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Revealing Business Opportunities in the Norwegian Power Industry

How the implementation of AMR facilitates new business models

Maren Sleire
Rikke Stoud Platou

Industrial Economics and Technology Management
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Supervisor: Øystein Moen, IØT

Norwegian University of Science and Technology
Department of Industrial Economics and Technology Management

Preface

This master thesis is written during the spring of 2011 and constitutes the final work of the five year Master of Technology education program at the Norwegian University of Science and Technology (NTNU). The master thesis is written for the Strategy and International Business Development section at the Department of Industrial Economics and Technology Management. The work has been both challenging and rewarding; we have explored and gained insight to the Norwegian power industry and discovered both how interesting the industry is and how exciting the future will be. We will continue to keep an eye on the further development in the coming years.

We would like to thank our supervisor, Professor Øystein Moen, at the Department of Industrial Economics and Technology Management for guidance and constructive advice and feedback. Jan Onarheim at the Norwegian Smartgrid Centre also deserves our gratitude for valuable and inspirational input. Further, we are thankful for the benevolence we were shown by the experts we have been in contact with, and the extensive amount of knowledge they shared with us.

Trondheim May 27th, 2011

Rikke Stoud Platou

Maren Sleire

1 Summary

This thesis aims to map the current state of the Norwegian power industry and reveal opportunities that can serve as a fundament for the formation of new business models in the industry post automatic meter reading (AMR) implementation.

Demand side management (DSM) arouse to include end customers and give them incentives for having a power consumption pattern which also benefits the power system. Market structure; lack of ICT infrastructure and understanding of the solutions; costs and competitiveness, as well as the lack of incentives are currently some of the most critical barriers to DSM implementation. However, the forthcoming establishment of a smarter transmission grid is expected to easier facilitate DSM actions. A smart grid facilitates transmission of information in addition to power, and is hence more intelligent than today's grid as it can integrate the behavior of all connected users. A smart grid is not one single installation, but consists of several components, of which AMR is one. The drivers for implementing a smarter grid in Norway differ from the prevailing European drivers. In Norway, the progress towards a smarter grid is driven by the desire to reduce peak loads and create a secure power system which benefits the end customer.

Implementation of AMR has been adopted in Norway, although the specific functionalities and responsibilities are not yet entirely determined. In addition to AMR implementation, a common Nordic end user market is also expected within the coming years. We expect the supplier centric model (SCM) to become the chosen market model. This involves a single contact point for the end customer, so that the supplier will handle most customer specific issues. AMR is expected to facilitate innovation opportunities that potentially can lead to a disruptive change of the industry. Dependent on current position, industry actors must determine whether to act as a first-mover or a fast second when taking positions in the future industry. End customer support is decisive for diffusion of the additional technological functionalities AMR can provide.

There are four key subjects for examining fundamental conditions for the formation of new business models in this market. These are industry changes; a possible redistribution of responsibilities and roles; mapping of market forces and last but not least revealing unrealized value in the value chain.

We find that a redistribution of roles in the electrical power market is probable, and that the actor most exposed to changes and new industry actors are the power suppliers. An assessment of market forces in the industry after AMR implementation shows that the end customer has the most power and is of great significance for the development of the industry. We reveal unrealized value in customer relations, customer flexibility and metering data.

AMR has disruptive characteristics, and competitive companies spotting disruptive change in advance can choose between defending against the threat and utilizing this change. Due to

uncertainty, companies are in danger of underestimating the potential impact of future disruptive changes. Existing power suppliers should enter into alliances to obtain future required qualities for success, such as flexibility, ICT knowledge and innovation skills. In order to achieve desired diffusion of new innovations, companies should be aware of the importance of mapping customers' behavior and willingness to adopt new solutions.

The revealed unrealized value can take different expressions in the future market. Metering data facilitate development of additional solutions on the AMR platform. The customer flexibility is extremely valuable but currently difficult to access. Transactions of flexibility from end customers can occur in four different ways, dependent on who is buying flexibility. Three different future scenarios for customer relations are predicted; *fully separated activities*, *concentrated activity bundling* and *fragmented activity bundling*, dependent on whether the customer relates to one or more power suppliers and service providers.

We expect an industry revolution which will favor companies which are close to the customer and which are flexible and possess competencies within innovation and ICT. Accessing the three sources of unrealized value, which are all customer related, can give competitive advantage and serve as a fundament for the formation of new business models in the Norwegian power industry post AMR implementation.

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2 Introduction

2.1 Background

Our introductory study conducted during the fall 2010 made it clear to us that the power industry, both nationally and internationally, is facing major changes, partly due to a smarter transmission network. "In general we are moving towards a more powerful customer through demand side management (DSM)" (Platou and Sleire, 2010). During our project work last fall it became clear to us that DSM can experience a renaissance when a smarter grid is established. Deadlines for implementation of automatic meter reading (AMR, no.: AMS) in Norway have been adopted, and we regard this as the first step towards a smarter grid. We believe that AMR to the greatest extent constitutes a starting point for advantageous future consumption control and that it facilitates new solutions and business models.

2.2 Problem statement

"Smart grid will facilitate new business models and a more digitalized industry. As a platform for the new generation electricity market and due to its revolutionary nature in how customer needs are fulfilled, it can be regarded a disruptive technology (Bower and Christensen, 1995)." (Platou and Sleire, 2010). In January this year Terje Riis-Johansen, Minister of Petroleum and Energy at the time, accelerated the implementation of AMR in Norway, with the following reasoning; "I believe that two-way communication between grid company and end customer will increase consciousness on energy consumption and at the same time stimulate to saving energy"[1]. A new market can emerge, but it is dependent on political will and actions; cooperation between stakeholders, as well as a reasonable distribution of incentives and significant investments.

Our main goal is to map the current state of the Norwegian power industry and reveal opportunities that can serve as a fundament for the formation of new business models in this industry post AMR implementation.

In order to achieve this goal we more specifically want to take a look at the following three issues:

1. The Norwegian power industry is characterized by traditions and predictability and we know that predictable industries are exposed to disruptive changes. We want to

[1] Regjeringen [1]. Olje- og energidepartementet, "Tar krafttak for automatisk strømmåling (AMS)", Regjeringen website, http://www.regjeringen.no/en/dep/oed/pressesenter/pressemeldinger/2011/tar-krafttak-for-automatisk-strommaling-.html?id=630569

examine whether the future changes can imply a redistribution of qualities leading to competitive advantages, and if new and possibly unexpected actors can displace currently incumbent firms.

2. The power industry is heavily regulated, and we believe this complexity and the partly divergent incentives of the different actors affect the development of new feasible solutions. We are interested in finding out *if* there are any new business opportunities, *where* they can emerge and to *whom* these opportunities are best attainable.

3. We learned from our preliminary project that power will shift downstream in the value chain and that the end customer is expected to become more powerful. What future consequences will this imply for the industry? We want to reveal opportunities in the Norwegian power industry, with a particular focus on the relationship between existing and entering actors.

2.3 Guide to the reader

This thesis consists of four main parts. The introductory part contains literature review. In the next part we consider the current situation of the power industry and treat three topics; demand side management, smart grid and automatic meter reading (AMR). We end this part with methodology and a preliminary analysis including four key questions for further studies. The third main part contains empirical data from conducted interviews with industry representatives and four analyses in which we answer our four key questions earlier stated. This part ends with a further analysis based on acquired information. In the fourth and last part we present our results and conclusion.

For the reader interested in a brief version of the thesis, we suggest reading the preliminary analysis and key questions for further studies (chapter 6), the further analysis (chapter 9), our results (chapter 10), and our conclusion (chapter 11). However, for a deeper understanding, we also suggest reading the answering of key questions (chapter 8).

LITERATURE REVIEW

3 Theoretical background

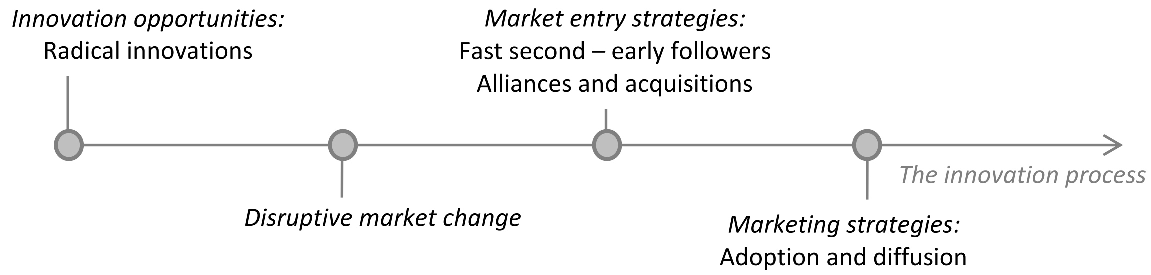

Figure 3.1: The innovation process

The innovation process allows for different market entry strategies and business opportunities. One may enter at pioneer level or enter the industry at a later stage. Pioneers can create radical new markets, which by definition will lead to a disruptive industry change. Some strategies for entrants post disruption are fast seconds, alliances and acquisitions. It is important to keep in mind that these market entry strategies are complementary and that both moving first and second can be advantageous. In the end, what matters is however customer adoption and diffusion – and how the choice of marketing strategies can help attract end users. Below we will provide some literature and insight to each of the steps along the innovation process.

3.1 Innovation opportunities

3.1.1 How innovations can lead to competitive advantage

In order to achieve a competitive advantage, companies must understand the drivers and trends in their industry. ”Beyond pressure to innovate, one of the most important advantages an industry can have is early insight into important needs, environmental forces, and trends that others have not noticed” (de Wit and Meyer, 2004). As Michael Porter (1990) states; “Some innovations create competitive advantage by perceiving an entirely new market opportunity or by serving a market segment that others have ignored.” But innovations do not necessarily arise within the relevant business domain. Sometimes innovations can create competitive advantage when transferred into new markets, and according to Porter (1990) it is not uncommon that momentous innovations originate in other industries or countries.

3.1.2 Radical innovations

The theory on radical innovations has evolved partly from Clayton Christensen’s *The Innovator’s Dilemma* (1997) (see chapter 3.2), as radical innovations can be viewed as the precursor of disruptive change. Leifer et al. (2000) defines the concept: “A radical innovation transforms the relationship between customers and suppliers, restructures marketplace economics, displaces current products, and often creates entirely new product categories.

