

The Role of Energy Efficiency in the Deregulated Swedish Electricity Market

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ABSTRACT

Four years have passed since January 1996 when retail competition was introduced in the Swedish electricity market. These years have been characterized by a rapid restructuring of the electricity supply industry through mergers and acquisitions, lower electricity prices, and a search for new marketing strategies in the competitive market. General trends and the results of two market surveys, undertaken in 1999, of energy efficiency services from electricity suppliers in Sweden are reported here. One survey targeted a sample of industrial and commercial customers, and one survey targeted all electricity suppliers. Energy services, in particular energy efficiency services, are offered by 83 per cent of the surveyed electricity suppliers. Customer relations and building customer loyalty is reported by 88 per cent of the suppliers as a motivation for offering energy services. Nearly half of the customers report a great confidence in the suppliers' ability and sincerity to deliver energy efficiency services. 22 per cent of the customers have contracted for energy efficiency services and those customers that have contracted for energy services have often contracted for several services. Less than 20 per cent of the customers think energy services is a way for suppliers to distract customers and remove focus from electricity price. In both surveys, roughly half of the respondents report that services are priced separately from electricity. The future role of government to facilitate and support the market for energy efficiency services is discussed based on market experiences so far.

Introduction

The prospects for energy efficiency in deregulated electricity markets have been discussed by many analysts. Market reform has no doubt resulted in reduced spending on traditional demand side management (DSM) activities in most countries concerned but also spurred increased efforts to sell commercial energy efficiency services (EES) in some countries.¹ Some analysts have argued that EES are likely to, or can, become an important part of the energy business in deregulated markets (e.g., Nadel and Geller 1996; Chamberlin and Herman 1996). Some analysts have argued that the commercial driving forces for DSM/EES are too weak and that regulation or subsidies will be needed (Keating 1996; Hirst

¹ By traditional DSM we mean activities done in a regulated environment and for which the customer does not pay the full cost. By commercial EES we mean services, stand-alone or in combination with energy supply, offered in a competitive environment.

et al. 1996). Yet another perspective is that neither will there be demand for DSM/EES, nor should the government intervene in the deregulated market and thereby distort competition.

Sweden did not have regulation or incentives for DSM prior to the electricity market reform in 1996. IRP and DSM was not systematically used and the initiative to programmes often came from politicians that were in the boards of municipal energy companies. Campaigns for compact fluorescent lamps (CFL) or other publicity oriented programmes were predominant. The growing interest in DSM before and around 1990 was motivated by the decision in 1988 to close a nuclear reactor in 1995/96 (Prop. 1987/88:90). That decision was revoked in 1991 and the first proposition to reform the electricity market was submitted to parliament in 1992 (Prop. 1991/92:133). Faced with a continued strong supply capacity and future competition, utility interest in DSM subsequently dropped (Olerup 1995). The anticipated price competition and levelling motivated many electricity suppliers to expand into the EES-market under the expectation that it was neither possible nor desirable to compete solely on price.

The Swedish Electricity Market

Per-capita electricity consumption in Sweden, about 16,000 kWh/yr, is the fourth highest in the world. A cold climate, electricity intensive industries, and a high level of electric heating, about 30 TWh in buildings alone, contributes to this situation.

Total power production in Sweden has more than doubled from 60 TWh in 1970 to 140 TWh in a normal year through the expansion of nuclear power. Sweden is a net exporter in wet years with much hydro production, such as 1998 when 154 TWh were produced and net exports were 11 TWh. In the dry year of 1996, 136 TWh were produced and net imports were 6 TWh.

Table 1. Power Production and Generators Share of Total Production in 1998

Power production	TWh	Generators	Share (%)
Hydro	73,6	Vattenfall AB	49,0
Nuclear	70,5	Sydskraft AB	19,7
Thermal	9,8	Birka Energi AB	14,2
Wind	0,3	Stora kraft AB	4,3
Total production	154, 2	Graninge AB	1,9
		Skellefteå Kraft AB	1,8
		Modo Kraft AB	0,9
		Remaining	8,2

Source: Swedish Power Association, 1998, and annual reports.

