish cleantech companies are small and are in a seed or development phase, phases that historically attract relatively small amount of capital.

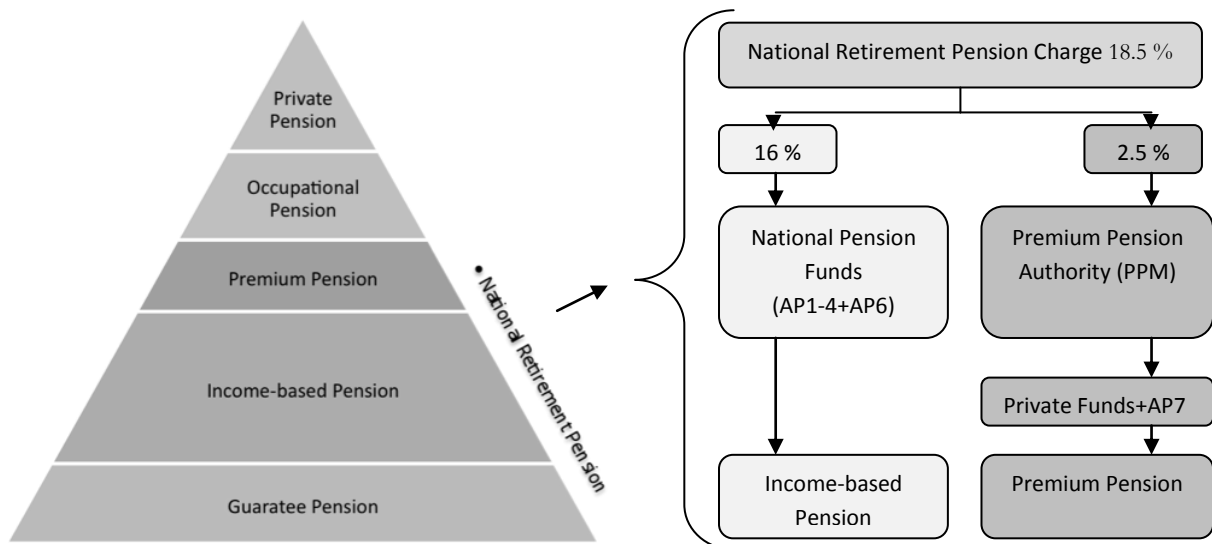
In summary, that cleantech sector grows at rapid pace at several locations in the world and will most likely continue to do so. Whether the Swedish cleantech sector is able remain on that train is however harder to predict. Even though the trend has been positive so far the future for Swedish cleantech is characterized by uncertainty.

4. The Swedish National Pension Funds – The AP funds

4.1. The Swedish Pension System

The Swedish pension system consists of three parts: national retirement pension, occupational pension, and voluntary, private pension. The national retirement pension consists, in turn of three parts; income pension, premium pension and guarantee pension. The income-based pension is financed by 16 percent of each employee’s gross annual income as well as other taxable benefits and is paid by the employer. The income-based pension is managed by the 1st, 2nd, 3rd, 4th and 6th AP funds (Swedish Ministry of Finance, 2009), also known as the buffer funds. The mission of the 1st through 4th and 6th AP funds is to exist as a buffer in the pension system, in order to even out temporary generational fluctuations that would have otherwise created an imbalance between pension contributions and pension disbursements (Swedish Government, 1999). As of writing this thesis¹, the 7th AP fund has the role of managing the Premier Saving Fund (PSF) and the Premium Choice Fund (PCF) with the interest of the pension savers in mind. The premium pension is made up of an additional 2.5 percent of the employee’s gross annual income and is managed by the employees themselves, whom are able to choose among a number of PPM-funds in which to invest their pension capital. If no active choice is made, the 7th AP fund will manage the pension capital. The third part of the National Retirement Pension is the guarantee pension. This is, as opposed to the income and premium pension, tied to the national budget and provides security to those citizens who have no employment at all (First AP fund, Online). An illustration of the Swedish Pension Fund System is given in figure 4.1.

Figure 4.1: The Swedish Pension System



Source: Second AP fund, Online; Sixth AP fund, Online

4.2 Swedish Pension Fund Governance

The AP funds are public authorities and are thereby under the supervision of the Swedish government, which determines the fundamentals for public authorities (Swedish Government, Online). The National Pension Insurance Funds Act (SFS 2000:192) and the Sixth National Pension Insurance Funds Act (SFS 2000:193) identify the responsibilities for the government and

¹ The 7th AP fund is, as of writing this thesis, undergoing changes.

the pension fund management as well as the objective and the purpose of the AP funds. The National Pension Insurance Funds Act (SFS 2000:192) controls what kind of authority the 1st through 4th and 7th AP funds have. The 7th AP fund has a different task than the 1st through 4th and 6th AP funds due to the fact that it is a premium pension fund and hence a part of the Swedish premium pension system. Nevertheless, it is included in the National Pension Insurance Funds Act and is thereby required to follow all regulations in this act except the investment directives (Seventh AP fund, 2009). The 6th AP fund is governed by the Sixth National Pension Insurance Fund Act (SFS 2000:193). The main difference between the 6th and the 1st through 4th AP funds is however the 6th AP funds' focus on small to medium-sized companies.

4.3 Investment Directives

Government bill 1999/2000:46 states that the 1st through 4th AP funds should invest their assets in such a way that it maximizes long-term return with a low level of risk. They are to manage the assets without being influenced by any prevailing governmental policies, whether industrial or economic. The AP funds are also to give consideration to ethics and the environment, although without compromising the overall goal of achieving a high return. In the National Pension Insurance Funds Act (SFS 2000:192) the specific investment directives the 1st through 4th AP fund are given (table 4.1).

Table 4.1: Investment Directives 1st through 4th AP funds

<ul style="list-style-type: none"> • Shares may be held in Swedish limited companies listed on a Swedish exchange or an authorized marketplace that equals to no more than 2 percent of the market value of the total amount of shares in the company.
<ul style="list-style-type: none"> • Investments are only allowed in companies which are, or within one year of the issuance intend to be, listed on an exchange or other regulated market.
<ul style="list-style-type: none"> • A maximum of 10 percent of the assets are allowed to be exposed to exchange risk.
<ul style="list-style-type: none"> • No less than 30 percent of the total assets of the funds are to be invested in debt instruments with low credit and liquidity risks and the 1st through 4th AP fund are not allowed to invest their assets in “options, futures, or other similar financial instruments for which commodities constitute the underlying asset” (p. 7).
<ul style="list-style-type: none"> • The 1st through 4th AP funds may not hold an amount of shares or other undertakings that result in a voting capital that exceeds 10percent. However, if the company is a venture capital company which is not listed on an exchange or any other regulated market, the 1st through 4th AP funds are allowed an amount of shares that equals 30 percent of the voting capital of the company.
<ul style="list-style-type: none"> • A maximum of 5 percent of the total assets of each of the 1st through 4th AP funds, valued at market value may consist of shares in unlisted venture capital companies, unlisted debt instruments and/or shares in funds which primarily invest in unlisted participations or undertakings. The 1st through 4th AP funds are not allowed to be the general partner of limited partnerships.

Source: *The National Pension Insurance Funds Act (SFS 2000:192)*

Besides the directives, the funds develop their own investment strategies. The investment strategies are found in the operational plan, including guidelines for investment activities, the exercise of voting rights in individual undertakings, and a risk-managements plan (SFS 2000:192). The investment directives are however not the same for the 1st through 4th AP funds as for the 6th and 7th. The 6th AP fund should, within the limits for what is good for the insurance of income-based pension, manage its assets through investments in the venture capital market. The capital

should be invested in such a way that the requirements on a long-term high return and a satisfying risk diversification are fulfilled in accordance with the Sixth National Pension Insurance Fund Act (SFS 2000:193). Some of the more specific directives are presented in table 4.2.

Table 4.2: Investment Directives 6th AP fund

<ul style="list-style-type: none">• The 6th AP fund is allowed to invest in Swedish shares, foreign shares, such convertibles or share option rights that are issued by Swedish and foreign listed companies such as venture capital in incorporated associations.
<ul style="list-style-type: none">• The 6th AP fund is not allowed to own more than 30 percent of total shares in a company on a regulated market. The directive is not applicable on investments in venture capital companies.
<ul style="list-style-type: none">• A maximum of 10 percent of the fund assets' market value are allowed to be exposed to exchange risk
<ul style="list-style-type: none">• The 6th AP fund are allowed to trade with financial instruments to increase management effectiveness or to protect the assets against exchange risks

Source: *The Sixth National Pension Insurance Fund Act (SFS 2000:193)*

Concerning the 7th AP fund, it is governed the in the same way as a corporate fund and can thus ignore the requirement of maintaining a low risk. However, this does not imply that they do not prefer low risk investments (Seventh AP fund, Online).

5. Factors Affecting Investment Decisions in Cleantech

The global financial market as a whole is to a large extent constituted by institutional investors and pension funds (Useem & Mitchell, 2000; Fristedt & Sundqvist, 2008) and they thereby exert an important role if the level of investments mentioned earlier is to be achieved. However, there exists reluctance among pension funds to expand investment strategies beyond classical financial barriers and to include other factors, such as climate change into their calculations (MISTRA, 2009). In previous research and reports (e.g. Pernick & Wilder, 2007; ITPS, 2008), a number of overall factors that affects investments in cleantech have been identified. This study divides these factors into two main categories; (i) political factors, and (ii) market factors. This section presents identified sub-factors affecting investors when evaluating cleantech investments. These sub-factors are of a general character and only a few of the factors are specific to pension fund investments. This review does not claim to be comprehensive in the sense that it covers all factors identified by prior research. It is also worth mentioning that the sub-factors are overlapping and intertwined in some cases.

5.1 Political Factors

Political factors could be considered as regulations, rules, norms and prerequisites set by the international and national political community, as well as the public. This section presents the political factors affecting investments in cleantech identified in previous research.