(…) The definition is driven by new value added to the marketplace, rather than by technical novelty or newness to the firm[2].” Corporate leaders are desperately seeking long-term growth, and it is widely accepted that radical innovations provide a platform for this. The challenge however, is to successfully develop and commercialize the idea. All companies can develop radical innovations, but the theory distinguishes between three categories of projects depending on the company’s existing business lines; (i) innovations within the technology/market domains of the existing business units, (ii) innovation in the “white spaces” between a firm’s existing business, meaning that the idea falls in under the established strategy of the firm, but the product may serve new markets and new ways. Last, the category representing the highest organizational uncertainty is (iii) innovation outside a firm’s current strategic context (Leifer et al., 2000). This theory implies that a company’s current business domain does not necessarily restrict the opportunity to succeed in new markets.

3.1.3 Classic traps of innovation

Based on what has happened through previous times of innovation, Kanter (2006) point at four classic innovation traps, one in each of the four fields; strategy, process, structure and skills. The typical strategy mistake is to neglect real opportunities in the search for the new *blockbuster innovation*, because these are extremely rare and require substantial investments. Another common mistake is to apply strict control to innovation processes, which by nature are uncertain and unpredictable. The classic structure mistake is to imbalance connection to and separation from the mother company when developing innovations. The mistakes made in terms of skills are often that technological insight is valued higher than leadership competence, and that communication is weak. However, it is not in every company’s nature to innovate and this may enhance the chance of failing.

Being able to understand *when* an innovation is a business opportunity can be a difficult task. “The likelihood that companies will miss or stifle innovations increase when the potential innovations involve expertise from different industries or knowledge of different technologies. Managers at established organizations may both fail to understand the nature of a new idea and feel threatened by it” (Kanter, 2006).

3.2 Disruptive change[3]

Several times throughout history innovations and new technologies have led to the failure of leading companies by displacing current standards.

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[2] Richard Leifer et al., *Radical Innovation: How Mature Companies Can Outsmart Upstarts* (Boston, MA: Harvard Business School Press, 2000), pp. 2-6.

[3] Source: Platou and Sleire (2010), “Stability and change. The future of the power industry.”

3.2.1 Theoretical basis

3.2.1.1 Creative destruction and disruptive technologies

Creative destruction and *disruptive technologies* are concepts related to the process of new innovations outperforming existing technologies and incumbent firms. Joseph Schumpeter argued through *Theory of economic development* (1911) that non-price characteristics like capabilities and performance should define competitive advantage, appreciating the ability to innovate higher than the ability to minimize costs (Spencer and Kirchhoff, 2006). For competitive companies it will be advantageous to be able to see technologies that potentially can disrupt the circumstances under which they operate. Businesses that spot disruptive technologies in time have two options: defend own company against the threat it poses, or utilize the new market opportunities the technology provides (Christensen, 1997). Large incumbent firms are thus the ones exposed to creative destruction and disruptive change. It is easier for smaller and more flexible firms to explore new innovations and adapt to new situations. Incumbent firms disapprove innovative technologies for a variety of reasons and fail to explore new opportunities due to market, technology and strategy commitments (Christensen, 1997). The commitments can be to the profitable customers or to their existing technology and specialized expertise.

3.2.1.2 The nature of sustaining and disruptive technologies

Bower and Christensen (1995) categorized technologies into sustaining and disruptive. Sustaining technologies sustain existing markets and competencies and contribute to improved performance of already existing core products. Disruptive technologies, in contrast, have an element of revolution and can radically alter how customer needs are fulfilled. Disruptive innovations are often characterized by being smaller, simpler, cheaper, more convenient to use, and they typically have lower margins than existing technologies.

When a disruptive technology gains foothold and is established, the cyclic pace for improvements starts. Initially its performance cannot be compared to existing technology, but the development trajectory follows a different slope and makes it possible for the disruptive technology to catch up with the sustaining (see figure 3.2). The figure also illustrates the potential development speed of a disruptive technology. It can develop at an almost exponential rate and rapidly change the industry, despite slow and incremental improvements during the early stage. Incumbent firms tend to develop at sustaining technologies, illustrated linearly in the figure. The disruptive technology matures in a smaller market on the side of the main market where other characteristics are appreciated. When it reaches the performance customers desire it proves to have a competitive advantage due to its special characteristics, and outperforms the old technology (Spencer and Kirchhoff, 2006). According to the theory, incumbent firms tend to underestimate the potential in disruptive technologies.

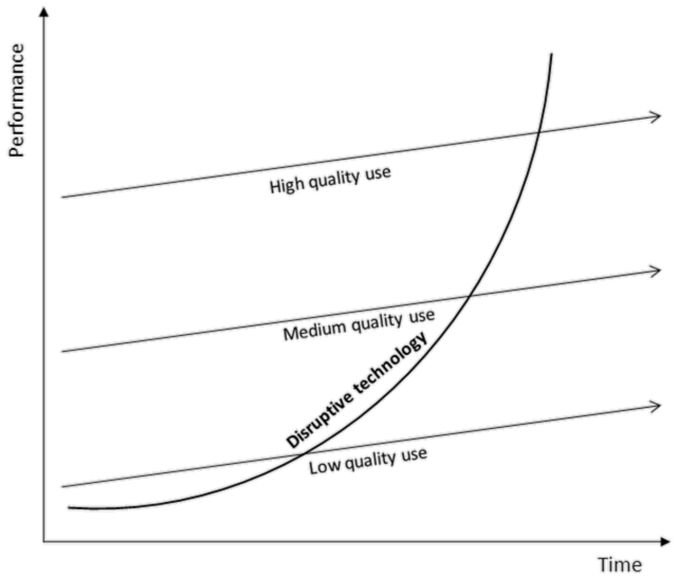


Figure 3.2: The development trajectory of a disruptive technology can catch up with the incremental improvements in sustaining technologies

3.2.2 Strengths and weaknesses of firms in different positions

The paradox of well-managed companies is that the same factors that contribute to their success also can lead to their failure. Listening to customer feedback; heavily investing in improvements, market trends research, and systematical allocation of capital to innovations with highest expected returns could lead to failure. So how can management know when it is right to follow the standard rules and when they should deviate from them? Very often the weaknesses of the large firms correspond to strengths of the small firms.

3.2.3 Characteristics of disruptive technologies

Christensen (1997) presents five principles, which illustrate barriers for managing disruptive change in incumbent firms and opportunities for small firms.

(i) *Companies depend on customers and investors for resources.* An incumbent firm's least visible and profitable customers are the ones most likely to convert to other solutions. Hence listening to the best customers will not give a representative image of the new technology's potential market power. New and small firms do not have a profitable and powerful customer base, thus they are more flexible in terms of making decisions freely. The only way for a large firm to handle such a challenge and achieve more flexibility would be to create an independent business unit or new company that focuses on the disruptive technology and opportunities. (ii) *Small markets do not solve the growth needs of large companies*. Larger firms require a higher absolute return on investments in order to grow at the desired rate than smaller firms with identical required growth rate. Smaller companies are thus exposed to a range of other smaller investment opportunities based on marginal technologies that a large company would not consider. (iii) *Markets that do not exist can not* *be analyzed*. Disruptive technologies create emerging and hence uncertain markets. The innovator's dilemma is that sustaining technologies have lower degree of uncertainty, but the follower will often succeed just as well as the leader. On the other hand, disruptive technologies are often related to great first mover advantages as higher risk can imply higher return. Another problem is that incumbent firms already committed to their current technology will have challenges transforming the business from being based on one technology to another (Abernathy and Clark, 1985). New firms will probably not be relying on older technologies, and thus prioritizing the technology with greatest potential. (iv) *An organization's capabilities define its disabilities*. High specialization and capabilities in some areas implies disabilities and lack of skills in others. The culture, values and managerial resistance of older firms can restrict the willingness to explore new technologies. Younger firms do not have the well-established culture and traditions and will thus be more flexible and not tightened to old technologies and habits. (v) *Technology supply may not equal market demand*. Technological development will often progress at a higher speed than the average customer needs and hence create a gap between accessible technology and market demand (see figure 3.2). Incumbent firms find it convenient to keep serving its customer base and are in danger of missing opportunities created by the disruptive technology.

By the principles presented above, Christensen seeks to point at barriers managers of incumbent firms must be aware of in order to deal with disruptive change in a successful manner. As mentioned, we consider the principles not only as barriers for incumbent firms, but also as opportunities for small firms, an opinion more corresponding to Spencer and Kirchhoff (2006). Spencer and Kirchhoff focus on the opportunities that emerge from the disruptive mechanisms and focus on the dynamic advantage and progress-driven economy that comes out of disruptive change. We consider this view as a more Darwinian approach to technological development, competitive advantage and survival. It is obvious that although the scholars agree on the fundamental theory, they disagree on the implications for an industry's development.

3.3 Market entry strategies

In the wake of disruptive technologies, firms are faced with strategic challenges. Changing markets are associated with a greater uncertainty and hence a greater risk. In this subchapter we will assess different entry strategies with a focus on changing markets. When looking at an industry undergoing changes, there is a distinction between companies operating within and companies operating outside the changing business domain. Appropriate timing of market entry will be decisive for success.

3.3.1 First-mover advantages

Advantages for first-movers exclusively can be of high value. First-mover advantages can arise through strategically utilizing certain asymmetries or opportunities in a market.

Companies can achieve first-mover advantages through three categories: *leadership in product and process technology, preemption of assets, and development of buyer switching costs* (Lieberman and Montgomery, 1988). Examples of the first category can be a technological lead, experience and learning advantages, or patent rights. Getting hold of scarce assets such as location or natural resources before its competitors is an example of the second category. Switching costs represents higher barriers for competitors to enter the industry. According to Lieberman and Montgomery, switching costs can arise because of (1) investments or transaction costs the buyer has to make in order to adapt to the product, (2) learning and habits of use of the first product, or (3) an intentionally created contractual switching cost. In the case of radical innovations, the timing of results, and also their magnitude are highly unpredictable. Speed and responsiveness therefore matters when entering a dynamic technological market. Jason Jennings states; "it's not the big that eat the small… It's the fast that eat the slow" (Jennings and Haughton, 2001). Convincing the consumers that you have a better product than what is already in the market is difficult, and being the first mover is hence going to give you a unique competitive advantage.