The three largest generators account for 83% of total production and state-owned Vattenfall is not allowed to increase its market dominance in Sweden (Table 1). Foreign ownership has increased markedly in the last decade. Germany's Preussen Electra and Norway's state-owned Statkraft hold 28 and 21 per cent shares respectively of Sydkraft. State-owned Finnish IVO and the city of Stockholm each have a 50 per cent share in Birka Energi. State-owned Electricité de France has a 30 per cent share in Graninge. Private investors are mainly represented in the larger companies such as Sydkraft, Stora kraft and Graninge.

The 400 and 220 kV grid is owned and operated by state-owned Svenska Kraftnät. Regional transmission networks at 20-130 kV are mainly in the hands of the three large

generators. Distribution in local networks below 20 kV is typically in the hands of the 220 distribution companies, down from 525 in 1976. Most of the distribution companies are municipally owned. The municipal companies often operate also district heating, water supply, waste handling, etc., and have retail electricity supply separated by legal entity in a subsidiary.

There are about 220 companies in electricity trade and retail. The three market leaders (Vattenfall, Sydkraft and Birka Energi) have 18,000 employees. The other 25 per cent of the largest companies have on average 264 employees and the remaining 75 per cent have less than 50 employees. Rapid restructuring has followed the market reform through mergers, acquisitions and partnerships. There are also new entrants, such as oil companies and new internet based retailers. Traded volumes and the number of actors on the power-exchange in Oslo, Nord-Pool, is increasing each year but most of the trade in Sweden is still through bilateral contracts. Relatively high hydro-production pushed annual average spot prices down to 1.4 cents/kWh (12.3 öre/kWh) in 1998 and even less (11.8 öre/kWh) in 1999.

The Market Surveys

The results of two independent surveys of the EES market are reported here. One survey targeted the demand for EES and the other targeted the supply of EES. The aim of energy services is to provide added value for the energy user. Examples of added value include; improved service, energy efficiency, and power quality. Energy services include energy efficiency services (EES). In this survey we distinguished between direct energy efficiency services (DEES) which include implementation of energy efficiency, and indirect energy efficiency services (IEES), which include audits, advice and statistics that do not necessarily lead to energy efficiency improvement. Furthermore, we make a distinction between short-term or one-off DEES and longer-term engagements through energy service agreements such as outsourcing.

The Demand Survey

The demand survey was undertaken in May 1999 by a market survey company and was commissioned by the National Energy Administration (NEA) for the purpose of mapping the businesses' demand for energy services (B2B 1999).

A series of phone interviews were made based on a questionnaire designed to investigate to what extent companies were purchasing EES and other services from primarily electricity suppliers. Questions about which EES, type of contract, company's relationship with the supplier, level of in-house competence, etc. were asked in order to profile companies that took an interest in these services and to identify main drivers.

The survey targeted companies in three different groups:

1. Energy intensive industry, including mining, pulp and paper, chemicals, and metals (population: 443; sample: 200; completed interviews: 60)
2. Manufacturing industry, including wood, rubber and plastics, metals fabrication, electronics, medical equipment, etc. (Population: 5029; sample: 400; completed interviews: 81)
3. Service sector, including building owners, hotels, banks, insurance, etc. (Population: 60678; sample: 400; completed interviews: 41)

The respondents were all involved in making decisions, or in providing decision support, on the choice of electricity supplier and on offers made by electricity suppliers. The phone interviews were conducted in only 5 days and from a sample of 1000 only 182 interviews were completed. In manufacturing there is a bias towards large companies (i.e., >200 employees) and in the service sector there is a bias towards building owners and operators. Also, terms and concepts were not defined for the interviewees. Thus, the survey results should be interpreted with great caution.

Key findings. Essentially all companies have signed new contracts for electricity deliveries, or considered doing it (Table 2). About one-third have included energy audit in the contract and 22 per cent responded that they presently have a contract for DEES with an energy supplier. Financing and outsourcing was less common. As expected, administrative services, which typically means simplified billing or other means of lowering administrative costs, was common. Disturbance analysis, helping customers identify problems in power supply in-plant was common in industry.