5.1.1 Climate Change

The notion of anthropologically caused climate change has according to Pernick and Wilder (2007) gone from being a questionable idea to becoming considered as universal knowledge. The fact that the climate change now is universally accepted as a real threat by governments, enterprises and people all around the world makes it a decisive factor for investments in cleantech. However, climate change should not be seen as a factor in itself, but rather as a foundation on which the arguments and action plans of the politicians and companies rely. Perhaps the most influential scientific organization when it comes to climate change is the International Panel on Climate Change (IPCC). In their latest assessment report, released in 2007, they conclude that eleven of the years between 1995 and 2006 rank amongst the twelve warmest since the instrumental recording of the global surface temperature began in 1850 (IPCC, 2007). Today, there is a widespread consensus that this increase in mean temperature is the result of human activity and, more specifically, by the increased amount of CO₂ emitted to the atmosphere through the combustion of fossil fuel. The annual emissions of CO₂ have grown by 80 percent from 1970 to 2004 and are projected to continue to grow (IPCC, 2007). In the light of the facts from the IPCC's Fourth Assessment Report, the issue of global warming has become one of the most debated and important questions of our time. The development and use of clean technologies is considered as an important solution to global warming and it is reasonable argue that the increased recognition, attention and information of how human activities affect the climate is a factor for the cleantech sector.

5.1.2 Emission Reduction Targets

As a response to the increased attention to climate change, politicians worldwide did in the early 1990s start to address this issue. In 1992, the UNFCCC was established in Rio de Janeiro. Under the framework of the UNFCCC, the first international agreement that actually had compulsory

and quantified goals for reduction of GHG emissions was formed in 1997, namely the Kyoto Protocol (European Union, Online (a)). The Kyoto Protocol could hence be seen as an international starting point when it comes to emission reduction targets as a factor affecting the cleantech sector (ITPS, 2008). In general terms, the whole Kyoto Protocol is seen as a factor and driver for the cleantech sector, but there are mechanisms within the protocol that are more important for the sector than others. Such mechanisms are the so-called Clean Development Mechanisms (CDM) and Joint Implementation (JI). The aim of CDM and JI is to facilitate the transition to a usage of more resource efficient technologies in countries where these investments otherwise would default. The investing country is then able to assimilate the emission reductions related to the investment. The projects executed within the framework of CDM and JI is assumed to comprise investments of about SEK 1 500 billion until 2012 (ITPS, 2008). Judging by the fact that no global treaty was agreed upon during the Conference of Parties 15 in Copenhagen 2009 could be argued to increase uncertainty about what is going to happen when the Kyoto Protocol expires in 2012. This uncertainty can also be referred to as regulatory risk (Wüstenhagen & Teppo, 2004).

The goals and targets of the European Union is a factor for the cleantech sector. The EU has established a comprehensive policy framework including the targets for 2020 (e.g. 20 percent decrease of GHG emissions, compared to 1990 levels), the target for 2050 (i.e. an 80 percent decrease of GHG emissions, compared to 1990 levels), and the European Union Emission Trading Scheme (EU ETS) that puts a price on carbon dioxide (Commission of the European Communities, 2009). To reach these targets, the European Council adopted an energy action plan for the years of 2007-2009. The action plan establishes that the EU energy policy rests on three pillars; (i) competitiveness, (ii) environmental sustainability and (iii) security of energy supply (Swedish Government, 2009). Furthermore, the action plan set specific targets in the areas of (i) energy efficiency, where a 20 percent reduction should be in place by 2020, (ii) renewable energy, where the share should increase by 20 percent until 2020, and (iii) developing an environmentally safe carbon capture and geological storage policy (European Union, Online (b)). In addition to the overall targets, the European Commission has proposed suggestions on how meet the targets that go in line with the EU energy policy pillars. In order to meet the targets of 2020 and 2050 huge investments in renewable energy solutions are needed, due to the fact that 80 percent of the present EU energy supplies is dependent on fossil fuel. The Commission believes that public and private investments in renewable energy and energy efficiency must increase by €50 billion over the next 10 years in order to succeed with hitting these targets (Commission of the European Communities, 2009).

In the light of the EU legislation, the Swedish government launched bill 2008/09 162 and 163 - *En sammanhållen klimat- och energipolitik* - on the 17th of March 2009. The overall Swedish GHG emission reduction target in this bill is 40 percent until 2020, compared to 1990 levels. However, this target is only relevant for the sectors outside the EU ETS. Furthermore, Sweden has envisioned climate neutrality by 2050 (Swedish Government, 2009). To succeed with this, the government intends to continue with, as well as develop, management control measures such as the carbon tax. They also intend to take actions to reduce GHG emissions in other countries by conducting investments within the framework of CDM. Moreover, the government presents three action plans for the adaptation; (i) a transport sector independent of fossil fuel, (ii) increase

energy efficiency, and (iii) promote renewable energy. Additionally, the Swedish government has, in collaboration with the Swedish Environmental Technology Council, recently presented an action plan on how to improve its efforts to support Swedish cleantech (Swentec, 2009a). Together with the examples of international targets, the Swedish government's management control measures and climate goals could thus be seen as a factor affecting investments in Swedish cleantech.

5.1.3 Incentive Programs

Different international and national incentive program is, according to previous research, considered as a factor affecting the will to invest in cleantech. On a global level, the feed-in tariff system is an example of such a program. The feed-in tariff is a policy mechanism that increases the chances of making the clean energy industry competitive with subsidized fossil energy. In short, the feed-in tariff system works like this: Nations enforce legal demands on utility companies to buy electricity from renewable energy producers at a premium rate. The utility companies have to buy this electricity during a guaranteed period, which makes the installation of renewable energy systems a meaningful investment for the producer (WFC, 2009). According to Gipe (2006) these kinds of tariffs have proven the most successful mechanism for stimulating investments in the clean energy industry worldwide. Today feed-in tariff systems have been implemented to a certain degree in at least 26 states (Feed-in Tariff, Online).

In Sweden, an incentive system based on green certificates has been in use since 2003 in order to increase investments in renewable energy sources. Producers of renewable electricity receive one electricity certificate for each MWh produced. The result is that producers are able to gain an additional income from electricity sales. It is mandatory for suppliers of electricity and/or users of electricity to buy a certain quantity of green certificates in relation to their sales/consumption. Each year the amount of mandatory green certificates is increased because this is expected to, in turn, increase demand for production. Normally, the supplier of electricity will purchase the green certificates for their customers and make sure that their mandatory amount is bought. The green certificates for new power plants last for 15 years, however not longer than 2030 (Swedish Government, 2005). For investors, as well as for producers, the green certificates are important mechanisms for the possibility to perform long-term and stable risk- and financial analyses (Swedish Energy Agency, 2009). The incentive programs presented above are hence identified as a factor that affects cleantech investments.

5.1.4 Pension Fund Governance

The investment directives given by the Swedish Parliament in the National Pension Insurance Funds Act (SFS 2000:192) and the Sixth National Pension Insurance Fund Act (SFS 2000:193) are per definition factors that affect AP fund investments, although in a general manner and thereby cleantech investments. The Swedish government bill 1999/2000:46 states that the 1st through 4th AP funds should invest their assets in such a way that it maximizes long-term return with a low level of risk. Moreover, they should manage the assets without being influenced by any prevailing governmental policies, whether industrial or economic, but at the same time give consideration to ethics and the environment, although without compromising the overall goal of achieving a high return. The 6th AP fund should, within the limits for what is good for the insurance of income-based pension, manage its assets through investments on the venture capital market. The capital should be invested in such a way that the requirements on a long-term high

return and a satisfying risk diversification are fulfilled (SFS 2000:193). The specific directives for the 1st through 4th and 6th AP fund are presented in table 4.1 and 4.2 previous in this study. Concerning the 7th AP fund, it is governed the in the same way as a corporate fund and could thus ignore the requirement on a low risk. However, this does not imply that they do not prefer low- risk investments. This fiduciary duty of generating a high overall return is something that in previous research is identified as a factor that affects pension fund investments in cleantech since they have the opinion that those investments conflicts with this duty (MISTRA, 2009).

A way that has been tested when it comes to how governments through governance could be able to increase pension fund investments in cleantech is to legislate. This is done in the US, where the state of California has decided that a part of the pension fund capital should be invested in cleantech. In the light of these examples, the Swedish Centre Party has launched a vision for the Swedish AP funds. In short, the vision implies that the 1st through 4th AP fund should invest at least 1 percent, about SEK 8 billion, beyond the 5 percent that can be invested in unlisted companies today, in Swedish cleantech companies. Such a strategy requires a change in the current pension insurance funds act (SFS 2000:192) but will most likely increase the return due to the fact that money is invested in businesses with good future potential (Swedish Centre Party, 2008). A modified investment policy with environmental requirements would not only generate more capital to the sector but also show other investors as well as companies that the government is serious with their ambition to become world leader (Swedish Centre Party, 2008). Pension fund governance can thus be considered as a factor that affects cleantech investments.

5.2 Market Factors

Along with the factors identified above, there are some factors that are not present on the political level, but rather on the level of the cleantech-companies themselves or in their immediate vicinity. However, these factors still have the ability to affect the willingness of the AP funds to invest capital in the cleantech sector.

5.2.1 Increased Costs for Fossil Fuel

New technology tends to be very expensive when first introduced on the market. A basic economic assumption is that if a certain input commodity becomes relatively more expensive than others, there will be investments made in order to decrease the dependence on that commodity. This assumption can be applied to the cleantech sector, where the increase of energy prices creates incentives for investing in more energy-effective markets and processes, thus increasing the market for clean technology (ITPS, 2008). This is a very influential factor for the cleantech sector today as there is a trend where the cost of clean energy is falling and the cost of fossil based energy is going up (Pernick & Wilder, 2007). Moreover, several studies show that the fast increase in energy prices has a positive impact on new energy-efficient innovations (e.g. Popp, 2002). The primary reason for using cleantech over other technologies emerges due to changes in its relative price, i.e. when environmentally harmful activities, for example emitting CO₂, become more expensive relative to environmentally friendly alternatives. Both management control measures as well as regular market forces can be the cause behind changes in relative prices (ITPS, 2008). The commodity with one of the largest impacts on the relative price of cleantech is oil. The price on oil have increased drastically from about \$20 per barrel in the end of the 1990s to about \$75 per barrel today (Oljepris, Online) and is expected to continue to increase

to about \$200 per barrel in 2030 (IEA, 2008). The price increase is mainly caused by the increasing demand in China and other developing economies.