3.3.2 Fast second: How early followers can outperform pioneers

As for other entry strategies, Min, Kalwani and Robinson (2006) argue that taking a fast second position is more beneficial than entering at pioneer level. They have conducted a quantitative analysis where they look at pioneers' and early followers' survival risk for different innovations. Their main conclusion is that pioneers suffer from a low survival rate if the innovation is radical or disruptive, but benefit from moving first when it comes to incremental innovations. The fast second on the other hand, has equal survival rates for the two innovation categories – but exceeds the pioneer in the case of radical innovations (see table 3.1 below) (Min et al., 2006).

Table 3.1 Survival rates first mover vs. fast second (Min et al., 2006)

12-year survival rates	Incremental innovation	Disruptive innovation
First mover	61%	23%
Fast second mover	38%	39%

"When a pioneer starts a new market with a [radical product], the costs and risks are unusually high, which makes survival more difficult. Because early followers can learn from the pioneer's mistakes, they are not as vulnerable to exit. In contrast, an incrementally new product typically has lower costs and risks, which makes it easier for the market pioneer to survive. In addition, a temporary monopoly plus first-mover advantages should yield higher survival rates for the pioneer than for early followers"[4]. Markides and Geroski argue that

[4] Min, Sungwook, Manohar U. Kalwani and W. T. Robinson, "Market pioneer and early follower survival risks: A Contingency Analysis of Really New Versus Incrementally New Product-Markets", *Journal of Marketing* 70, (January 2006): 15.

pioneering by big companies rarely makes sense. Instead of struggling to be the first mover, they should race to be second[5]. They introduce the terms *colonizing* and *consolidating* markets. The activity of discovering a new product and the creation of a new market niche is referred to as colonizing. Consolidating the market is done through scaling the niche up to mass market. The competencies required for these two sets of activities are conflicting – firms that are good at invention are unlikely to be good at commercialization and vice versa. Primarily small, young firms are good at colonization, while large, established and older firms are better at consolidation[6].

For incremental innovations pioneers have great advantages in terms of market share, but for radical innovations the benefits of being the early follower exceed the pioneers' first-mover advantages (Min et al., 2006). Pioneers – the colonizers of the market – rarely succeed in scaling the product up into mass markets, but the established market consolidators do. Established companies should hence not move fast, but rather choose the best time to move, which is rarely first.

3.3.3 How to adapt to changing markets and modes of market entry

The choice of entry mode when entering a new industry, and the choice of strategic actions to take during industry changes are decisive for the company's future success. Industries undergoing substantial changes are associated with uncertainty, and uncertainty always makes such choices more difficult. Intense competition favors innovative adaptable companies, which perhaps can displace incumbent firms. Companies outside the changing market will in the following be denoted *external* companies and companies already present in the industry will be denoted *internal* companies. An external company must assess potential modes of market entry appropriate for the situation, whereas internal companies must assess how to best maintain or consolidate its market position.

An internal company is interested in retaining or expanding its existing position in the industry. When major changes occur, the value of the prevailing core competencies may diminish and create space for new leading practices. Hence it will be necessary to acquire new competencies. Classically, there are three ways of doing this: 1) developing new competencies internally, 2) building partnerships with other firms and 3) accessing new competencies through market transactions (Claude-Gaudillat and Quélin, 2006).

An external company may want to enter the industry due to new opportunities. Some conceivable modes of market entry for an external company can be internal development, market transactions, alliances or acquisitions. Lee and Lieberman (2010) list three criteria for assessing different entry modes. These are the *cost of entry*, the *risk of entry* and the *speed of entry*. There are two classical approaches for companies entering a new industry

[5] Markides, Constantinos C. and Paul A. Geroski, *Fast second. How Smart Companies Bypass Radical Innovation to Enter and Dominate New Markets* (San Francisco, CA: Jossey-Bass, 2005), p. 11.
[6] Ibid., p. 9.

depending on its existing competencies and resources. When these are close to the new industry's requirements it is common to use internal development. When supplementary competence is required to deal with the requirements of the new market one often uses acquisitions (Lee and Lieberman, 2010). However, these approaches are not always successful. Lee and Lieberman claim that when existing capabilities are not related to the new industry's requirements, acquisitions are suitable only when the entry is outside the company's primary business domain. However, when the entry is inside the company's primary business domain, acquisitions are suitable when these capabilities are closely related.

Claude-Gaudillat and Quélin (2006) show that the later a company enters a new changing industry, the more it relies on acquisitions and alliances. Dyer, Kale and Singh (2004) argue that acquisitions is a better choice than alliances when the desired synergies come from combining hard resources like machines, and that alliances are most suitable when resources are soft. However, acquisitions are to be preferred when the objective is to generate reciprocal synergies by close cooperation and an iterative process of knowledge exchange, whether the resources are hard or soft. Dyer, Kale and Singh (2004) also state that in highly uncertain circumstances, alliances have an edge over acquisitions due to more diversified risk.

3.4 Diffusion: adoption or rejection

The theory behind diffusion seeks to explain why customers either adopt or reject new technological ideas, and was first introduced by Everett M. Rogers in *Diffusion of Innovations* (1962). "The diffusion of innovations is essentially a social process in which subjectively perceived information about a new idea is communicated" (Rogers, 1995).

3.4.1 Diffusion: adoption or rejection

Several different factors are affecting decisions regarding adoption and rejection of new technological ideas. Obvious advantages of new technologies and products alone are not sufficient in creating a success. People's behavior and attitude are also important determinants. Rogers is concerned with how to faster achieve widespread diffusion and adoption. According to Walker et al. (2002), technological solutions for services must be balanced between the organization's desires and the customers' behavior and willingness to adopt new technology. Investigating what customers are willing to adopt before developing and implementing high-tech solutions will therefore be crucial.

Rogers (2003) defines diffusion as *the process in which an innovation is communicated through certain channels over time among the members of a social system*. He is concerned with the key elements in the definition: the *innovation* itself, the *communication channels* through which the innovation is communicated, the *time* dimension, and the *social system* that defines the target group.

Diffusion is heavily affected by the two concepts *uncertainty* and *information*; innovations can trigger uncertainty, which in turn motivates an individual to seek information. Uncertainty can be reduced if the individuals involved obtain more information, and hence the process of diffusion is socially, rather than technologically, driven.

3.4.2 The innovation-decision process model

Rogers (2003) developed what is referred to as the Innovation-Decision Process Model (IDPM). The innovation-decision process is the process an individual goes through when assessing a new innovation. Five recognizable phases are listed in this process: (1) knowledge, (2) persuasion, (3) decision, (4) implementation and (5) confirmation. The decision of adoption or rejection occurs in the third phase, decision. Three main types of innovation-decisions can be identified: (1) optional innovation-decisions, (2) collective innovation-decisions and (3) authority innovation-decisions. An individual's disposition to adopt innovations varies and adopters can be divided into five different categories: (1) innovators, (2) early adopters, (3) early majority, (4) late majority and (5) laggards.

Providing customers with sufficient information is critical in order to make customers adopt innovations. The diffusion process is a social process in which communication and information are key factors, as opposed to the initial phases of the innovation process, which heavily relies on hard technological capabilities and strategic decisions.

Changing markets are challenging to the existing actors and survival is not given for large resourceful companies. The appropriate strategy for success is dependent on size, market position, ability to innovate and move fast, stage in value chain and relations to both customers and other companies. In the following chapter we will present the current situation of the power industry, before we apply the presented theory on today's situation.

CURRENT SITUATION AND METHODOLOGY

4 Demand side management, smart grids and AMR

4.1 DSM – A mature concept with slow implementation

“A more active participation of the demand side would make electricity markets more efficient and more competitive”[7]. Demand side management (DSM) is not a new concept in the energy industry. The fundamental thought initiating DSM was that consumers did not want energy per se, but energy *output*. To the extent possible energy output (light, heat, power, etc.) should hence be provided with a minimum of energy input (kWh, BTU gas, etc.) (Nilsson, 2007*)*. In 1985, one of the first definitions was presented: “DSM is the planning and implementation of those electric utility activities designed to influence customer uses of electricity in ways that will produce desired changes in the utility’s load shape” (Gellings, 1985). Gellings further stated that load management, new uses, strategic conservation, electrification, customer generation and adjustment in market share were all utility programs falling under the umbrella of DSM. Today, DSM is referred to by the International Energy Agency (IEA) as “all changes that originates from the demand side of the market in order to achieve large scale energy efficiency improvements by deployment of improved technologies” (IEADSM). Although the first approaches towards involving the end user and making the demand side behave in a way more beneficial to suppliers were introduced already in the 1980s (Gellings, 1985) implementation has been slow. The practical execution of DSM is constantly changing and being adjusted for market dynamics. The basic idea remains, but market liberalization has changed the conditions for DSM instruments and implementation is evolving (Nilsson, 2007).

4.1.1 The objective and benefits of DSM

Originally the objective of DSM was to change the load shape and hence balance utility and customer needs. The load shape is the daily and seasonal electricity demand per time unit, and six categories of DSM actions were initially introduced; Peak clipping, valley filling, load shifting, strategic conservation, strategic load growth and flexible load shape (Gellings 1985 and Tatapower).

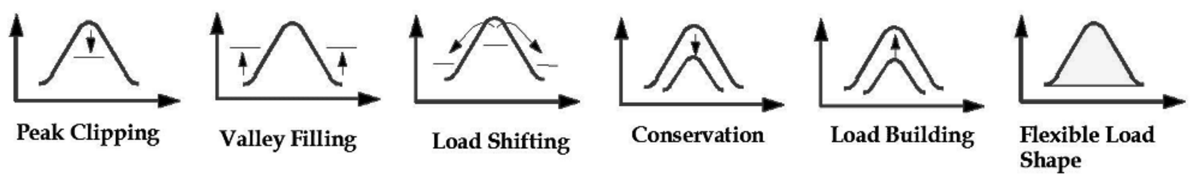


Figure 4.1 Load shapes (Tatapower)

[7] Kirschen, Daniel S. *IEEE Transactions on power systems*, 18(2), (2003): 520.

Cash flows and regulations in the Norwegian electrical power market

The *production companies* generate their income from wholesale of electrical power through Nord Pool. This income covers their operating and maintenance (O&M) costs, depreciation of power plants and investments in new plants, facilities or equipment. Because most hydropower plants are already fully depreciated and face very low O&M costs, the power producers in Norway are in a relatively safe and fortunate situation. However, the largest producers are state-owned and most profit is returned to the government instead of invested in innovative and developing activities. This partly diminishes the generating companies' financial situation and their room for maneuver.