Table 2. Examples of Survey Responses Concerning Contracts for Electricity Supply and Inclusion of Energy Efficiency and Other Services (per cent)

Industry/Sector	Energy-Intensive	Manufacturing	Service sector	Total
Base (number of companies interviewed)	60	81	41	182
Has switched supplier during last three years	33%	35%	17%	30%
Has signed new contract with old supplier	78%	80%	59%	75%
Has considered changing supplier	35%	27%	46%	34%
Has DEES contract with supplier	22%	28%	10%	22%
DEES is paid separately from electr. price ^a	62%	39%	75%	50%
<i>Contract/agreement w. supplier includes:</i>				
- Energy audit (IEES)	47%	37%	17%	36%
- Assistance with financing EE measures (IEES)	12%	7%	7%	9%
- Outsourcing of heating plant (long term DEES)	13%	17%	24%	18%
- Outsourcing of HVAC and light (long term DEES)	5%	21%	27%	17%
- Administrative services (customer service)	35%	41%	20%	34%
- Disturbance analysis (IEES)	30%	25%	5%	22%
- New applications for electricity (to incr. demand)	13%	14%	12%	13%

a. The base (# of companies asked) in this case is 13, 23, and 4 respectively, in total 40.

Many respondents agreed with the statement that efforts have been made in their company to save energy in production, more so in industry than in the service sector (Table 3). Relatively few companies, only one-third in energy intensive industry, have employees with high level of energy efficiency competence. More companies agree that the management gives priority to energy efficiency although customer demand is not perceived as an important driver. Many respondents have great confidence in the ability and sincerity of suppliers to deliver energy efficiency. Companies in the service sector are more sceptical to the motives of suppliers for selling services than industry companies. In the service sector, 34 per cent agrees with the statement that offering energy services is a way to confuse customers and distract attention from price.

Table 3. Attitudes and Perceptions Held by Respondents

Industry/Sector	Energy intensive 60	Manufac turing 81	Service sector 41	Total 182
Base (number of companies interviewed)				
We have employees with high level of EE competence	32%	22%	24%	26%
We have made efforts to save energy in our production	55%	38%	27%	42%
Customer demands has forced us to prioritise EE	3%	8%	15%	8%
The management prioritises EE	40%	43%	41%	42%
<i>These criteria are important when choosing supplier:</i>				
- A good and long-term business relationship	63%	67%	66%	66%
- Electricity price	93%	81%	76%	84%
- Supplier's competence in EE	56%	65%	56%	61%
Electricity represents a large cost to us	60%	48%	37%	49%
Electricity is ONLY a matter of price per kWh	52%	42%	49%	47%
Suppliers are competent and well equipped to deliver EE	50%	44%	42%	45%
S. use services to confuse us and remove focus from price	14%	17%	34%	19%
We rather buy EE from independent consultants than S.	21%	16%	24%	19%

The results in the table shows the share of respondents in the categories largely agree [8-9] or fully agree [10] on a scale 1-10.

Those with contracts for DEES (22 per cent of respondents) have confidence in the suppliers to deliver energy efficiency and they also think electricity represents a large cost to their company. Factors and attitudes that correlate with not having a contract include low confidence in suppliers, they did not perceive electricity as representing a large cost, and the company belongs to the service sector. Those that had contract for energy audit had all contracted for one or more other services as well.

It was difficult to get answers to questions that quantified present consumption, amount spent on EES, and realised savings. As expected, typical payback requirements on energy efficiency were less than three years. 32 respondents (18 per cent) had contracts with guaranteed savings but only 12 could quantify the savings, which were equally distributed in the intervals 1-5, 6-10 and 11-20 per cent of total energy cost. Half of the respondents had not spent anything on EES through their energy supplier and one fourth could not answer how much they had spent. The remaining fourth was equally distributed in the ranges \$1-6,000, \$6,000-12,000, and more than \$12,000. The amount spent on EES from electricity suppliers in the last 12 months ranged from about \$1000 up to \$3 million in one case, with a median value of about \$6000.

The Supply Survey

The overall purpose of this survey is; (1) to map the way in which energy companies work with energy efficiency and energy services in a deregulated energy market and (2) to provide an explanation to their existence. The survey was undertaken from November 1998 until February 1999, as part of a research program based at Gothenburg School of Economics (Strid and Bergmash 1999). The survey was distributed to all Swedish energy companies that sell, produce or deliver network energy, i.e. electricity, district heating/cooling and gas. We limited our study to energy companies that have their main operations in the physical electricity market. The issues addressed includes market changes, competitive strategy, design of energy services, etc. The survey was distributed to 159 companies with a response rate of 79 per cent. The respondents were mainly managing directors or marketing directors.