5.2.2 Information Asymmetry

The problems related to information asymmetry derive from the agency dilemma (see Jensen & Meckling, 1976; Jensen, 1986) and the relationship between the company and its stakeholders, i.e. anyone who have an interest in the company's performance. In the context of this study, it is primarily the relationship between the owner and manager that is of importance. In this relationship, the owner (principal) hires the management (agent) in order to perform the task of managing the firm. Even though the manager is hired to pursue the interests of the owner, the agency dilemma states that this might not always be the case, since there is good reason to believe that the manager also will pursue his own interests and that these interests are not in line with the interests of the owner. However, only the agent knows to what extent he is acting in self-interest and there is no way for the principal to know this. This uneven or asymmetric distribution of information decreases the level of trust between the two parties. This problem constitutes the foundation for two reasons why cleantech companies could be skeptic towards issuing external equity.

Capital Preference

There are a number of theories on why companies prefer certain ways of funding to others. The financial Pecking Order Hypothesis (POH), developed by Myers (1984) and Myers and Majluf (1984), state that companies primarily prefer internal financing using retained profits. If internal financing is unavailable, companies tend to first seek what they consider the safest external financing, in the form of debt, followed by some type of hybrid security to finance the company. Lastly, if no other means of financing are available, companies take on external financing emitting new equity. In the POH, the asymmetric distribution of information between the financier (principal) and the manager of the company (agent) will cause the financier to value the equity of the firm based on insufficient information and thus create a situation where the firm's cost of capital becomes higher than it ought to be. Therefore, the POH predicts that managers will use external equity only as a last resort (Myers & Majluf, 1984). However, the POH is dependent on the sources of financing available to the company at the time of the investment decision (Mac an Bhaird & Lucey, 2007), which in turn is usually dependent on the stage of development of the firm (Walker, 1989; Scholtens, 1999). A model that does take the development of the firm into account is the Financial Growth Cycle (FGC) (Berger & Udell, 1998), which describes the company as being subject to an evolutionary cycle, through which it advances during the course of its life. During each of the individual stages of the growth cycle, the company will prefer different kinds of financiers to others. The FGC has three stages; (i) early stage, (ii) mid-stage and (iii) late stage. In the early stages of the life cycle, also known as seed or start-up stages, the owner's savings, along with loans from his or her friends and family, constitute the primary sources of capital for the firm. Governmental grants/loans and business angels are also present in this stage, although less preferred. In the second stage, as the firm starts to leave the start-up stage and start to expand, capital is mainly obtained from banks, venture capital and general partners. In the third and last stage companies have either gone or intend to go public within a short period of time. In this stage, public markets for equity become the main sources of capital (Berger & Udell, 1998). According to Berger and Udell (1998), the lack of capital is particularly

difficult during the initial two stages of the FGC. First and foremost, companies in these early stages have less access to internal financing, since sufficient profits might not be generated and the private funds of the owner and his friends and family might be limited. Second, companies in the early and mid-stages are characterized by information opacity, which further increases the problems related to information asymmetry mentioned earlier (Berger & Udell, 1998). Therefore, Small and Medium sized Enterprises (SMEs) are having additional difficulties communicating their qualities in a credible manner and are thus even less likely to find external debt financing (Mac an Bhaird & Lucey, 2007). Since 87 percent of the Swedish cleantech companies are considered SMEs, problems related to capital preferences can be considered to affect investments made in the cleantech sector.

Control Aversion in SMEs

In many cases, the need for independence and the notion of being one's own manager is the major reason for starting up a small business (Sexton & Bowman, 1985; Davidsson, 1989). Some small business owners and entrepreneurs are reluctant to actions that somehow limit or remove their control of the company, an attitude also known as control aversion. The control aversion of the entrepreneur is primarily directed towards external financiers (Cressy & Olofsson, 1997), where the asymmetric distribution of information between the entrepreneur and the financier decreases the level of trust between the two parties (Berggren et al, 2000). Companies with a high level of control aversion will therefore instead choose the financing method that maximizes their freedom (Berggren, 2002), in accordance with the POH (Berger & Udell, 1984).

In the case of some entrepreneurs, whom Cressy (1995) define as movers, the attitudes towards external financiers are able to change over time. Other entrepreneurs are stayers, and have stable attitudes that are very difficult to change. Based on this distinction, Cressy (1995) argues that the control aversion of the movers is able to diminish over time as a result of growth. In times of financial distress, control aversion is generally reduced, irrespective of whether or not the company is considered a mover. This is because the survival of the company is considered to be the highest of all priorities to the entrepreneur (Berggren, 2002). Furthermore, according to Cressy and Olofsson (1997), the control aversion of an entrepreneur seems to correlate negatively with the level of growth ambition. This suggests that a company that has little or no control aversion would be more open towards external financing and the positive effects it can have on the growth of the company (Berggren, 2002). According to the research by Berggren (2002), Swedish SMEs seem to follow the preferential order described by the POH, with one exception. In his observations, new technology based firms (NTBFs) with high growth ambitions seem to skip the first stages of the growth cycle and go straight for external equity financing. Berggren suggests that this can be explained by such companies' lack of internally generated funds, their lack of collateral to pledge for a loan, as well as their complete lack of control aversion, which stems from their high growth ambition. Even though many cleantech companies could be classified as NTBFs, their growth ambitions may vary, implying that control aversion still could be considered as a factor affecting cleantech investments.

5.2.3 Innovation and Business Risk

According to Reid and Smith (2003) there is always a measure of innovation risk in advanced technological sectors, such as the cleantech sector. The main risk with an innovation is that it may become unusable and thereby not fulfill its original purpose. Moreover, even if the

innovation fulfills its purpose, it may be too expensive due to the long time it generally takes to develop and produce innovations. If the market is unwilling to pay the higher price, there is innovation risk in not being able to generate enough profit to pay for the long R&D process once the product is launched. Innovation risk is also somewhat related to what is known as demonstration risk. The concept of demonstration risk implies that companies in a sector such as cleantech in many cases are dependent on being able to demonstrate or test their technologies in pilot facilities in order to attract customers. However, such facilities are generally very expensive (DealFlower, 2003).

For an investor, the innovation risk results in a business risk due to the fact that analysts are not able to accurately estimate the potential market value of the innovation or product (Reid & Smtih, 2003). Barney et al. (1989) refers to business risk as the risk of not obtaining the expected return on the investment. In the case of cleantech, business risk is created due to the fact that economists, accountants, analysts, etcetera are unable to accurately estimate the value of cleantech products and processes because of the complex environment it exists in. There is also business risk in the inability of entrepreneurs to take advantage of potential opportunities that the market may provide. Business risks can be argued to be related to what DealFlower (2003) describe as the market risk. The market risk describes the issue that arises when the market is not mature enough to absorb the product, despite the fact that it fulfills all the requirements set up by the company. This problem is derives from things such as price levels, competing techniques, lock-in effects and marketing difficulties. If the market is not ready for the said new technique, it will result in an obstructed market introduction, implying delayed, or defaulted, revenues.

Summary of the theoretical framework

To summarize, four sub-factors constitutes the category named political factors; (i) climate change, (ii) emission reduction targets, (iii) incentive programs, and (iv) pension fund governance. Further, there are three main sub-factors forming the category market factors; (i) increased costs for fossil fuel, (ii) information asymmetry, and (iii) innovation and business risk. These sub-factors are the foundation for the analysis conducted in next section.

6. Empirical Results

This section provides an analysis of the interviews conducted with respondents from the AP funds and with Henrik Malmsten from Durable Vision Invest. The analysis of the empirical material has been methodically conducted by using the analytical scheme presented previously. The empirical data has been scanned to disclose if the identified factor does affect the AP funds' investments in clean technology negatively.

6.1 Political Factors

6.1.1 Climate Change

The factor of anthropologically caused climate change and the increased recognition and acceptance of the phenomenon over the past decade is considered to be an important factor, as well as driver, for the cleantech sector. In fact, it could be argued that the threat of global warming, along with the political measures that has and will be taken in order to prevent it, constitutes the main foundation for the demand of cleantech.

Over all, the AP funds seemed to acknowledge the potential of the cleantech sector and were generally positive towards investing in it. Christina Olivecrona, Analysts Sustainability at the 2nd AP fund, says:

Companies that succeed in creating solutions to climate change or other environmental problem have a huge potential from an investor's perspective.²

In conformity with this statement Per Olofsson, Manager of Alternative Investments at the 7th AP fund argues that:

We believe that there will be an enormous amount of money invested in cleantech since everyone, sooner or later, are forced to convert to renewable energy sources.³

Moreover, Christina Kusoffsky Hillesöy⁴, Head of Communication and Sustainable Investments at the 3rd AP fund state that they believe that the cleantech sector has future potential to deliver high returns. If they thought otherwise, they would not already have invested in cleantech companies. The only respondent that had doubts about the potential of the Swedish cleantech sector was Olof Jonasson, Head of European Equities at the 1st AP fund.

I am not at all convinced about the fact that the cleantech sector has a high future return potential in itself. The aggregated return does not necessarily have to be fantastic, even if there are some companies that do well.⁵

This statement should be seen in the light of how Jonasson (AP1) argues that about 70 percent of the cleantech that is developed today is developed by large companies with their roots in other sectors than pure cleantech. Hence, Jonasson (AP1) see a potential in cleantech but is not

² Christina Olivecrona, Sustainability Analyst at the 2nd AP fund, Interview April 29th 2010

³ Per Olofsson, Manager of Alternative Investments at the 7th AP fund, Phone Interview May 20th 2010

⁴ Christina Kusoffsky Hillesöy, Head of Communication and Sustainable Investments at the 3rd AP fund, Phone Interview May 21st 2010

⁵ Olof Jonasson, Head of European Equities at the 1st AP fund, Interview May 6th 2010

convinced about the potential of the pure cleantech sector, i.e. companies that only develop cleantech innovations. Hence, there is a unified opinion among the AP funds that there exists a potential in clean technology but not necessarily in the pure cleantech sector. Judging by the attitude of the respondents towards cleantech, no matter by whom it is being developed, it is reasonable to argue that they take climate change and its effects on future regulations into consideration. Thus, ignorance of climate change cannot be seen as a factor that could hinder the AP funds from investing in cleantech. The fact that the public has become more aware of, as well as involved in climate change and the issues related to it does however not seem to affect the AP funds' investments in cleantech. As an example, Jonasson (AP1) phrases that the 1st AP fund has not experienced any kind of external pressure from the public concerning increased investments in cleantech companies. The increased pressure from the public is instead treated through corporate governance by stating that environmental and social degradation from companies where they are owners will not be tolerated. This approach is focused on the technique called negative screening, which implies not investing and/or selling equity already invested in companies that are determined being the worst companies seen from an environmental or social perspective in a particular industry. Concerning the 6th and the 7th AP funds it is unclear whether external pressure from media, the public, and other stakeholders, except for the government and the parliament, have an effect on their investments in cleantech.