The *grid companies* operate in a monopoly and are therefore strictly regulated by the Norwegian Water Resources and Energy Directorate (NVE). Statnett is the Norwegian TSO and owns and operates the majority of the central national grid. The power producers pay a feeding tariff to the TSO to feed electricity into the grid, and the power suppliers pay a central network tariff to use the grid for distribution. The feeding tariff is set by the TSO itself, while NVE controls the network tariff by an annually fixed income cap – an upper limit for how much the company can charge for the transmission of electrical power (Statnett). The local grid companies, distributing power to end consumers, receive local network tariffs from their customers. These network tariffs are subordinate the same NVE regulations as the central network tariff. The objective of this regulation is to promote a socio-economic and rational operation of the grid. Statnett is fully owned by the Norwegian government and hence most of the TSO's profit is returned to the state. With income being fixed and capped and profits being removed from the company, grid companies are left with little or no incentives for grid investments or smart grid innovation.

The *power suppliers* purchase their power through Nord Pool and sell the power directly to end customers. They can be regarded as a pure trading institution, with no physical assets. As opposed to the monopoly that grid companies operate in, power sales is subject to free market competition. Distribution activities are fully market-driven because access to the grid is not restricted and anyone can distribute and sell electrical power. Free competition incentivizes distributors to be innovative and service minded, and distribution can therefore be regarded as the most market efficient activity in the industry.

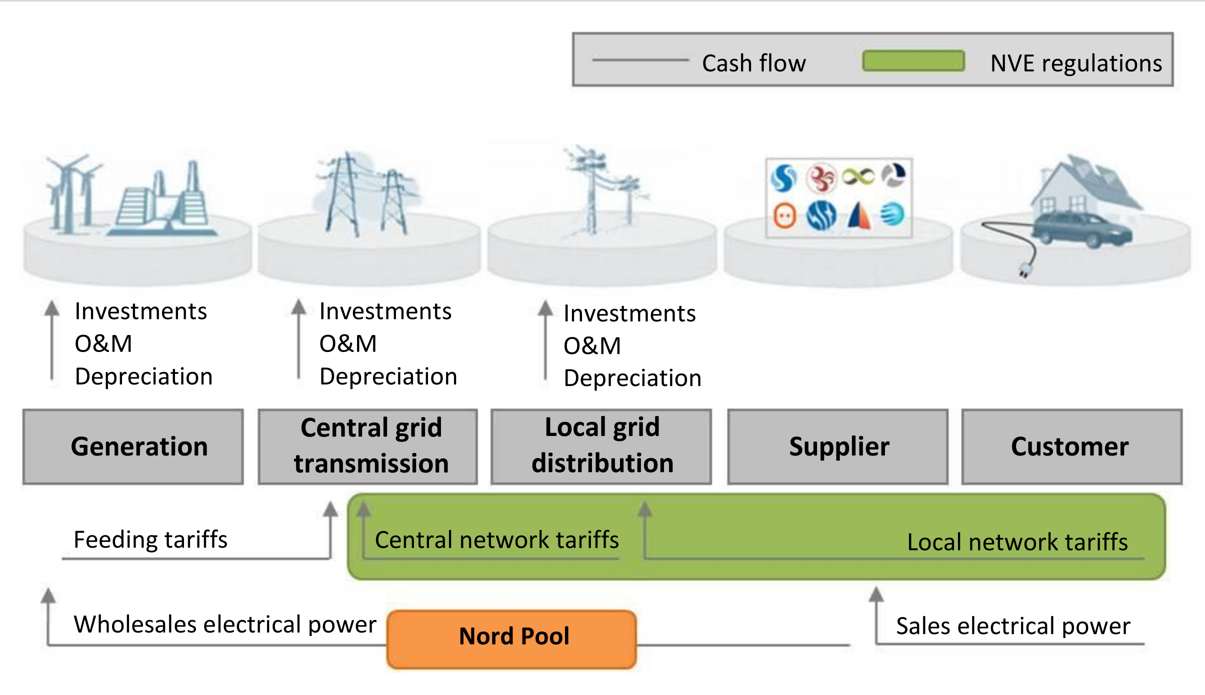


Figure: Cash flow and regulations in the Norwegian electrical power market (some illustrations borrowed from energinet.dk)

Peak clipping – the reduction of utility load primarily during periods of peak demand.

Valley filling – the increase of system load factor (the ratio of the average load to the maximum load capacity) by building load in off-peak periods.

Load shifting – the reduction of utility loads during periods of peak demand, while at the same time building load in off-peak periods. Load shifting typically does not substantially alter total electricity sales.

Conservation – the reduction of utility loads, more or less equally, during all or most hours of the day. This involves a reduction in sales and a change in the pattern of use.

Load building – the increase of utility loads, more or less equally, during all or most hours of the day. This implies a general increase in sales, and often involves a shift in market share of loads served by competing fuels (in some cases referred to as *electrification*[8]).

Flexible utility load shape – refers to programs that set up utility options to alter customer energy consumption on an as-needed basis, as in interruptible agreements.

4.1.2 Historical and current DSM techniques

DSM techniques are the concrete actions for achieving desired customer behavior. The choice of appropriate techniques depends on regulations, customers, grid condition etc. The greatest beneficiary from DSM is the supply side. Consumers are mostly compensated through a reduced electricity bill when they behave in such ways that suit the supplier, the network or the generator.

4.1.2.1 Practical examples of advantages of DSM

The risk of a black-out in extreme peak hours forces producers to keep a generation margin well above the average load. In the UK the generation utilization is around 50% on average and the network utilization is even lower (Strbac, 2008). By clipping peaks or initiate a strategic conservation, the generators can reduce their margins in line with the reduced risk of a black-out. Additionally they are allowed more efficient operations because of higher utilization. The network companies improve grid capacity during peak hours and hence improve security of supply.

In the table below an elaboration of specific techniques put in to practice is provided.

Table 4.1 DSM-techniques (Strbac, 2008)

DSM-techniques	**Description, review and potential**
Night-time heating with load switching	In UK tariffs were developed to support night-time storage heaters. These led to an increased domestic night-time load, resulting in a more balanced use of electricity and network

[8] Electrification is a term employed to describe emerging electric technologies such as electric vehicles, heat pumps, etc.

	across the day.
Direct load control	A technique widespread in the USA, where receiver systems are installed on electrical appliances to control its load. The utility cycles or shuts off an appliance on a limited number of hours for a limited number of occasions. Customers who agree to direct load control are compensated through reduced electricity bills.
Load limiters	Load limiters limit the power that can be taken by individual consumers. The scheme offers some choice to the end-user for which appliances to use and what consumption to postpone.
Commercial/industrial programs	Peak load management programs, such as load-interruptible programs for providing reserve services and for enhancing system reliability. The interruptible load control is not exercised on a daily basis but is used to support the system following outages of generation or network facilities.
Frequency regulation	System frequency is the balance between generation and system demand and must be maintained within narrow limits. If a large generation drops out, frequency drops significantly and the signal is used to trigger load reductions that contribute to frequency regulations. Industrial consumers, such as aluminum smelters, take part in this activity.
Time-of-use pricing	Time-of-use rates are designed to reflect the generation cost structure, where rates are higher during peak periods and lower during off-peak periods. The method is widely practiced in the European countries where electric household heating is common.
Demand bidding	Potential technique. Demand bidding programs are designed for customers who are willing to reduce or forgo their consumption of electricity at a certain predetermined price. Programmable thermostats and internet-based programs with load-and pricing overview are required tools for this technique.
Smart metering and appliances	Potential technique. Some form of real-time pricing is required to fully inform users about the value of electricity at each point in time and location. Before such demand-response can be effectively deployed in the residential sector, a number of technical challenges – such as communication infrastructure, metering infrastructure, programmable thermostats, etc. – need to be resolved.

4.1.3 Challenges to the implementation of DSM

Several challenges still need to be addressed for a truly successful program to be implemented, even though DSM-techniques may seem effective and beneficial to the supply side. *Lack of ICT infrastructure, market structure, lack of understanding of the solutions, costs and competitiveness and lack of incentives* are currently some of the most critical barriers and will be further elaborated below (Strbac, 2008).

Lack of ICT infrastructure: To enable DSM-advantages, an increased deployment of various sensors, advanced measurement and control devices is required, accompanied with much more sophisticated energy metering and trading functions. Further, ICT implementation for the control of electricity networks drives the need for an integrated energy and communications system architecture (Strbac, 2008).

Market structure: In the pre-liberalized market vertically integrated companies were able to optimize the overall system value, but in today's deregulated supply side some DSM-techniques can increase arbitrage opportunities. Speculation across the different stages of the supply chain and across the separated operations is more present in the liberalized market (Strbac, 2008). Current regulations in a liberalized market can also restrict implementation of DSM-techniques.