A shortened version of the inquiry was undertaken, by means of telephone interviews with the non-responding companies. Results from the telephone interviews revealed that there was no bias in the responding group.

Key findings. The survey revealed that 83 per cent of the companies work with some kind of energy services and 66 per cent of all companies offer DEES. The most important motive to offering energy services is building good, lasting customer relationships with the customers. Another important factor is the possibility of using the services as a competitive tool in energy contract negotiations. These two motives were ranked highest by 66 and 10 per cent, respectively, of the respondents. This indicates that most companies use energy services to support their main business. Through energy services, the companies move closer to their customers thereby gaining knowledge about the customers' use of energy. With this proximity and knowledge as a foundation, the company develops a relationship with the customer in a way that the sale of energy cannot achieve by itself. Making a profit from EES was not one of the most important motives.

The origins of the energy services for suppliers is grounded to a large extent, in reaction to the deregulation. More than half of the companies questioned state that they began to offer energy services either just before or just after the market reform. Only nine per cent stated that it was easier to offer DEES under monopolistic conditions, 43 per cent were indifferent; and 39 per cent stated that it is easier to offer DEES in a deregulated market. This last view is held predominantly amongst managers from larger companies who also argue that deregulation provides stronger incentives for DEES. Another reason is that the customer base has expanded due to market change. Mainly small companies preferred a monopoly market because this gave possibilities to subsidise DEES through the tariffs and the only way for customers to reduce their energy costs were through energy efficiency. Other reasons included high customer focus on price and the reduced exchange of experience between electricity suppliers.

The dominating energy services are energy advice and analysis, offered by 83 per cent of the responding companies. Other frequent services include energy statistics and audits, offered by 60 per cent of the companies. These energy services (IEES) are relatively standardised and require minimal resources. As such the smaller companies in particular offer such services. Furthermore, such services are not integrated with the energy but, rather they are used more for marketing purposes. The primary role of these energy services is to foster good relationships with the customers whereas profitability is not necessarily prioritised.

Around 20 per cent of the companies reported a loss when selling energy services. Of these companies most work mainly with energy advice, analysis and audits. Two out of five companies report profit, the most profitable services being long and short term DEES and service agreement (service of high-voltage, stand box, etc). Of the companies who state their profit is 'satisfactory', most are larger companies that have worked with energy services for several years. They have made their investments in energy efficiency, both within their own company, e.g., in product development, and at their customers' premises. An increase in the investment budget corresponds well with an increase in the market shares and vice versa. It is mainly the smaller companies that declared losses in their work with energy services. Smaller companies have also reduced their investment budget following deregulation. These findings suggest, that it is the active companies who are successful in selling energy services. It may

take several more years before the companies can expect energy services to yield good profits. Furthermore it is important to have the resources required if the intention is to develop EES business. This implies that if the importance of energy services as a competitive tool is to increase, smaller companies will have difficulties competing with energy companies that can offer the full range of energy services.

Investments made after the deregulation have primarily been geared to the demand side, aimed on improving customer service. The suppliers have invested in improved computer technology and administrative systems. There are relatively few people employed in the energy service market. Less than eight per cent of the staff work in the personnel-intensive energy services business. We estimate the total turnover of energy services to roughly be 295 million USD, corresponding to about 3 per cent of total turnover in the energy business. This figure, however, should be treated with caution because the estimate is based on the stated share of energy services in total turnover and was only provided by 46 per cent of the respondents. Most respondents with energy services report that the share is in the 0.5 to 5 per cent range.

As much as 91 per cent of the companies were not able to comment on how much they have reduced their customers' energy use through EES. . In other words, there appears to be poor follow-up on these services. One reason for this may be that lost volume in the sale of energy is not as important for the companies post-deregulation compared to conditions of the monopoly market. Under monopolistic conditions, energy efficiency improvements represented a loss in revenue due to lower volumes. This limitation no longer exists when it is the companies own responsibility to retain and attract new customers in a competitive market.

Discussion

Does the Market Deliver EES?

Both surveys presented shows that there is a market for EES. 83 per cent of the suppliers offer EES and 66 per cent offer DEES. Roughly one-third of customers had contracted for an energy audit. The volume is difficult to determine. We estimate the total turnover for energy services, including non-EES, to 295 million USD. The result in terms of energy efficiency improvements is even more difficult to determine. Very few were able to answer this question in either survey which suggests that results are poorly monitored and evaluated. Realised energy cost savings were in the zero to 20 per cent range in the few cases where customers could make an estimate.