In review, ignorance of climate change cannot be seen as a factor hindering the AP funds from investing in cleantech companies. Rather, the funds acknowledge a great potential in cleantech, although there were some disagreements on what company structure that is best suited to develop it. Still, there have been few investments by the AP funds in the cleantech sector. For example, the 6th AP fund has SEK 70 million, or 0.4 percent, of their total capital invested in cleantech companies.⁶ Hence, it is reasonable to argue that there are other factors hindering the AP funds from exploring the potential that they see.

6.1.2 Emission Reduction Targets

The global, the European and the Swedish emission reduction targets are in previous research identified as factors affecting the prerequisites for investments in cleantech products and innovations. Since all of the AP funds, except for the 6th AP fund, work on a global level, the Kyoto Protocol and a potential following protocols set the overall guidelines for how climate change is going to be treated in the future. Until recently, the Kyoto Protocol has been the document that investors can refer to, but the fact that it expires in 2012 and that no agreement was reached at the Conference of Parties 15 (COP 15) in Copenhagen seem to affect how the AP funds perceive the future of the cleantech sector. There were two different approaches among the funds. The first approach identified state that the uncertainty about what is going to happen after the Kyoto Protocol has a certain importance, but that it will not have any major implications for the cleantech sector since an agreement will come into place sooner or later anyway. Olofsson at the 7th AP explains:

It is just a question of time before most of the countries will agree on a common climate policy even though they did not succeed in Copenhagen. There are ongoing discussions and we all have to pull in that direction since there is no other solution.

⁶ Christina Brinck, Investment Manager at the 6th AP fund, Interview May 17th 2010

This approach implies a conviction that the cleantech sector has potential to generate returns without having to rely on the context that a new global climate treaty would create. The fact that an agreement is actually made is of course important, but it is not seen as a factor that could obstruct investments in cleantech. Out of all the interviewed respondents, only the respondent from the 7th AP fund was found sympathizing with this approach.

The second approach identified stresses the importance of a global political action plan and the impact it would have on predictions of the future of the cleantech sector and thus investments made in it. The unsuccessful negotiations of COP 15 in Copenhagen and the fact that nothing further was agreed upon concerning an expansion of the emission certificate system was a disappointment, as well as a negative incentive for many companies (Jonasson, AP1). It could thus be argued that the advocates of this approach feel that the international political insecurity that the failed negotiations of COP 15 brought imply higher risks, which in turn results in less investments in cleantech by the AP funds. Politicians worldwide must show what they are going to do about climate change and set the rules before the AP funds can act appropriately based on accurate calculations on the returns of a cleantech investment. This approach was advocated by the 1st, 2nd and 3rd AP funds. There is an obvious distinction between the two approaches, where the first approach is proactive and the second approach is reactive. Due to the fact that a majority (73 percent or SEK 526 millions) of the pension capital is located in funds advocating the second approach, it is reasonable to argue that the absence of a global post-Kyoto treaty is a factor that affects pension fund investments in cleantech negatively.

On a European and Swedish level the climate targets have a longer time perspective and the argument saying that politicians have to reach an agreement is thereby not applicable. However, there exists a perception that the regulations related to the cleantech sector, and especially the energy sector, have to be clearer. Christina Brinck at the 6th AP fund argues:

When we make calculations on a wind power project there exist uncertainties about the wind conditions, the lead time for the wind mill, the service of the mills, the interest rates, the cost of capital, the existence of the green certificates, the tax level on electricity, and so on. Since there are so many factors to take into consideration it is more or less impossible for us to invest in a wind power park – because of the uncertainty. In general, I believe that the legislation is good in Sweden but it could be even more distinct. If that were the case, more investors would dare to invest in such projects.

In order to facilitate for investors to invest funds in cleantech, it is hence of importance to set the regulations in a way that reduces the uncertainties for investors. The legal framework surrounding investments in cleantech could, according to this logic, thus be seen as a factor hindering the AP funds from investing in cleantech. Even though these regulations do not stand in direct relation to the Swedish climate targets, it could be argued that play an important role in Sweden's ambition to fulfill the vision of becoming climate neutral by 2050.

Additionally, the Swedish government has, in collaboration with the Swedish Environmental Technology Council, recently launched an action plan on how to improve its efforts to support Swedish cleantech and realize their vision of becoming a world leader in the development and production of cleantech. However, this vision of the government does not concern the AP funds,

according to the respondents. Even though they are public authorities it is of utmost importance not to confuse them with the government, as they are different entities. Jonasson (AP1) states:

If the government expresses a vision concerning stimulation of the Swedish cleantech sector it is not possible, with current legislation, to use the AP funds as an instrument to achieve that.

Hence, there exist a vision of that the government are not allowed to affect the daily work of the AP funds, nor its investments. The AP funds have the task to manage pension capital with maximum return, but they have a wide mandate to invest in different industries. The AP funds experience a lot of external pressure from different actors about what they should invest in. However, this is not something that the AP funds can take into consideration since it is not within their task. Christina Brink explains:

There is often pressure from the outside saying: "You have to invest in this company, in that town, because no one else is willing to invest there and you are a public authority". We say no to these kinds of investments since that is not our task – it is the task of the industrial policy. We work under the Ministry of Finance and they measure our return over time, every year, and it is thus impossible for us to motivate such an investment.

As long as the task of the AP funds is to maximize return, the visions of the government seem to be irrelevant. According to AP funds, it is thereby impossible to practice environmental or commercial policies through them. One respondent on the other hand, claim that AP fund investments tend to be political from time to time⁷, although the AP funds themselves claim the opposite. The fact that the AP funds, by means of current legislation (Swedish Government, 1999), are not allowed to abide to industrial or environmental policy should thus not be seen as a factor that is obstructing the AP funds from investing in cleantech, but it is still important to keep in mind.

To sum up, the AP funds generally consider the absence of an international post-Kyoto treaty and the unclear formulation of national regulations as a factor that discourages them from investing in cleantech. It creates additional uncertainties, which make it harder to calculate expected returns on investments in the sector. Moreover, the fact that industrial or environmental policy is unable to influence the investments made by the AP funds with current legislations is important to keep in mind.

6.1.3 Incentive Programs

In general, the cleantech sector, and especially certain industries within the cleantech sector such as wind power, is to a great extent dependent on different incentive programs to remain competitive. On an international level, so called feed-in tariff systems are most common type of incentive program. In Sweden, a system with green certificates is used to transfer money from the fossil fuel based energy producers to producers of renewable energy.

The design of the incentive programs could be considered to be even more important to the AP funds than to, for example, venture capital investors. This is due to the fact that the AP funds are required to keep a low risk profile and are thus to a greater extent dependent on accurate investment calculations. Overall, there was a general opinion among the respondents that the

⁷ Henrik Malmsten, Durable Vision Invest, Phone Interview May 16th.

design of incentive systems for cleantech, both internationally and nationally, are poor. On an international level, Spain constitutes an interesting example where the design of the incentive system produced unexpected consequences. Christina Brinck of the 6th AP fund gives her view on the matter:

The incentive program supporting solar cells with several billions that was launched in Spain resulted in loads of applications and start-ups from which people soon started to buy electricity, eventually leading to investors starting to invest. The problem was that when the incentive program was finished there was an enormous production capacity for solar energy systems, but no one was willing to invest in production facilities anymore since it was not favorable without the incentive program. Who took the hit? Well, the suppliers and the investors. If you have to use incentive systems, they have to be in it for the long-term, be distinct and sustainable.

To experience such as backlash from an incentive system, or knowing of others that have experienced it, will result in a general skepticism towards incentive systems and most likely make an investor think twice before entering such a project again. The international incentive systems must therefore be designed to be very clear and secure for a long period of time in order to not scare investors, as they then may do more harm than good to the cleantech sector.

When it comes to the Swedish system with green certificates the problems are not so much focused around the issue of durability, since this system will exist until at least 2030. Instead, that the biggest problem with the system is the focus of the incentives it provides. It does not promote small-scale cleantech solutions, which, according to Henrik Malmsten of Durable Vision Invest, it should:

If I generate energy from my home I do not get paid, the law says no. This circumstance is very unfortunate. In 40 other countries you would get paid if you were able to produce energy.

Malmsten (Durable Vision Invest) is convinced about that if the world is going to transform into a society built on renewable energy, the key is to support small-scale solutions. Germany, parts of China and the US have succeeded in making their incentive programs vital, while Sweden is lagging behind, according to Malmsten (Durable Vision Invest). For example, Germany has subsidized their cleantech energy sector heavily and given good feed-in tariffs, which have resulted in many good solar and wind power companies with a bright future. Germany has, through these incentive systems, become one of the biggest producers of solar cells in the world (Jonasson, AP1). Moreover, Malmsten (Durable Vision Invest) argues that if the cleantech sector, especially in the energy industry, is going to be able to compete toe-to-toe with its competition, more capital is needed from fossil fuel based energy producers. “The ‘dirty’ industries should be punished much harder for the environmental harm that it causes”, Malmsten (Durable Vision Invest) says.

To sum up, the respondents generally agreed that incentive programs are necessary in order to keep cleantech a competitive alternative to fossil based technology. However, some of the respondents state that they would never allow an investment calculation to only rely on the existence of an incentive program and that there must be a competitive advantage in the product or service itself (Olofsson, AP7; Brinck, AP6). Furthermore, many of the respondents expressed

a worry that problems with the design of the incentive programs may cause them to do more harm than good, since the increased risk a badly designed incentive program entails may discourage further investments in the sector it was designed to help.