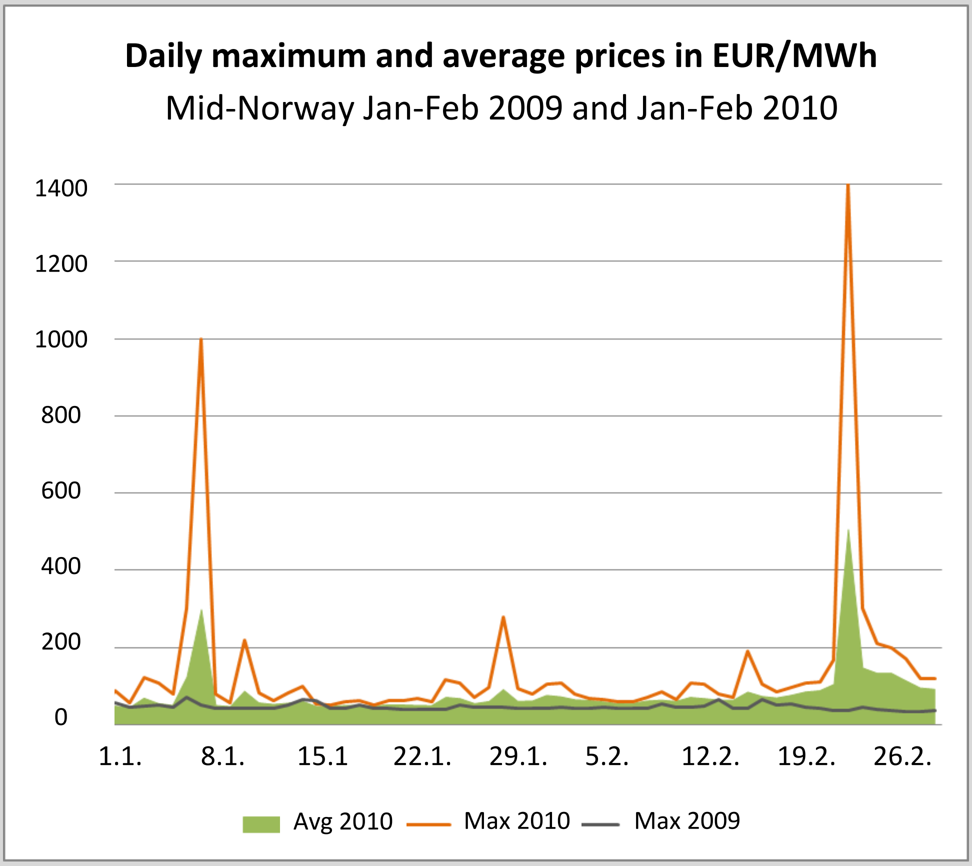
Lack of understanding solutions, costs and competitiveness and lack of incentives: The level of system stress is decisive for DSM cost-benefit-calculations, as these efforts will be more valuable in the segments that need reinforcement. Many of the proposed methods and techniques for DSM are still hard to quantify due to the lack of a consistent and uniform methodology. As a result of this missing methodology and understanding it is difficult to objectively compare DSM with traditional solutions, and hence traditional approaches to capacity problems are often perceived as more convenient (Strbac, 2008). To further incentivize DSM and attain a successful implementation "we need either some sort of regulation or someone that can change this situation into a business-opportunity" (Nilsson, 2007).

4.1.4 Future potential and new business models as a result of DSM

Energy from renewable sources is becoming more widespread and new systems for integrating and distributing a less carbon-emitting energy mix are required. "New renewable supply sometimes suffers from intermittency which can be solved with development of DSM as a balancing action (or as a virtual storage) for their full integration into the systems". Improved computerization will enable smart grid services and smart metering, and hence enable the end-user to adapt its consumption to the present situation and local circumstances (Nilsson, 2007). Intelligent metering will contribute to a new and more digitalized form of DSM than what has been observed so far, and is a crucial step towards a true DSM-revolution (see chapter 4.3). Looking forward, it is expected that DSM will motivate new business models to deliver the invisible resource that energy efficiency is (Nilsson, 2007).

Extreme area price peaks during winter 2009/2010

During the winter 2009/2010 Mid Norway experienced unusually high price peaks for electricity. The graph illustrates the price developments for the area from 1/1/2010 to 28/2/2010, as well as the maximum daily prices for the same dates in 2009 (Nord Pool Spot). The extreme prices of 1000 EUR/MWh and 1400 EUR/MWh on 8/1/2010 and 22/2/2010 respectively, were due to high and inflexible demand as a result of cold weather. Both production in the area and import from surrounding areas were at maximum capacity[9]. Due to low inflow to Norwegian hydropower plants capacity was lower than in winters with more precipitation (NVE [1]).



Source: "Area prices", Nord Pool Spot website, http://www.npspot.com/reports/areaprice/Post.aspx

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[9] NVE [1], Johnsen, Tor Arnt (red.), "Kvartalsrapport for kraftmarkedet 1. kvartal 2010", Report 20/2010, p. 97.

4.2 Smart grid

4.2.1 What is a smart grid?

Smart grid is a digital electricity grid which allows for two-way communication to optimize supply and demand. Smart grids are promoted as a remedy against global warming and peak loads on the grid, although the drivers for implementing smart grid varies among countries. A smart grid is *smart* because it facilitates the transmission of not only electricity, but also information. Smart grid advocates promise improved energy efficiency and security of supply, fewer and quicker response to outages and facilitation of new solutions. It should enable more active participation by consumers; accommodate all generation and storage options; enable new products, markets and services; optimize asset utilization and respond to system disturbances (Enbysk, 2010). The European Technology Platform has tried to summarize its values and characteristics: Smart grids are "electricity networks that can intelligently integrate the behavior and actions of all users connected to it - generators, consumers and those that do both – in order to efficiently deliver sustainable, economic and secure electricity supplies" (SmartGrids [1]). A smart grid is thus not one single installation but emerges from technological progress in several different areas. As an example, smart meters alone do not constitute a smart grid, but can be regarded as a part of one.

4.2.2 Background and fundamental smart grid components

As the demand for electricity increased, partly due to electrification of households, the need for smarter grids aroused. The term has been intensively discussed, but development has been slow (McKinsey & Company, 2010). The national grids in most countries have evolved little over the past decades and thus not kept up pace with this modernization. "Current grids have served well but will not be adequate in the future: grids must ensure secure and sustainable electricity supplies throughout Europe, take advantage of new technologies and comply with new policy imperatives and changing business frameworks"[10].

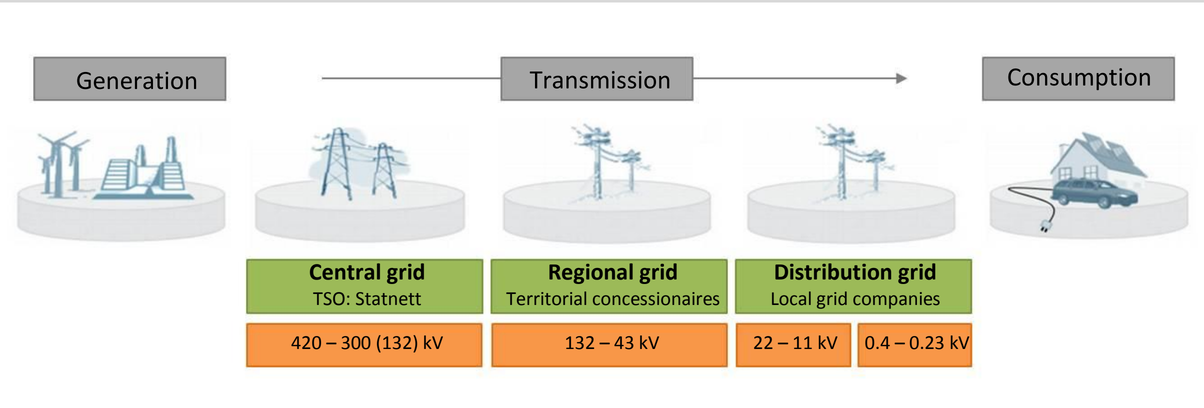
Ever since demand side management was introduced in the market, the discussion around smart grid has also existed. Not until recent years has technology been advanced enough to implement various forms of smart grids. These forms include automatic meter reading (AMR), visualization technology and phasor measurement units (PMU) (Department of Energy). AMR provides consumers the ability to use electricity more efficiently through price signals, and provides utilities with the ability to detect problems on their system and operate them more efficiently (see chapter 4.3). Visualization technology will provide "wide-area grid awareness, integrating real time sensor data, weather information and grid

[10] European Commission, European SmartGrids Technology Platform, European Commission, Directorate-General for Research (2006), (http://www.smartgrids.eu/documents/vision.pdf), p. 6.

The Norwegian power system and smart grid

Building transmission grid is expensive and hence society will benefit from a single transmission system. The electricity grid is organized as a monopoly regulated by the government, and all users of the grid are committed to their local grid company (Regjeringen [1]).

The Norwegian electricity grid has three levels; the central grid, the regional grid and the distribution grid. The central grid is the highways of the power system and is mainly owned and operated by the Norwegian TSO, Statnett. The central grid has high transmission capacity and besides connecting producers and areas of consumption, it also comprises transmission lines out of Norway. The regional grid connects the national grid and the distribution grid, and is operated by territorial concessionaires. The distribution grid is local transmission lines serving power to end consumers (NVE [2]).



Source: NVE [3], "Kraftsystemet", NVE website, http://www.nve.no/no/Energi1/Kraftsystemet/

modeling with geographical information. Potentially, it will be able to explore the state of the grid at the national level and switch within seconds to explore specific details at the street level"[11]. PMU samples voltage and current many times a second, offering wide-area situational awareness to ease congestion and bottlenecks and mitigate – or even prevent – blackouts

Table 4.2: Benefits from a smart grid (Department of Energy)

Desired grid characteristics	**Smart grid benefits**
Enabling active participation by consumers	Informed, involved and active consumers – demand response and distributed energy resources.
Accomodating all generation and storage options	Many distributed energy resources with plug-and-play convenience focus on renewables
Enabling new products, services and markets	Well-integrated wholesale markets, growth of new electricity markets for consumers
Providing power quality for the digital economy	Power quality is a priority with a variety of quality/price options – rapid resolution of issues
Optimizing assets and operate efficiently	Greatly expanded data acquisition of grid parameters – focus on prevention, minimizing impact to consumers
Anticipating and responding to system disturbances (self-healing)	Automatically detects and responds to problems – focus on prevention, minimizing impact to consumers
Operating resiliently against attack and natural disaster	Resilient to attack an natural disaster with rapid restoration capabilities

4.2.3 Smart grid status today

The electricity sector is facing a paradigm shift and such a transformation creates new requirements in the electricity system. Despite several good reasons for rapid implementation of smart grid, the course of the adoption of smart grid is uncertain and smart grid deployment has been slow (McKinsey & Company, 2010). In Europe, the Nordic countries and Italy are considered progressive countries and dynamic movers in terms of smart meter deployment (Smart Regions, 2011 and McKinsey & Company, 2010). Development and deployment are driven and hindered by different factors, but a gradual implementation of a smarter grid will happen.

[11] Department of Energy, The Smart Grid: An Introduction, (http://www.oe.energy.gov/DocumentsandMedia/DOE_SG_Book_Single_Pages(1).pdf), p. 11.

4.2.3.1 Organization of European activities

In Europe the smart grid development is also regarded a step towards an integrated European market. Despite being made up of separate countries, the European region is well ahead of the US-market when it comes to region-wide smart grid plans (Enbysk, 2010). The European Technology Platform is the main supporter and advisor of smart grids in Europe with the organization SmartGrids. The European commission, TSOs, DSOs, regulators, research centers and consumers are among the stakeholders of the SmartGrids forum. One of SmartGrids' main activities is to ensure consistency with EU policy, to link relevant technology platforms and to ensure strategic relevance (SmartGrids [2]).