Have EES Increased After the Reform?

There is strong evidence that more energy efficiency is delivered by and through electricity suppliers after the reform. The strongest indicators are that the market leaders prefer to deliver EES in the new market and that most companies responded to market reform by introducing EES. However, DSM-programs prior to reform were few and of relatively small significance. Sweden did not have regulatory incentives and programs were often limited to isolated publicity oriented CFL-campaigns and the like.

Which EES and for Whom?

Most companies offer IEES, including energy advice, audits, monitoring and statistics. DEES, however, are offered by the large companies, create more turn-over and are more profitable. Traditional DSM programmes such as soft loan or rebates hardly exist. The large companies offer short term DEES mainly to electricity intensive industry. Long-term DEES are offered to a wide range of businesses. These services have economies of scale, are labour intensive, and thus require large volumes to be profitable. The results indicate that demand for long-term DEES is low relative to other EES. One likely reason is the transaction costs associated with negotiating contracts. One observation is that outsourcing of HVAC-systems is more common in medium sized (50-199 employees) manufacturing industry. An explanation could be that they own the premises and/or do not have employees with energy efficiency competence. Some small companies are attempting to sell EES to residential customers, e.g., heat pumps to customers with electric resistance heating.

Why EES?

EES were mainly motivated by Swedish energy policy goals in the monopoly market, but in some cases also to offer service to some important customers. The public benefit perspective has faded post-reform and the focus on profitability has transformed the view on these services. EES and other services, together with building brand names, are key instruments to compete for customers on something else than price. The two kinds of EES are used in different ways. Supporting the energy sales and building customer relations are the main motivation for IEES. Profitability and the prospects for growing in a new market motivate DEES. They are also easier to separate from the energy sales and can be offered to customers that have not contracted for energy, but who might in the future as a result of successful DEES. This is difficult to achieve through IEES.

Competition has resulted in low profit margins on electricity, which has motivated EES in general and DEES in particular. The market for EES is relatively immature with higher margins and less competition. Customers are motivated by the perception that energy represents a large cost and that they lack competence. DEES such as outsourcing is also a way for customers to divest capital and focus on core-business.

Initially, customers were hesitant to buy EES from electricity suppliers. The surveys show that there has been a change in attitudes and that many customers, notably the larger ones, have great confidence in the ability of electricity suppliers to deliver EES and prefer them rather than independent consultants.

How are EES Priced and Sold?

Based on the early market experience it has been argued that EES were used as a smoke screen to remove customer focus on price by including EES and avoid price competition (Olerup 1998). Competition has made packaged EES and electricity deals a difficult sell and today more than half of the EES are priced separately. Some customers, however, are still hesitant to the motives of electricity suppliers, see Table 3.

DEES are typically tailored to each customer's needs but standardised DEES are also widely used when selling short term DEES. The pricing of DEES is typically based on full

cost pricing. The larger companies also factor in how profitable the measures are to the customer. This is possible since the value to the customer is known through the estimated energy savings for DEES.

Energy companies' investments in the customers' premises are mainly done in connection with long term DEES contracts. The investments are paid through shared-savings or instalments.

What are the Barriers to EES in the Reformed Market?

Most of the already well known barriers to energy efficiency are largely unaffected by restructuring and some may be exacerbated. For example, customers' lack of knowledge and information as may be even more severe in competitive markets where information and experiences are no longer shared between suppliers or given away for free. Many other barriers, such as the split-incentive problem, may remain largely unaffected by competition.

Electricity suppliers compete mainly on price and the resulting reduction in electricity prices reduces the value of savings. In addition, price competition has resulted in that customers mainly focus on the price of electricity and fail to recognise that the total electricity cost is also comprised of non-negotiable partly variable network charges and taxes. Costs that DEES can help reduce. Thus, the focus on price is a barrier to EES.

Transaction costs can be considerable in the immature market for EES where there are no standards or codes of practice for measurement and verification, or other specifics of an EES-contract. Negotiations can be time consuming when, at least one and maybe two, inexperienced players are at the table.

Is there a Future for EES in Sweden?