6.1.4 Pension Fund Governance

The way the government manages the AP funds do per definition affect in what the AP funds are allowed to invest their capital, at least to certain degree. The general opinion among the AP funds seems to be that the investment directives decided by the Swedish parliament do not affect their possibilities to invest in cleantech. Nevertheless, statements by two AP fund executives in an article in the Swedish newspaper Dagens Nyheter indicate that there could be potential problems with the current investment directives. In this article, the 3rd and 4th AP funds express a wish of being able to invest a larger portion of their assets in unlisted companies (Gripenberg, 2007). If such a change were carried out, it would imply that the AP funds could invest in companies in earlier stages and thereby also take advantage of the greater potential of high returns that companies in earlier stages have. A quote by Jonasson at the 1st AP fund support the statement made in Dagens Nyheter to some extent:

It is possible to argue that the limit of 10 percent ownership in a listed company could be considered a limitation due to the fact that many cleantech companies are small. But since a lot of cleantech is found in big companies, this is not an issue for the real exposure towards the sector.

Judging by these statements it is reasonable to argue that the investment directives set out by the parliament do not stimulate investments in small companies. Since a majority of the cleantech companies in Sweden are small, the legal framework governing the pension funds could indirectly be considered to hinder the 1st through 4th AP funds from investing in cleantech. The legal framework established in the Swedish National Pension Fund Act (SFS 2000:192) is thereby not sufficient and is to some extent being experienced as a factor that indirectly obstruct investments in cleantech companies.

The AP funds are not only governed by investment directives, but also by government bill 1999/2000:46, which state that the AP funds should invest their assets in such a way that it maximizes long-term return with a low level of risk. They should manage their assets without being influenced by any prevailing governmental policies, whether industrial or economic. The AP funds are also to give consideration to ethics and the environment, although without compromising with the overall goal of achieving a high return. The interpretation and adaptation of the last sentence is especially interesting, due to the fact that it does not seem promote proactive actions, judging by the way that the AP funds refer to the paragraph. Instead, the AP funds refer to this more as guidelines for how the AP funds should relate to companies that do not manage their social an environmental issues properly (Olivecrona, AP2). During the interviews, it became evident that the most important paragraph is the one referring to the overall goal of high return. This overall goal is not supposed to be renounced, and there is hence no direct room for the AP funds to work with social and environmental issues in a proactive way. However, this is not considered as a factor that has the ability to obstruct investments in the cleantech sector, but rather as a factor that is not stimulating the AP funds to work with social and environmental issues in an adequately proactive manner.

If the parliament has the ambition to govern the AP funds in a direction where more capital is invested in the cleantech sector, this could only be achieved by amending the pension fund acts. The Swedish Centre Party has explicitly expressed such a proposal, based on examples from the US where institutional investors have played a huge role for the development of the cleantech sector. As stated in the theoretical framework, the strategy advocates an amendment in the Swedish National Pension Fund Act (SFS 2000:192) implying that at least 1 percent (SEK 8 billion), more than the 5 percent that the 1st through 4th AP funds are allowed to invest in unlisted companies today, should be invested in Swedish cleantech. This should generate the necessary capital to the sector and also demonstrate the Swedish government is serious with the ambition of becoming a world leader in cleantech. Such a change in the investment directives would however not be appreciated by any of the interviewed AP fund respondents. First and foremost, they doubt the very possibility of finding enough cleantech companies in which to invest SEK 8 billion. Christina Brinck (AP6) states:

In short – no, there is no room for a SEK 8 billion investment in the part of the Swedish cleantech sector that the 6th AP fund is legally allowed to invest in (i.e. mainly unlisted SMEs).

This means that even if an amendment would be passed, the Swedish cleantech sector is currently too small for such an investment and it would, according to Jonasson (AP1), probably just be a waste of money:

It would not be beneficial for the cleantech sector to just receive a huge chunk of capital without having good ideas that would work - that is just capital destruction. I have seen this happen too many times – cleantech companies that receive capital but cannot handle it.

In short, the investments that Swedish Centre Party proposes as being beneficial to the cleantech sector and a mean to show other investors that the cleantech sector is worth investing in, is not something that the AP funds would approve of. Secondly, it is a question of whether or not it is a good idea that the parliament conducts industrial policy through AP funds. Jonasson (AP1) argues that having capital earmarked for the cleantech sector it is not the right way to go. He is, along with most of the other AP funds, very skeptic towards letting anything interfere with the mission of generating high a high return in order to ensure the welfare of future senior citizens. The previously mentioned statement where AP fund executives state that the AP funds in fact would like fewer directives confirms this attitude further. Moreover, the respondents state that such an amendment would require two consecutive majority decisions by the parliament and are thus quite complicated to put into effect.

To sum up, the investment directives can to some extent be considered to be a factor that obstructs the AP funds from investing in cleantech. The fact that government bill 1999/2000:46 does not promote an proactive approach for taking social and environmental consideration is not a part of that factor, but it cannot be said to stimulate the development of cleantech either. Visions on how such an approach could be demanded by the pension funds have been expressed, but these were not met with much enthusiasm by the AP funds.

6.2 Market Factors

6.2.1 Increased Costs for Fossil Fuel

The fact that the supply of fossil fuels is diminishing, as well as becoming increasingly more expensive to extract, will consequently increase its price on the market, as well as the price of the products and services that rely on it. As a result of this, the relative price of cleantech will decrease, i.e. the cost for producing wind power will become increasingly lower, relative to the cost producing the same amount of fossil based power. The fact that the output of clean technology will become increasingly less expensive to produce relative its fossil based competition is definitely seen as a driver for the cleantech sector. However, being able to predict how these changes in relative price will occur is a fundamental part of analyzing investments in both cleantech and fossil based technology.

In general, the respondents agree with the notion of increasing costs in the fossil fuel based energy sector and they also state that this is something that is included in their investment calculations. Olofsson at the 7th AP funds says:

It is very hard to estimate, but at the same time, that is the only thing we can do since no one knows what the price of energy will be in the future. Nevertheless, we are convinced that the prices of fossil based energy will increase until the day when there exist sufficient renewable energy sources. But absolutely, this is something that is included in our calculations.

However, there seem to exist some reluctance among the funds to talk about what is being included in these calculations and what kind of special competences they use to evaluate cleantech companies as opposed to fossil fuel based producers. Kusoffsky Hillesöy at the 3rd AP fund states that:

We do never speak about how we do our calculations concerning an investment. But generally speaking, we look at different risk factors.

It is hence hard to draw any conclusions about what kind of factors the AP funds would look at in a comparison between an investments in a fossil fuel based company and an investment in a clean energy company. While it, in this context, may seem easy to criticize the AP funds for their holdings in fossil based energy companies, the AP funds themselves argue the other way around, by claiming that it is better that a pension fund owns such a company, than if that someone else would have owned it. Jonasson (AP1) explains:

It is very important that we own these companies, so that we can affect them in a positive way, as opposed to if we would have disaffiliated from these holdings. I mean, there will always be owners to those companies anyway.

However, given the belief that companies based on fossil technology will be worse off in the future, this attitude could be seen as somewhat short-term. Yet, there will still be a long time before, for example, oil companies will experience significant impact from the price increase according to Jonasson (AP1):

The oil companies are decreasing in value and this is partly related to the price increase on emissions. But this is very long-term and does not have short-term effects.

Another point made by Jonasson (AP1) is that the price increase will not primarily affect the companies. Rather, he claims that it will be the consumers that will take the bigger hit by having to pay the higher price, given that the price is still lower than that of renewable energy, and the revenues of the oil companies will thus remain unaffected for a long time ahead:

The best returns available today are achieved by doing the opposite and not by investing in cleantech. Among the best sectors, on a ten year perspective, in regards to return is the oil sector. The worst sector on a ten years perspective is the technology sector. Well, it is not always the most interesting and exiting sector that generates the highest return.

Hence, given that the overall goal of the AP funds is to generate as high returns as possible, the oil sector will still be considered to be a very favorable investment for yet some time. If these companies were to be punished even harder for their impact on the environment, it would give the investors fewer incentives to invest in the sector and thus increase the incentives to invest in the cleantech sector instead. This is in accordance with what Malmsten (Durable Vision Invest) stated earlier.

To sum up, the AP funds generally agree on the fact that an increased cost for fossil fuel based energy is a factor that affects cleantech positively. However, there are still incentives to own fossil fuel energy producers despite the expected price increase, since the increase will take place on a long-term perspective. Since the AP funds does not have a perspective that stretches this far ahead, the price increase of the products of fossil based technology does not seem to affect their investments in any major way. This results in continued incentives to invest in sectors such as petroleum, which in turn results in relatively fewer incentives to invest in a sustainable alternative. Increased costs for fossil fuels can however not be seen as an obstacle for investing in cleantech, but not as much of a driver either.

6.2.2 Information Asymmetry

The previous research presented in the theoretical framework suggests that the asymmetric relationship between the manager and financier creates situations in which companies prefer certain types of financing to others and that companies in general try to avoid external equity funding. These preferences could pose problems for the cleantech companies when it comes finding capital.

Capital preferences

In this study, a point of departure is the notion of a general capital deficit within the cleantech sector. During the interviews, there were a general acknowledgement of the deficit, but the responded tended to disagree on its location and extent. All the AP funds claimed to have little or no involvement in the earliest stages of development of companies. In the case of the 1st through 4th funds, this is completely natural since the law forbids them to invest in unlisted companies. However, even the 6th AP fund, which is to invest its funds in Swedish small and medium-sized growth companies claimed to avoid the earliest stages, in order to achieve a higher return:

Our goal is a high return, and return is very dependent on time. In order to shorten the time it takes until the return is sufficient, investments are made in more mature stages. However, on the energy market the companies are so large that they most often are not even in demand

of external capital and there is thus very little business to be done with the more mature companies there.

The 7th AP fund also showed a degree of skepticism toward the earliest stages:

The shortage of capital is present over the entire spectrum. However, we try to avoid the super-early stages and instead focus on companies that are close to being, or already are profitable. It is not our intent to invest in start-up projects where an injection of capital is needed every year for five or six years before something starts to happen. Sure, there is such a component in our portfolio as well, but the risks are so high [in this stage] that we are unable to invest any larger amounts in this stage, since we have to primarily consider the interests of our savers.