4.2.3.2 European drivers for a smarter grid

Environmental and political forces. Global warming and climate change have exerted pressure on European governments and businesses to move rapidly towards a more sustainable future. Environmental and political forces are driving a development where fossil fuels increasingly are being replaced by renewables. EU's adoption of the Third Energy Market Package has triggered public awareness and is the main driver for smart metering implementation in Europe through its objective to achieve energy savings and reduce peak loads (Smart Regions, 2011).

Electrification and increased generation from renewables. Higher electrification of transportation, due to higher concentration of electric vehicles, and heating is expected to exert extra pressure on the electricity system. Electricity is increasingly being generated from renewable sources. Sun-, wind- and hydropower are often generated from installations with dispersed locations determined by geographical factors rather than proximity to markets. Long distance transmission and remote locations require a more sophisticated grid with sensors and self-healing abilities.

Different drivers in Norway. The drivers behind smart grid progress in Norway differ from the drivers in other parts of Europe. Environmental demands constitute important drivers in large parts of the world, but in hydropower intensive Norway, economic considerations related to troubleshooting, prevention of congestion and blackouts as well as efforts to reduce peak loads are given priority. Technology enables a range of new solutions which can result in economic benefits, not only for end customers and companies but also for the society. The marginal cost of increasing system capacity to take extreme peak loads exceeds the cost of facilitating a system which controls demand and gives customers incentives to reduce consumption.

4.2.3.3 Barriers for smart grid implementation

Global warming, demands for energy efficiency and available technology is apparently not sufficient reasoning to implement smart grid. Three restraints for smart grid adoption remain: the required underlying technologies are expensive; it requires changes in customer behavior and the cost structure for such new solutions are uncertain (McKinsey & Company, 2010). Political, economical and market structural barriers hinder implementation

Pilot project profile: EcoGrid EU

The EcoGrid EU aims to be a full scale demonstration of how a distribution system can operate efficiently with more than 50 % renewable energy sources and by using smart communication and smart market solutions. The island of Bornholm has been selected to be laboratory and test site and 2000 of the 28 000 residential consumers will participate in the project by utilizing smart meters and demand response to real-time price signals (eu-ecogrid.net). Power is generated from wind, CHP (biomass), biogas and photovoltaic (*An easy guide to the large…*). As a part of the project, robust ICT platforms will be developed and implemented. "Installation of the smart solutions will allow real-time prices to be presented to consumers and allow users to pre-program their automatic demand-response preferences, e.g. through different types of electricity pipe contracts" (Energinet.dk [1]).

The project is a European cooperation which will derive advantages from related smart grid projects in both Europe and the United States. The project has a total budget of € 21 million of which approximately fifty percent is financed by the EU (Energinet.dk [1]).

Source: EcoGrid EU, "A Prototype for European Smart Grids – In Brief", http://www.energinet.dk/SiteCollectionDocuments/Engelske%20dokumenter/Forskning/EcoGrid%20EU%20-%20In%20brief.pdf in different countries all over the world. For example, European deregulated markets have a market structure in which there is a discrepancy between actors responsible for investments in the system and actors getting the profit. According to McKinsey (2010), there are three main barriers for investments in smart grid in Europe. These are lack of a clear regulatory framework and incentives, absence of significant consumer demand and segment-specific issues such as cost issues and standardization of metering (McKinsey & Company, 2010).

4.2.3.4 Future consumption will depend on production

The electricity systems need to be updated in order to accommodate the imminent changes in the electricity consumption. We know that both production and consumption will have a different composition from today. Common to all countries is that electricity production today is adjusted to consumption, while in the future consumption needs to adjust to production[12]. We know that the share of renewable energy will increase and that transportation and heating will increasingly become a part of the electricity system. More electric vehicles and heating pumps will further increase the load. A smarter and more sophisticated grid will also facilitate increased use of demand side management and utilization of customer flexibility which in turn will help smooth out both electricity load and prices.

4.3 What is smart metering and AMR?

A smart meter digitally monitors and communicates electricity consumption from customer to the grid company. The customer will no longer meter own consumption, and smart metering will provide a more correct electricity bill as consumption is communicated more frequently. The forthcoming smart metering implementation is mainly focused on households and private customers. EU is currently promoting smart metering implementation in most member states, and Norway is one of the forerunners when it comes to developing a legal framework and implementing a standardized system (Smart Regions, 2011). NVE is in the process of determining the guidelines for a standard AMR (Automatic Meter Reading) in Norway, and the complete report will be published May 2011. In mid-Norway AMR is expected implemented before 1/1/2014, while the rest of Norway will follow before 1/1/2017.

4.3.1 Benefits and challenges of AMR implementation in Norway

The main functionality of AMR. AMR includes digitalized and automatic electricity measurement as well as two way communication. The end users are no longer required to report their quarterly consumption to the power supplier as the AMR will do it for them on

[12] Koordinationsudvalget for Fremtidens Elsystem, Rapport: Kortlægning af den danske elbranches Smart Grid FUD-indsats, Energinet.dk & Dansk Energi (2011), p. 7.

NVE consultative paper on AMR, February 2011

NVE set guidelines for development and published a consultative paper on AMR February 2011 (NVE [4]). The document describes the functionality and defines responsibility of AMR in Norway. Proposed changes must be sent to NVE before 06/05/2011, and the final amended regulation will be valid from 01/01/2017. Below we will list some of NVE's main proposals for AMR functionality and information exchange[13].

- The AMR shall save measured values with a frequency of maximum 60 minutes and be able to save values at every 15 minutes.
- The grid company shall be able to reclaim measured values instantaneously.
- The AMR shall be able to connect to external devices through standardized communication based on internet protocols.
- The AMR shall be able to connect to and communicate with other types of meters.
- The AMR shall be able to send and receive information about prices, tariffs, total costs, load control etc.
- The grid company shall provide measured values to the end customer over internet at no charge.
- Providers of energy services shall have access to measured values from the grid company by authority from the end customer.

Frequent measurements and information exchange are key elements in NVE's suggestions to changes in the administrative regulation. Massive amounts of information can become accessible and communicated to several actors and create a fundament for the development of new solutions.

[13] NVE [4], "Avanserte måle- og styringssystemer (AMS). Høringsdokument februar 2011", Document 1/2011, p. 35-36.

a daily basis. A display connected to a communication platform will facilitate price signals and other relevant information from the market to the end user, and will also enable the power supplier to remotely control the end users' load (NVE [4]).

The potential impact of AMR. It is expected that AMR to a great extent will change customer behavior and supplier activities. Power consumption and distribution will in general become more transparent and efficient, and a range of new services and opportunities may evolve in the intersection between power supplier and end user. The grid companies are pointed out as the main stakeholder in the implementation of AMR, and are responsible for organizing the competition in the market (NVE [4]).

Communication platform. The choice of communication platform for AMR is yet to be determined. NVE makes no demands for this, leaving the product developers to decide the best solution. Looking to Denmark, the most appropriate platform seems to be through fiber net, but other platforms such as telephone landlines, GSM, radio and power line communication (PLC) have also been considered. For different reasons over the last decade both power suppliers, grid companies and internet providers have installed fiber in Norwegian urban areas, and the first movers naturally have monopoly in the given area. Given this partly existing infrastructure, the experience in Denmark, and the capacity and stability of fiber net it is natural to believe that fiber will be important in the emerging market of power communication.

Challenges related to investments. Costs of AMR implementation, installation and grid preparation are high, and so far the grid companies are expected to cover the expenses. Due to the monopolistic market they operate in, grid companies have very few incentives for making costly investments (see *Cash flows and regulations in the Norwegian electrical power market*). There is clearly a challenge entailed with this financial mismatch, where the players expected to make the investment are not the main long term beneficiaries.

4.3.2 AMR as an enabler for new business models?

AMR is expected to bring socio-economic benefits through improved energy efficiency and facilitate a range of new business opportunities, but there are still challenges that need to be resolved. The financial responsibility is the most urgent topic as we approach the implementation deadline set by the government. The determination of communication platform may however also be game changing, as it will enable power suppliers to better prepare for the new market that will emerge in the wake of a full scale AMR implementation.

4.3.3 Towards a common Nordic retail market

Since 2007 the Nordic Energy Regulators (NordREG) has worked with the process of implementing a common Nordic retail market within 2015. The remaining process has been divided into three parts (see figure 4.2); *specification*, *design* of processes, systems and changes in regulations, and the actual *implementation*.

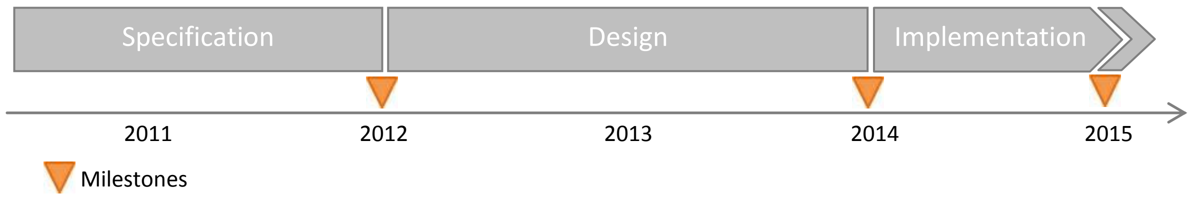


Figure 4.2: The process towards a common Nordic end user market with start and end dates.

The objective of a common Nordic end user market is to bring added value to all stakeholder groups and smart metering and AMR will be an important step in the integration process. The competition between suppliers will grow fiercer, but regulatory and technical obstacles will minimize for the suppliers willing to operate in other Nordic countries (NordREG [1]). Market efficiency will improve; the customer will benefit from an increased pressure on retail prices as well as a wider choice of products and suppliers. Further, the connection between wholesale and retail markets will strengthen when new players, products and business models are being introduced to the national markets. This strengthened relationship is expected to increase demand side response and have a positive impact on the wholesale market (NordREG [2]).

NordREG suggests in their specification that each TSO has the formal balance responsibility in the country they operate. It is crucial that market actors have easy and safe access to high quality market data and hence one common standard for electronic communication should be used across the whole Nordic region. By having national hubs and databases one can ensure standardized and efficient communication. (NordREG [2]).