A competitive market is important for the development of electricity company EES. Suppliers will have little or no incentive, unless presented one by the regulator, to offer EES if competition does not work. The market for EES is still immature and a majority of EES offered show little or no profitability. IEES show the lowest profitability and their future as separate services is uncertain. DEES are to some extent profitable and can be a powerful tool to win new customers for energy and be a business on its own.

Reserve and peak-load capacity has been decommissioned or mothballed as a result of competition. Load management could emerge as an important service if the market rules for dealing with capacity constraints can be properly developed.

A continued strong price competition leads to price levelling. The competitive force of the price will diminish and other tools will be more important in attracting and retaining customers. EES may then play an important role. A condition for an energy company to successfully deliver EES is to have a long term and carefully planned strategy for these services. The company also has to build an organisation that supports the sales and development of EES. Presently, only the market leaders meet these conditions.

The Role of Government

The government can take action to reduce barriers to EES in the EES market, in addition to implementing other energy efficiency policy mechanisms, e.g., standards, labelling, procurement policy, RD&D, etc. Three key areas include reducing transaction costs, regulating network tariffs, and leverage or stimulate selected EES. Measures should be aimed at stimulating EES in general and not only energy company EES.

Reducing transaction costs in the market for EES is one important area for government activities. 62 per cent of the respondents in the demand survey did not know about any of the four government energy efficiency programmes or two commercial EES-brands that were presented to them. More than half wanted information about opportunities for energy efficiency. The need for independent information increases as energy companies turn more and more to marketing. Establishing certification systems, standard contracts, measurement and verification protocols, etc., in the EES market is another important area where government can play an important role to reduce transaction costs.

Lower electricity prices, at least in the short run, resulting from competition is an important barrier. At the same time, competition and the resulting price levelling is a key driver for EES. However, there is one area in which government can influence prices, i.e., network tariffs. As illustrated in the Table 4, the avoided cost by saving electricity would increase by 36 to 47 per cent if network companies were regulated to have only variable charges in the tariff. The effect would be similar in the domestic sector. Much stricter regulation is also motivated by the large differences in tariffs between different network companies and the tendency to cross-subsidise between network and competitive businesses even when separated by legal entity.

Table. 4 Total Variable Electricity Cost for a Hypothetical Medium-Sized Manufacturing Industry with Typical *Present* Share of Fixed Charges and if Charges Were Made Variable *Only*

Network cost segment ^a	Fixed network cost (US\$/yr)	Fixed network cost per kWh ^b (c/kWh)	Variable network cost (c/kWh)	Electricity cost (c/kWh)	Total variable cost ^c (c/kWh)	
					<i>present</i>	<i>only</i>
High	52,000	1.04	0.57	1.65	2.22	3.26
Medium	38,700	0.77	0.47	1.65	2.12	2.89
Low	38,000	0.76	0.27	1.65	1.92	2.68

a. Network tariffs were divided into three price segments and a representative tariff from each segment was selected here.

b. The assumed customer has an annual consumption of 5 GWh and a maximum load of 1.25 MW. The fixed price has been recalculated to variable by dividing the fixed prices by the total electricity consumption 5 GWh.

c. The column *present* displays the sum of electricity and variable grid price. The column *only* also include fixed grid price/kWh.

This study has targeted EES in the commercial and industrial sector. There is little interest in marketing EES in the domestic sector due to the low potential savings per customer in absolute terms. Government could explore opportunities to stimulate EES in this market segment as well.

Governments can also have an important role in supporting or accelerating the introduction and diffusion of new energy efficient technologies or practices through what is generally called market transformation programmes. Government can utilise the EES-market to leverage such efforts, if there is a functioning EES-market.

Conclusions

The development of the EES market is mainly a response to, or spurred on by, competition. The market for EES is, however, immature and still in the introduction stage. Most of the EES do not carry their own cost so far. IEES are the most common services, but DEES have the highest turn-over and profitability. The energy companies use these two types of EES in different ways. IEES are offered as a complement and energy sales support. Low profitability or losses from IEES are accepted by many companies. DEES are profitable on their own and can lead to growth into a new business, in addition to supporting energy sales. Government should consider measures to stimulate the EES market, including information dissemination and other mechanisms to reduce transaction costs, and regulation of network tariffs to make EES more profitable.

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