Henrik Malmsten of Durable Vision Invest claimed that the early stages make many investors skeptic due to a history of not living up to its expectations and adds that the notion of cleantech being perceived as an additional risk factor:

Seed and other early stage companies in general have not really paid off in Sweden they way people had hoped they would. If you add a couple of tablespoons of cleantech to the mix, then people start to get really cautious.

On the other hand, both Olivecrona (AP2) and Jonasson (AP1) questioned if capital really was the limiting factor of the cleantech-sector in Sweden. For example, Jonasson (AP1) states that:

The way I look at it, there is always capital available to finance a good idea. If the cleantech-sector is experiencing a capital deficit, then they are either unable to present their ideas well enough or they simply don't have products that are good enough.

Jonasson (AP1) presents an interesting point of view in which the capital deficit in the cleantech sector is the product of the cleantech companies' disability to present ideas that are good enough to him, rather than an actual capital shortage on the financial market.

Control Aversion in SMEs

The Swedish cleantech sector is to a large extent constituted of Small to Medium-sized Enterprises, with a significant part of these being classified as micro companies with a turnover less than €2 million. SMEs are characterized by informational opacity, implying that small companies experience the problems related to information asymmetry to a greater extent than other companies and thus have problems credibly communicating their qualities to potential investors. Given the capital deficit in the sector, the most natural funding method available to the cleantech sector would be internally generated funds. However, new technology based firms generally have little access to internally generated funds during its early stages due to the amount of time spent on research and development. There are certainly companies that are able to grow organically to some extent, but a reasonable conclusion is that the demand cannot be saturated using internal financing alone. NTBFs also do not have the ability to pledge collateral to the same extent as other companies and might have a harder time being granted a loan as a result. This leaves the cleantech companies with different kinds of equity financing, i.e. venture capital companies, business angels, private equity funds and, perhaps, pension funds. However, it should also be taken into account that not all cleantech companies have high growth ambitions by default. At this point, the demand for equity financing seems to depend largely on the company's

level of control aversion, which in turn correlates negatively with its level of growth ambition. According to the Brinck at the 6th AP fund, control aversion has been a deal breaker in some discussions they have had with companies:

There are many companies that ought to take on external equity financing, but there are few that are willing to pay the price. For the entrepreneur, the choice between owning 100 percent of a small company and owning 20 percent of a larger company is not as easy as it might seem. It may not always be about the money, it is a choice that will affect his whole way of living. The fact that the original owners are reluctant to let go of the reins has been a deal breaker in many potential investments we have been discussing. However, this is but one of the problems that the cleantech sector is facing and it is not even specific to this sector – it exists in all entrepreneurial companies.

Henrik Malmsten (Durable Vision Invest) agrees that control aversion can play a large role in the financing decision for the entrepreneur:

The entrepreneur often feels like he is being engulfed by the company as it grows larger and this is something that the entrepreneur in most cases does not want. It is very rare that the entrepreneur wants to abandon his fantastic project after several years or hard work with a quick exit. A loan to finance a bridge is usually fine, but to suddenly have a “Big Brother” telling you what to do, well, that is a much more complicated matter.

The 6th AP fund further states that there certainly seems to exist preferential order for capital and that the entrepreneur generally prefers a loan to equity:

If given a choice, entrepreneurs usually prefer borrowing capital to issuing equity, since they seem believe that they will be able to pay the loan back within a year. Well, this is not always the case and the company will usually need additional funding rounds further down the road.

However, the 6th also stresses the point that there are companies that seem to not abide to this preferential order and instead recognize the benefits that come with issuing equity:

Of course, there are also those companies that feel the other way around; they want the benefits that equity financing can provide, in the form of added competence to the board, networking etc.

Overall, the respondents acknowledged the notion of capital preferences among entrepreneurial companies. However, due to the capital deficit the cleantech sector is experiencing, along with the problems that small to medium-sized enterprises as well new technology based firms are having, it is reasonable to argue that the survival of the company becomes the primary focus, making it harder for the companies to abide to such a preferential order. Generally speaking however, the problems related to information asymmetry, especially those derived from control aversion, have potential to constitute an obstructing factor for pension fund investments in cleantech.

6.2.3 Innovation and Business Risk

Innovation and business risks are risks related to not getting a sufficient return on invested capital. In the context of pension fund investments in cleantech, these risks could be argued to be

one of the major factors obstructing development and making the AP funds hesitant about investing. In this section five major cleantech business risks are identified.

Managerial Challenges within Cleantech Companies

The first factor that the respondents noted was the managerial challenges that arise when firms grow. In the technological industries, entrepreneurs are often inventors or scientists that to some extent might lack the managerial skills usually demanded by a CEO. Because of this, some cleantech companies are according to the respondent experience problems when trying to market and sell their finished product. Malmsten (Durable Vision Invest) and Brinck (AP6) explain:

In many cases, and now I am generalizing to a very large degree, it is scientists that find themselves with the mission of taking something all the way to manufacturing, marketing and distribution. There are very few people that have what it takes to overcome that challenge (Malmsten, Durable Vision Invest).

Few people are able to fulfill the role of CEO of a company as it grows all the way from a start-up stage to a company with SEK 500 million in revenue (Brinck, AP6).

The skills and qualifications that are demanded of a CEO are usually dependent on the size of the company. As the company grows, numerous organizational tasks and challenges arise that did not exist prior to the growth occurred. According to Brinck, the 6th AP fund often recommends the companies they invest in to instate new CEOs in order to accommodate the need for the different types of leadership and organizational structure that growth implies. As 87 percent of the Swedish cleantech companies are classified as micro companies in accordance with the EU definition (European Commission, 2003), 6 percent are classified as small and an additional 6 percent are classified as medium-sized, a large portion of the cleantech companies could reasonably expect to encounter these problems in one form or another, if they are to grow. Kusoffsky Hillesöy (AP3) describes her view on the subject:

In innovative sectors like cleantech, it takes a lot of investments in technology in order to develop a product. However, it is important not to forget about the market. Being great at developing a technology does not mean you are going to be good at selling it. The successful cleantech companies that I have heard of have, in many cases, recruited a management team that has been very sales-oriented.

Olofsson (AP7) confirms:

Many cleantech companies have problems with marketing themselves and their ideas, which of course is understandable, but I think the companies could do a lot better. At the moment, Sweden is inferior to, for example, USA when it comes to marketing, raising capital, starting the production and being able to show the utility of their product and so on. I believe it is starting to improve though.

Thus, the AP funds see a business risk in the fact that many cleantech companies and CEOs are unwilling to do what it takes to grow. Whether this actually is the situation or not will not be able for this study to answer, but there seems to be a widespread notion among the AP funds that cleantech companies, as well as entrepreneurial companies in general, often lack management and marketing competence, which poses a risk to the AP funds, since it may hinder growth.

Lack of Reference Cases

An additional factor associated to business risks is the opinion among the AP funds that there is a lack of good reference cases, i.e. investments and companies that have gone through the whole process from investment to divestment and generated high return. Brinck (AP6) argues:

I think that the cleantech-sector needs a few companies that have done really well and gone through the whole process of being bought and sold. Cleantech is still a relatively new concept and there are few investors that have made significant investments in the sector. A few cases that people could refer to and think, "this is the next it-company", would give people the courage to invest.

When relaying this thought in the interview with Henrik Malmsten (Durable Vision Invest) he responds:

Well, we won't see those for another 10 years. It will take a long time before many of these companies will make significant profits.

A reasonable interpretation of these two statements is that there is a catch-22 situation, where investors are going to be hesitant against investments in cleantech companies as long as no good enough investments have been made to act as reference cases. The fact that it will most likely take a couple of years before such reference cases come along could imply that investors will remain skeptical towards the cleantech sector for the time being. If this is the situation, it is of course a problem. Malmsten (Durable Vision Invest)'s comparison with the IT-sector exemplifies this:

We have just recently started to truly reap what we sowed during the IT-boom, the massive investments that were made during that era are paying off only now ten years later. And I am personally convinced that we will see a boom within the cleantech sector in couple of years and if you are not investing now, you will later be watching the train go by without being onboard.

However, Malmsten (Durable Vision Invest) also point out that there are many cleantech companies that do not deliver what is expected from them in terms of return. This in turn, decreases the credibility of the whole sector. The fact that the sector lack from reference cases considered to be successful enough by investors is hence increasing the business risk and is a factor affecting AP fund investment decisions.

Cleantech Sector Hype

A number of the respondents expressed concerns about hype in the cleantech sector and as a result, overpriced investments. Olivecrona (AP2) states:

There seems to be a certain degree of anxiety that the cleantech industry becomes overpriced due to its hype, which I think might discourage some investors.

Kusoffsky Hillesöy at the 3rd AP fund confirms:

There are companies in all industries who are capable of delivering a return that is higher than average, the challenge is to find those companies. It is also important to consider the

time frame of your investment. Is it possible to hold off the investment until the hype is over? Many of the cleantech companies are small and are not delivering very high returns at the moment. You will have to calculate the amount of time you can hold off before you need the return. (...) The hype absolutely affects our investment decisions in cleantech. When analyzing an investment, one has to take the expected return, the time horizon and the cost of the investment into account. If the price is very high, well, of course it will have an effect on the decision.

In addition, Jonasson (AP1) argues that there historically have been several hyped companies and specific cases that have made investors reluctant towards invest in emerging industries:

I think many people have burned a lot of bridges because of these hyped stories. We have been rather good at doing that in Sweden – just remember the dotcom boom and how all those companies seemed so great and then they all just crashed and burned? It may just be that the memories of those days are still in peoples' minds.

Thus, two things are, according to the respondents, the cause of the hype. On the one side, the respondents felt that the hype increased the expectations on the sector in terms of return, which consequently becomes unable live up to for the companies in many cases. On the other side, the great interest in the few public cleantech companies available has caused the price for these shares to become excessively high. An investor will have to take the additional risks these effects imply into account when evaluating a potential investment. However, the effects of the hype do not seem to stand in conflict with the capital deficit noted in other parts of the sector.