4.3.3.1 The supplier centric model

One of the market models proposed in the implementation plan is the supplier centric model (SCM). This model is regarded a likely outcome when choosing market structure and implies that most customer specific issues are handled by the supplier, including the billing of network tariff. Strictly network related issues, such as interruptions, technical aspects of metering and metering devices, quality of supply, new connections and compensation for interruptions, will remain the responsibility of grid companies. The responsibility of ensuring that there is a customer service available for these issues also lies with the grid company, but a supplier may handle these network related questions. According to NordREG the purpose of SCM is to make it easier for the customer to operate in the electricity market, by only relating to one other market player. The supplier will hence be given the main role in the market, while the grid companies have the role of market facilitators (NordREG [2]).

Telenor Cinclus

Telenor Cinclus was established November 2004 and aimed to be a complete supplier of smart metering solutions in the Nordic market. Their business proposition was to deliver GPRS-based metering technology and Telenor invested 1.1 billion NOK in the company (Dagens IT). Cinclus was owned 66 % by Telenor and 34 % by Skagerak Energi AS (Proff).

In 2006 Cinclus entered into contracts with the Swedish energy companies Fortum and E.ON and agreed to assure that the two energy companies would fulfill the Swedish governments demand for AMI within the summer 2009. This involved installation of approximately 800 000 smart meters to Swedish households and the physical installation of meters turned out to be more expensive than anticipated (Dagens IT).

In January 2010 it was officially decided that the company was to be liquidated within June the same year. It resulted in an overall loss of 1.7 billion, of which Telenor had to carry 1.1 billion and Skagerak Energi the remaining 0.6 billion. The stated reason was that costs, time and risk had been underestimated (E24).

5 Methodology

In the following chapter we will present our work methodology, starting with the overall approach to our thesis, before presenting the different research methods. All the subchapters will follow the same structure; the purpose and goal of our research, how we conducted the research and finally what challenges we experienced along the way. At the end of the chapter we will present possible improvements when looking back and evaluating our research method and approach.

5.1 Overall work approach and research methods

Goals and targets: While our preliminary project last fall revealed some expected future changes in the electrical power industry, we now wanted to look into the actual business opportunities these changes would enable in the intersection between grid companies, power distributors, potential new entrants and end customers. With a focus on smart metering, demand side management and a potential smarter grid in Norway, our overall target was to identify and map out possible gaps in the end user market that may be covered by new business models.

Research strategy: Our two main sources of information have been written material and interviews with industry representatives. We have also participated on a conference regarding the future of the electricity industry in Norway. Because the concept of smart metering is new to the end users and still not a standardized product or service in the industry, we decided that a qualitative research method would best cover the empirical needs of our thesis. This decision is also supported from research method theory: "Qualitative methods can be used to better understand any phenomenon about which little is yet known" (Strauss and Corbin, 1990). Conducting a large scale survey would be difficult when most respondents would not have any knowledge of the product's purpose or the possibilities it provides. We needed respondents with fundamental knowledge of the electrical power industry and with an idea of the possibilities that smart metering facilitates. This could only be achieved by talking to representatives from power companies, from the government and other involved organizations.

Table 5.1 Steps of qualitative research (Bryman, 2008)

Steps of qualitative research		Translated to our work
1)	General research questions	Our problem statement, in addition to hypotheses and assumptions made in the initial phase, before conducting interviews.
2)	Selection of relevant sites and subjects	Through dialogues with our supervisor and the Smartgrid Centre at NTNU we were introduced to relevant theories, previous research within the field, and industry chief officers who were involved with the Smartgrid Centre and hence were in our target group of interview objects.

3)	Collection of relevant data	Reading legislative documents, online articles, journals, relevant theories, participating on a conference, interviewing interesting industry actors both in person and by telephone.
4)	Interpretation of data	We crossed industry findings and interview results with known theory and a priori expectations, and looked for similarities and contrasts. Further we categorized companies, strategies, models, products and services, and tried to find parallels across the different industry layers to discover new connections and market trends.
5)	Conceptual and theoretical work	Our preliminary analysis was the first conceptual work. In such a complex industry it is difficult to generalize results and our main goal was not to generate theories but market insight and opportunities. However, by proposing and later answering four key questions in our main analysis we generalized – to the extent possible – our view and our findings about the different market actors.
5a)	Tighter specification of research questions	After the preliminary analysis we articulated the main research questions, and after analyzing these results we further specified questions to our last round of telephone interviews. Still it was important to us to have all interviewees to answer the same questions and hence the main content remained the same in most interviews.
5b)	Collection of further data	After we finished our main analyses and started to outline our final conclusions we tested our results with objective professionals within the industry. By presenting our conclusions and ideas with them, we got input on feasibility. This could then be included in our final conclusion.
6)	Writing up findings and conclusions	We worked through our interview summaries, had them tested for respondent validity by the interviewees and finally finished our final analysis and conclusions.

One of the most important criterions of research is its validity. There are several different forms of validity, and some of them are more relevant than others to our qualitative research. *Measurement validity* determines whether a measure actually reflects the relevant concept. In our research we conduct in-depth interviews where no answers are being generalized or quantified, and hence we are confident that our measurement validity is good. The interviewees' answers are simply reproduced more or less in their entirety to provide an insight to the industry for the reader, but with a few important quotes highlighted. In terms of *internal validity* there is of course an issue associated with all interviewees being connected with the Smartgrid Centre in Trondheim. This means that our respondents already is likely to be more updated and involved in the development and implementation of AMR and smarter grids in Norway. However, this partly reduced internal validity is not of significance to the result of our research because of the qualitative research design, and because our different findings only represent the respective company. If our results were being generalized across the entire industry the research data would have been biased and the poor internal validity would affect the research quality. That is not the case with our results and we thereby regard our internal validity satisfactory. *External validity* is less relevant to our research because we are not generating theories from our findings. We provide the reader with business and market insight into a changing industry, and this insight should be manageable to replicate. The external validity is hence good, but not very relevant. Last we have the *ecological validity*. We believe that due to our selection of interviewees and our semi-structured interviews the ecological validity is satisfactory. The respondents are not forced into an unnatural setting where they are asked to answer hypothetical questions.

Challenges experienced: The electrical power industry has a very complex structure – both in terms of regulations, cash flows and organizational structure. Many people know fractions of this business very well, but it proved difficult to obtain people with a complete overview of the market and industry dynamics. Most of the papers we read and the representatives we talked to had a detailed knowledge of their respective stage of the value chain, but no one seemed to have the exact perspective we wanted for our thesis. To obtain a complete picture of the market we had to piece the information together and constantly secure the accuracy of the details. Another challenge we experienced throughout the process was our own lack of education within the technical fields of electrical power and communication. A considerable amount of time was thus spent researching and studying basic principles that seemed fundamental to both the power and ICT industry.

5.1.1 Data collection through written sources

Goals and targets: Our goal was to gather data that combined would give us a fundamental understanding of the market – of its regulations, its history and its current standards. By collecting information from published written sources we could to some extent get an objective and theoretical view of the industry. We also hoped to find theories on innovation, market entry strategies and diffusion that could provide a platform from which we could identify opportunities in the market and possibly develop new business models.

Research strategy: Literature explaining the innovation marketing process and disruptive technology was collected from widely recognized books and journals, but also from individual papers, which often provide an opposing or complementary view of the subject. In addition to looking for relevant articles and books, we looked at the sources of the articles we found. We could then in turn read the papers that the relevant article was based on, and in that way work ourselves back to original literature and discover useful theories along the way.

Because of the strict government regulation of this industry we paid attention to government sites, such as the Ministry of Petroleum and Energy (OED) as well as documents from NVE. We used online newspapers and technical journals to stay updated on the latest discussion documents from NVE, media's view on smart metering and how this was communicated to the end users. To understand the market dynamics and common practices and standards we used information from the Norwegian TSO, Statnett, but also presentations and information collected from commercial industry players.

According to Bryman (2008) there are four key questions to keep in mind when analyzing newspapers and commercial reports, to assess the objectivity and credibility:

1. What kind of person, company or newspaper has produced the item?
2. Who (or what) is the main focus of the item – one specific politician, expert, organization or technology?
3. Who provides the alternative voices?
4. What was the context for the item – an interview, the release of a report or an event?

We kept these questions in mind when assessing online newspapers, company reports and websites and even journals. If the content did not seem objective we tried to look for opposing sources. There is often an agenda behind the publication of reports advocating one technology, one industry or company, and it was important for us not to treat such articles and reports as facts but as input to a discussion. We preferred using official government documents or objective consultant reports as references, rather than newspaper articles and company specific articles to avoid a biased view on the subject or industry.

Challenges experienced: The electrical power industry has so far been characterized by great stability and little innovations in the end customer market. Thus there was no available literature on innovations carried out in this industry that could help us in evaluating and analyzing today's situation. Additionally, the power market in Norway is not comparable to other free competitive markets due to its strict regulation. Relevant literature hence was not always applicable due to the absence of common market forces. Looking to innovative power markets elsewhere was also challenging, as the market structure in Norway differs from many others both in terms of regulation, fuel mix and amount of electrical power used for household heating. Further, it was challenging to find credible sources on the near future development of the energy sector due to the amount of uncertainty and speculations.

5.1.2 The interview process

Goals and targets: By interviewing chief officers representing different stages in the industry we wanted to achieve a 360 degrees perspective of the subjects in question. Our target was to get an idea of what was going on in the industry – from their point of view, to find out if and why some companies felt more threatened or confident than others, and why, and last; if our objective data collection really was representative for the involved parties.

Research strategy: We chose our interview objects based on business and market focus. Common for most interview objects was the connection to the Norwegian national Smartgrid Centre. Through the Smartgrid Centre we were able to get access to member lists and board representatives. These companies were already involved in activities related to smart metering and smart grids, and therefore appeared interesting to us. By further referring to our connection to the Smartgrid Centre we were able to establish contact with most of the companies enquired. One interview was conducted during the conference in Trondheim as a result of this representative's participation in the first session.