Few Investment Possibilities

Another problem related to market conditions that emerged during the interviews is that the AP funds feel that there are too few good cleantech companies and cleantech funds for them to invest in. Jonasson at the 1st AP fund describes the Swedish situation:

Sweden claims to have very successful environmental and cleantech sectors, which might be the case. However, there are no large companies within these sectors.

Jonasson (AP1) continues:

Many of the cleantech companies are too small. While we certainly could put a lot of time and effort into evaluating these companies and then invest something like SEK 40 or 50 million, it would be pointless since they are such small companies. Even if such a company would do extremely well during a period of time it would not contribute enough to be motivated. We are a too large capital investor to get involved in venture or seed capital.

Judging by these statements, the company size and structure of the cleantech sector is a problem when it comes to further investments from the AP funds. There does also seem to be a major gap between the smaller companies and the larger companies in the cleantech sector, according to the respondents and the statistics. The explanation for the existence of this gap is, however, hard to identify. One explanation could be the shortage of capital in the early stages of the companies' life cycle. Another explanation could be that larger companies, that do not view cleantech as their main business concept, are acquiring the successful cleantech companies (Jonasson, AP1). As a result, the medium-sized cleantech companies may seem to have vanished

in the statistics. The fact that it hardly exist any big cleantech companies within Sweden could thus be a factor affecting investments in the Swedish cleantech sector. However, this problem is mainly related to the 1st through 4th AP funds, since they are very large capital owners and thus focus on big investments. The 6th AP fund does only focus on small to medium-sized companies and the 7th AP fund have a different role, which results in that the problem could be said to be less relevant for them. When it comes to investments in cleantech funds, Jonasson (AP1) states that they evaluate such funds and compare them with other investment alternatives. However, there seems to be problems finding successful funds that focus on cleantech. Kusoffsky Hillesöy (AP3) states:

If you look at the amount of private equity funds that only focus on cleantech, they are few. This could be an indicator of a problem with raising capital. On one hand, there are not enough interesting companies to invest in, and on the other hand there could be difficulties finding enough investors.

After the financial crisis struck in 2008, the situation for these funds has worsened even more. The market became hesitant towards investments and instead focused on the future and their own survival (Malmsten, Durable Vision Invest). Furthermore, the AP funds themselves all made significant losses during this year, most likely implying that they have tried to avoid risky investments to an even greater degree ever since. In short, the fact that the AP funds regard the Swedish cleantech sector as containing too few interesting investment possibilities is considered a factor that affects investments in Swedish cleantech. Olivecrona from the 2nd AP fund confirms this further by saying:

The problem from an AP fund perspective is that there are too few good investment objects in the sector, both from company perspective and from a fund perspective.

What the conditions look like regarding sector structure and cleantech fund performance on the international cleantech market has unfortunately not been possible to determine based on the conducted interviews.

Competence

The factors above are all considered to be business factors, affecting investments in cleantech from an AP fund's perspective. Another such factor is competence. The respondents agree that special competences are needed to evaluate the risks and possibilities within the cleantech sector in an accurate manner. However, the respondents disagreed on whether or not the AP funds themselves have access to these competences.

Normally, the AP funds employ external managers to manage a large portion of their assets and these managers are generally very competent, according to some of the respondents. In addition to this, the AP funds hire further consultation and external analysis from consultants with various areas of expertise. However, there is a general knowledge about climate change and its effects in-house, e.g. to what extent industries are likely to be effected by increased costs associated with CO₂-emissions. Olofsson (AP7) explains that:

Although there are relatively few with competence on this subject, it is a necessity for us in order to be able to evaluate what ideas that have potential to lead to something long-term. We believe we have found a number of external managers with the competence we seek.

Overall, it could be argued that AP funds themselves are convinced about that they possess, and/or have the possibility of hiring the competence that is needed to evaluate the cleantech sector in appropriate manner. However, Malmsten of Durable Vision Invest, who has experienced both sides of the spectrum, disagrees:

Generally speaking, the Swedish investment sector as a whole is underdeveloped when it comes to cleantech investments compared to the US, Germany or China. As of today there are very few of us who can properly evaluate the new cleantech companies in need of financing. Apart from financing the cleantech companies also need support in a variety of ways during the development stages.

Even though the AP funds do not necessarily use national external competences, the statement could still be considered to be an indication that the AP funds do not have sufficient competence. If they do not have enough competences in-house, it would imply that they are left out entirely to the use of external competences. However, this may very well be the case in several other sectors as well. Nevertheless, the competence required is very hard to acquire, implying that this could be considered a problem not only for the AP funds, but also for investors in general.

Seen from an AP fund perspective, the cleantech sector lacks business credibility in many cases, which in turn becomes a factor that obstruct investments. The fact that AP funds are bound to consider risks to an even higher extent than other investors make them even more sensitive to these issues and leads to an increasing skepticism towards the cleantech sector. However, it is unclear whether or not the AP funds have the competence to evaluate many of the risks that are specific to the cleantech sector and it thereby becomes reasonable to question whether this skepticism is justifiable or not.

7. Conclusion

7.1 Findings

The overall objective of this study has been to portray factors affecting AP fund investments in clean technology negatively. This has been done within the given premises of political factors and market factors. The following section intends to present the results of the study, discuss the validity of these results, and identify potential future research.

7.1.1 Political factors

Within the factor concerning political matters, four sub-factor affecting investments in cleantech were identified; (i) Climate Change, (ii) Emission Reduction Targets, (iii) Incentive Programs, and (iv) Pension Fund Governance. Out of these four, the only sub-factor that is not considered to have a negative impact on cleantech investments was climate change. All of the interviewed AP funds do see anthropological caused climate change as the underlying factor for the business potential of cleantech, which in turn was expected. The remaining political sub-factors are thus argued that, to some extent, affect the AP funds' investments in cleantech negatively. Firstly, the fact that emissions reduction targets are not in place or are too unclear is considered to be a factor affecting AP fund cleantech investments. Emission reduction targets are by previous research identified as a driver for the cleantech sector but the result of this study shows that these targets seem to be too unclear to have any positive effect on investments in cleantech. Secondly, the poor design of incentive programs is seen as a factor of uncertainty and does thereby have a negative impact on AP fund investments in cleantech. The incentive programs are however a driver and a prerequisite for the existence of a cleantech sector but according to the results of this study poor and unstable design of these programs affect investments in cleantech negatively. Thirdly, the Swedish pension fund investment directives are considered to be a factor obstructing AP fund investments in cleantech due to their strictness. The investment directives are in many cases considered as good but the fact that they oppose investments in early stages of companies is according to some of the respondents have negative effects on investments in cleantech. Table 7.1 illustrates the political factor findings.

Table 7.1: Political Factor Findings

Political Factors	Negative Impact on AP fund Investments in Cleantech	
	YES	NO
Climate Change		X
Emission Reduction Targets	X	
Incentive Programs	X	
Pension Fund Governance	X	

From an AP fund perspective, the result could be interpreted as an indication of that political policies concerning emission reductions, incentive programs and pension fund governance are of inferior standard when it comes to give incentives for cleantech investments. The fact that the AP funds are obliged to invest with lower risk than other investors implies that the political risks, both nationally and internationally, in many cases are considered as too high. Even though governments are keen on stimulating investments in cleantech it does not seem to be enough for

the AP funds. The AP funds need a context of robust and long-term political solutions in this issue otherwise capital investments in cleantech will most likely be delayed. However, this is complex issue dependent on actions at several political levels. There are hence no easy solutions to reduce the negative effects of the political factors identified in this study. But as long as the national pension fund regulations do not include paragraphs about a proactive approach to environmental issues, the incentive program designs are poor, and a post Kyoto Protocol agreement is not made, the pure cleantech investments from the AP fund will most likely continue to be small. Especially since the AP funds seems to see pessimistically at the market incentives to invest in companies only focusing on clean technology at the moment.

7.1.2 Market Factors

Within the market factor category, three sub-factors were identified: (i) Increased Costs for Fossil Technologies, (ii) Information Asymmetry and (iii) Innovation and Business Risks. Due to the nature of the factor, increased costs for fossil technologies is not considered to have the ability to affect investments in cleantech negatively. Rather, it is a question of the extent that this factor can affect investments in a positive manner. As long as the increase of the cost is gradual over a long period of time, the impact on investments in the cleantech sector will work through incentive systems and international regulations, as discussed earlier. Overall, there are still enough incentives for the AP funds to invest in fossil technologies. However, continued investments in fossil technologies do not have to imply negative impacts on investments in cleantech.

The asymmetric relationship between manager and financier can pose a negative impact on investments in cleantech. Because of this asymmetry, companies develop capital preferences that generally discourage from external equity funding, which is the investment method employed by the AP funds. However, studies have shown that new technology based firms, and especially small ones, have a hard time procuring the capital they prefer, due to less access to internal funding and lower chances of getting a loan due to a general lack of collateral to pledge. Depending on the company's level of control aversion, it will be more or less likely to seek external financing. According to some of the respondents, the company's level of control aversion is sometimes what makes or breaks an investment decision.

Several interesting topics were derived from the interviews concerning innovation and business risks. The AP funds generally felt that cleantech companies tend to encounter managerial problems while growing due to a lack of market focus and management competence. Furthermore, many of the funds thought there were too few interesting investment opportunities in the sector, which made investors uneasy, and some stated that a few successful reference cases might be able to negate this problem. In addition, there were worry among the AP funds that the cleantech sector has become overprices due to its present hype. Lastly, some of the respondents questioned the AP funds' competence on analyzing and evaluating investments in the cleantech sector. Overall, all the aspects of innovation and business risk mentioned above can be considered to have negative impact on investments in the cleantech sector. The overall impact of market factors is displayed in table 7.2 on next page.

Table 7.2: Market Factor Findings

Negative Impact on AP fund Investments in Cleantech		
Market Factors	YES	NO
Increased Costs for Fossil Technologies		X
Information Asymmetry	X	
Innovation and Business Risk	X	

Thus, the final result of this study is that five out of the seven identified sub-factors could be considered to affect AP fund investments in cleantech negatively. By portraying these factors it also reasonable to argue that the overall objective of this study is fulfilled.

7.2 Concluding Discussion

The climate crisis is on the top of political agendas across the globe, and so is the continued development of the technology that is supposed to minimize its consequences. In Sweden, this development is hindered by, among other things, problems with finding capital. This study investigates factors that obstruct capital from being obtained from the Swedish National Pension Funds. As shown by this study, there are a great number of factors that have the potential to do this, making it a very complex matter to resolve. However, it is important to consider that the AP funds will not invest in cleantech out of obedience to some industrial policy or government vision, nor out of respect for the environment, but because they see a potential for high return. This is simply because that is the mission they have been instructed to carry out. As it stands now, if the pension funds do not see this potential, there will not be any pension capital invested in the cleantech sector. Nevertheless, capital from the AP funds being invested in the cleantech sector could be considered as an important part of a further expansion of the Swedish cleantech sector. Hence, this comes down to a question of responsibility, i.e. who is responsible for solving the identified obstructions?

On one hand, it could be argued that the market will figure itself out and that its forces will, in due time, make the cleantech sector more attractive to investors. From this perspective, the responsibility lies within the cleantech sector itself and it is up to the cleantech companies to deliver better products that can produce a better return for the investors that are risking their capital in order to develop it. As it stands now however, oil and other fossil based options still holds an advantage in being significantly cheaper to produce than its cleaner alternatives. The point where the supply of fossil fuels will start to diminish, and thus increase its cost, is still so far ahead in the future that it will take a long time before the market forces will be able to create significant incentives for choosing cleantech over fossil based technologies. This is driven further by the fact that electricity and fuel are both easily accessible goods for most citizens of industrialized nations and clean versions of these goods does not constitute any obvious advantages to the end customer. Furthermore, many of the identified problems related to the cleantech market are not specific only to cleantech, but exists in many emerging markets. Overall, it could be argued that market forces alone will not be able to create a prosperous cleantech sector, at least not at the pace needed to meet the goal of not exceeding an average increase in mean temperature of two degrees Celsius.

The cleantech sector is hence a sector that is highly dependent on political decisions and stimulation. This dependency can be said to be even higher in the case of AP fund investments in cleantech since the AP funds are controlled, however indirectly, by politics, as opposed to a private venture capital fund. However, the fact that the mission of the AP funds, to generate a high return while maintaining a low level of risk, is formulated by politicians could be said to relieve the responsibility of the AP funds. The AP funds are only supposed to perform the task given to them in the National Pension Funds Act and if investments in cleantech do not show the required levels of return and risk, they will not be undertaken, implying that the responsibility lies not with the AP funds, but with the politicians formulating their mission. Nevertheless, it could be argued that the fact that Government bill 1999/2000:46 states that the AP funds are to give consideration to the environment could be said to, by definition, entail some degree of responsibility.

If the market forces alone do not hold the power create enough incentives for investing in cleantech and the AP funds themselves have little room to conduct investments that are not one hundred percent in line with their mission, the responsibility arguably lies with the politicians. It is the political sector that is responsible for stimulating the market in such a way that cleantech is allowed to flourish, as well as formulating the legislations that constitute the mission of the AP funds. A simple solution might be to undertake a suggestion similar to that made by the Swedish Centre Party, i.e. devote a certain portion of the assets of the AP funds to cleantech investments only. However, such a method would require an amendment of the National Pension Funds Act, making it a difficult method from an implementation point of view. Furthermore, such a method might be considered as a slightly harsh way of stimulating a sector and could thereby end up being somewhat inefficient. A method where further incentives are given to invest in cleantech using different types of incentive programs would most likely be considered a more dynamic method for stimulation, at least from the perspective of an investor. This could be achieved either by stimulating cleantech directly by encouraging investments in the sector, or indirectly by discouraging from investments in fossil technology.

Overall, the political responsibility and the political factors must be considered to be of higher importance than the market factors and the responsibility of the investors. In the end, it all comes down to a question of who is responsible for solving the climate crisis as a whole. On a global level, the countries that will be in the largest demand of clean technologies in the future are developing countries, which will need cleantech to be able to skip the stage of development that the developed countries are trying to transition away from now, in order for the world as a whole to avoid a global climate crisis. The question is who is responsible for providing the vast amounts of capital that will be needed to achieve this? Regardless of where this responsibility lies, market forces alone will, as previously mentioned, not be able to produce these amounts of capital and political measures will therefore have to be taken in order to generate them. Due to the important role that cleantech plays in the prevention of a climate crisis, the option of letting the free market govern investments in cleantech will not be sufficient, at least not in short enough time for it to matter.

7.3 Critique

The validity and reliability of the results could be discussed due to the implications mentioned in section 2.2 and 2.3. Given the scope of the study, the conclusion that five out of the seven identified sub-factors are considered to affect AP fund investments in cleantech negatively, should be seen from an investor's perspective. The fact that an AP fund considers a factor to have negative effect does however not necessarily mean that a factor constitutes an obstruction in the eyes of other stakeholders, for example the cleantech companies themselves, since they only represent one side of the issue. An optimal study would thereby investigate the perspective of the cleantech sector as well as the perspective of political stakeholders, both on a national and on a European level. Moreover, the fact that interviews were only conducted with one respondent from each organization results in further implications for the validity of the study. To increase the validity, interviews with several respondents from each organization would have been preferred. Such an interview set would have given an improved representativity for the approach of the entire organizations, as well as further decrease the chance of overlooking additional factors.

The empirical data presented in this study could however be considered as rather unique seen from an international perspective. For students to be granted interviews with professionals at leading positions in the some of the country's largest institutional investors seems unlikely anywhere outside of Scandinavia. Thus, the material and results presented in this study is considered to give interesting input on factors obstructing institutional investments in cleantech, despite the validity implications.

7.4 Future Research

This section identifies two potential areas of interest for future research:

1) *The perspectives of other stakeholders*

Being able to grasp the perspectives of other stakeholders in this issue could be vital in order to fully understand the situation. Examples of such stakeholders are: the cleantech sector, private equity funds specialized in cleantech and/or various political institutions such as the Swedish Ministry of Finance.

2) *Comparison with pension funds outside of Sweden or a private pension fund*

It is of interest to study pension funds outside of Sweden, e.g. the Government Pension Fund of Norway, and how they regard the cleantech sector and its potential. Can the same obstructions be identified in other countries?

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Appendix I: Interview Guide

1. What does cleantech mean to the X AP fund?
2. Is cleantech seen as an important investment area for the X AP fund?
3. Who is responsible for cleantech investments in the X AP fund?
4. How much did the X AP fund invest in cleantech last year?
 - Swedish?
 - Total?
5. What are the reasons for the X AP fund to not invest more in cleantech?
 - What is holding back the money? (Investment objects, uncertainty regarding the future (e.g. political risk, breakdown in Copenhagen, uncertain market price for emission allowances, etc.)
6. What investment potential does the X AP fund see in the cleantech sector?
 - What about the Swedish cleantech sector?
 - o More or less potential than foreign competitors?
 - o Why?
 - How do you investigate and evaluate this potential?
 - o Is any specific competence needed when doing these evaluations?
 - How is negative and/or positive screening used to evaluate climate friendly investments?
7. How is the paragraph “Regard is to be taken to ethics and the environment, though not in such a way that it stands in conflict with the overall goal of attaining a high return” interpreted at the X AP fund?
8. The Centre Party envisions that at least 1 percent (SEK 8 billion) beyond the 5 percent that can be invested in non-listed companies should be invested in cleantech.
 - Is it possible to invest SEK 8 billion in cleantech today with the current demands on return?
 - What could be done to achieve this goal? (i.e. where are the AP funds able to invest their money? In other funds that invest in smaller cleantech enterprises? In direct investments? Is there enough of funds to invest in? Is there enough of medium sized cleantech companies to invest in? If not, what should be done?)
9. What, from your perspective, is required from the cleantech companies for the X AP fund to invest more in cleantech?

(It is important to focus on different phases of the investment process (seed, growth, bridge etc.) Are there too many small cleantech enterprises and is the flow from small to large companies too bad? If that is the case, what could be done? What are the suggestions from the AP funds?)
10. What is required from the government for the X AP fund to invest more?

11. What is required to channel money from the X AP fund to early stage investments in cleantech?

- Decent VC funds (of what size)?

12. What about the risk evaluation, how is the “carbon-risk” of carbon intensive companies evaluated and how does it affect investments decisions?

- Do they utilize projections of future carbon pricing when estimating future cash flows?
- Do you have an official measure that they use when doing cleantech investments?

Appendix II: Glossary & Abbreviations

AP fund

National Pension Fund (Swedish abbreviation for *Allmän Pensionsfond*)

Clean Technology

See section 3.1.

CDM

Clean Development Mechanisms

EU ETS

European Union Emission Trading Scheme

GHG

Green House Gas

Institutional Investor

A large organization, such as a bank, trade union, pension fund or insurance company, that has substantial sums of money to invest on a stock exchange (Oxford Dictionary of Finance and Banking, 2008).

IPCC

Intergovernmental Panel on Climate Change

JI

Joint Implementation

NTBF

New Technology Based Firm

Pension Fund Governance

The concept of pension fund governance is related to the discipline of corporate governance. Corporate governance is defined as “the control and direction of companies by ownership, boards, incentives, company law, and other mechanism” according to Thomsen (2008) (p. 15). At a basic level corporate governance is about how to manage institutions that lead to wealth creating business decisions (Thomsen, 2008). The concept of pension fund governance is thus “the structure of pension plan boards, along with the complex rules that and practices that guide its oversight of fund assets” (Useem & Mitchell, 2000, p. 490).

Private Equity

An umbrella term for stocks not listed on a public/official stock exchange (The Sixth AP fund’s Annual Report, 2009).

Small to Medium-sized Enterprise (SME)

Companies with less than 250 employees and annual turnover of maximum of €50 million or a balance sheet total of maximum €43 million (European Commission, 2003).

UNFCCC

United Nations Framework Convention on Climate Change

Venture Capital

Venture Capital is according to the Oxford Dictionary of Finance and Banking (2008) defined as “Capital invested in a project in where there is substantial element of risk, especially money invested in a new venture or an expanding business” (p. 387).