We decided to conduct semi-structured interviews, because we wanted to be able to compare the different answers to the same questions, but still keep an informal tone and let the representatives talk freely when desired. A semi-structured interview process is flexible; questions that are not included in the original guide may be asked as the interviewer picks up on things said by the interviewees. Additionally, a semi-structured interview is to prefer when there is more than one person conducting the fieldwork and when you want to address specific issues during the investigation – rather than a general notion (Bryman, 2008). Both of these characteristics were descriptive to our case. On the other hand semi-structured interviews put higher demands on the interviewer. Body language, patterns and forms of behavior become more important (Bryman, 2008), and a careful qualitative treatment of the answers is crucial to achieve valid and credible results.

Prior to the interviews we spent a considerable amount of time formulating two interview guides; one for distributors or suppliers and one for grid companies. However, only two questions differentiated the two guides, both consisting of 21 questions (Appendix I). We based our guide on the following setup for preparing interviews (Bryman, 2008);

1. Create an order on the topic areas so that your questions flow reasonably well.
2. Formulate interview questions in a way that will help you answering your research questions.
3. Use a language that is comprehensible and relevant to the interviewees.
4. Do not ask leading questions.
5. Ensure to collect information of general kind (name, company, position, etc.)
6. Get hold of a good-quality recording machine

After conducting the interviews we listened through the audio records and printed a full transcription of the session. Although this was a very time consuming task, it turned out to be one of the most important steps in the interview process as it allowed us to examine the answers more thoroughly. We were brought closer to the key data of our thesis, we discovered parts that none of us had apprehended during the interview, and it became a lot easier to discuss and compare answers from different interviewees. The task partly eliminated challenges related to internal reliability as we had all data in written form. Before publishing our report we sent the relevant transcripts to the respective interviewee for respondent validation.

Challenges experienced: Most of the time we were impressed by the interviewees' participation and involvement, but as we talked mainly with chief officers some of them were difficult to get hold of. Because we only talked with one or two representatives from each stage of the value chain our results do not necessarily reflect all companies or players in the same stage. This is however a known disadvantage with qualitative research as opposed to statistically significant quantitative research, and hence we were prepared for this. Before conducting the interviews we made interview guides that we presumed would cover most topics. Our plan was to have different representatives providing us with their perspectives on the same issues, in order to compare the different approaches. During the interviews however, we learned that the main business focus was quite different across the different companies, which implied that our interview guide in some cases was insufficient and varying parts of it became irrelevant.

5.2 What could have been done differently?

When looking back there are things we could have done differently. Whether this would improve our report or not is difficult to assess as we are confident that our approach have been satisfactory for the intended purpose.

We could have talked with more third part service providers to get an even more nuanced view of the emerging market. These companies are however reluctant to provide too much information about strategies and new products because of the competitive forces in the industry. Additionally they may be difficult to obtain because they are not yet visible in the market.

In general we could have conducted more interviews with representatives from companies in the same layer of the industry. The results would hence be easier to generalize, but if our goal was solely to generalize results we would have chosen a more quantitative approach in the first place. With our few but thorough interviews we got insight to the business strategy and perspective of the companies in question.

Throughout the report we have kept a clear business focus, rather than concentrating on the advanced technological issues. We could have kept a more technical perspective, as many of our industry sources kept a technologically sophisticated level both in terms of language, illustrations and problem statement. Our reasoning for this was partly our limited education within energy, electricity and communication technology, and partly due to our decision of keeping a general and comprehensible language and style in our thesis. It was important to us to publish a report that was easily intelligible to our main target groups; market actors with a customer oriented approach, new actors who have limited knowledge about the technological aspects of the industry, and students with similar background and goals as us. Our business focus kept us from dwelling too much on technical expressions and details irrelevant to our key problem statement; mapping out the current state of the Norwegian power industry and revealing opportunities for future business models.

6 Preliminary analysis in light of presented theory

As previously discussed, a deregulated electricity market has resulted in a regulated industry with clearly defined areas of responsibilities and hence market forces are somewhat unconventional. The implementation of AMR in Norway can have major implications for formation of new solutions and business models. Will AMR facilitate further innovation based on existing or new technology? Which companies will be innovative – in terms of technology or application of current solutions in new markets, and are there any obvious traps in this particular market? Will new companies enter this industry? Will first-movers have advantages over fast seconds, and is the end customer the final determinant of success? In the following preliminary analysis of implementation of AMR we will address these questions and provide our initial thoughts on the subjects in light of the theory presented.

6.1 Preliminary analysis

6.1.1 Innovation opportunities

The digitalization of the distribution grid and implementation of AMR create a new arena for innovation and this can be a new market opportunity. AMR will be the first step towards a "digital brain" in every household, and it is obvious that digital metering, monitoring and communication with external parties can be valuable and trigger innovation of new solutions and services. Several companies have already developed platforms for third party services on top of the fundamental metering functionalities, but the final form and functions are not yet fully developed. The AMR may hence potentially facilitate radical innovations in accordance with Leifer et al.'s theory (2000). New product categories and new relationships between customers and suppliers can arise, the market economics can be restructured and current products can be displaced.

6.1.2 Disruptive change

AMR fulfills existing customer needs in a simpler, cheaper and more convenient way, and we therefore predict a disruptive change of the power industry in line with Christensen's theory (1997). The technology is not yet implemented, but the potential scope of technologies, third-party services and market size suggest that the speed of development and performance will follow the trajectory of a disruptive technology (see figure 3.2). The Norwegian power industry is dominated by strong incumbent companies and corporations, and according to theory on disruptive change, these companies can be exposed to threats when new disruptive technologies capture markets. Traditionally, Norwegian power producers, grid companies and to some extent power suppliers have been operating in a stable and predictable environment. In accordance with Christensen's (1997) theory, if these incumbent firms spot the disruptive technologies in time, they can either attempt to defend own company or utilize the new market opportunities the technology provides. Disruptive changes also represent opportunities for smaller and more flexible firms. AMR indicates a transition towards ICT, and companies within the ICT-industry are known for being dynamic, innovative and fast. Hence we believe ICT-companies can rise to threaten incumbent firms in this industry.

6.1.3 Market entry strategies

Implementation of AMR and other smart grid initiatives suggest that the power industry is undergoing changes. The industry is faced with uncertainty and current actors are required to take actions and make strategic decisions. As changes will occur close to the end customer, we believe that competencies relevant to retail activity, as well as partnerships with companies with a direct relation to end customer can be valuable. Companies entering this industry as third party service providers are likely to possess the required competencies and hence use internal development as opposed to acquisitions, in line with Lee and Lieberman's literature. According to the quantitative study conducted by Min et al. (2006), incremental innovations will yield first mover advantages, while disruptive innovations imply greater risks and hence an early follower strategy is more beneficial. The way we see it, AMR is not a technological revolution itself, but the subsequent business models will have disruptive characteristics for companies already operating in the power industry. Because of this perceived disruptiveness and according to theory, established firms should choose an early follower strategy in the aftermarket. They should race to become second. Looking to Markides and Geroski's (2005) theory on fast second strategies, this decision is supported, as pioneering by big companies rarely makes sense. Large companies should focus on consolidating activities, on scaling the product up to mass markets. On the other side, we expect new players in the market, such as ICT-companies and third party service providers, to harvest great advantages from making the first move. To these companies AMR can be regarded as an incremental innovation because all technology is known. We even expect the emerging business models to be comparable to models that these companies already are familiar with. As we learned from the study of Min et al. (2006), the survival rate for first movers versus early followers – when it comes to incremental innovations – is sovereign. New market players can oust the large, established firms by being flexible and moving fast in a business environment that to them appear familiar. ICT companies and third party service providers should hence aim for the first mover position, as opposed to the fast second strategy the established companies should focus on.

6.1.4 Diffusion: adoption or rejection

AMR in its most simple form is not dependent on broad customer support among all layers of the population as it is imposed by the government, and utilization does not *require* customer participation. However, in order to achieve diffusion and adoption of the additional technological functionalities AMR can provide, customer support is decisive. When applying Rogers' theory (2003) on the case of AMR, we see that the social system in which the customers belong comprise every single household throughout Norway, and is thus extremely comprehensive. Relatively simultaneous implementation of AMR will force obtainment into a smaller time interval than regular market products and perhaps reduce the share of customers in the last adopting categories such as *late majorit*y and *laggards*. The behavior and attitude of customers is defining the rate of adoption and whether a new AMR-based solution has potential for success or not. Sufficient information about AMR, what possibilities it facilitates and how and why this benefits the customer will reduce uncertainty and speed up adoption.

6.2 Key questions for further studies

Based on our preliminary analysis of the potential consequences of implementation of AMR, we will in the following bring forth some key questions for further studies towards an understanding of how this market may look like in the future, and the shape of new business models.

6.2.1 Changes in the industry

Based on the above analysis we predict a disruptive industry change, but we are interested in finding out if our impression is in line with industry representatives' thoughts and predictions.

Will the forthcoming changes in the Norwegian power industry be of a disruptive nature?

6.2.2 The different actors' exposure to changes

Due to strict regulations and distinct division of roles in the Norwegian electricity industry, a redistribution of responsibilities and roles can have important consequences for innovation climate in different layers of the industry.

Who will benefit and who will suffer from a possible redistribution of responsibilities and roles in the power industry? Is such a redistribution likely to occur?

6.2.3 Market forces post AMR implementation

As the relationship between customers and suppliers in the electricity industry is strictly regulated and anything but conventional which forces acting on which actors can be difficult to reveal.

Which are the most important market forces and what is their strength and direction?

6.2.4 Central factors of value for business development

An important question is concerned with unrealized value as we believe this will be a key factor for future success. Discovering unrealized value in the industry and being able to utilize it can constitute the perfect basis for developing new valuable business models and competitive advantage.

What is of unrealized value in the electricity industry today, and what can be sources of value in the future? To whom is this valuable?

The Norwegian power industry is facing forthcoming changes and these will be disruptive to existing industry players. There are opportunities for innovation, both in products and in business models, and hence new relationships between customer and supplier will arise. To obtain first-hand information and prevailing opinions about the current state and future of this industry, we conducted interviews with representatives from different layers of the Norwegian power industry. Highlights from the interviews will be presented in the following chapter before we move on to answering our four key questions through various analyses.

CHALLENGES

7 Interviews

In the following we will present the outcome of several interviews. We conducted three face-to-face interviews and four telephone interviews with industry representatives in relevant positions from different layers of the value chain. A number of our interviewees are affiliated with the Norwegian Smart Grid Centre, a national center of expertise on smart grids. We aimed to get a broader understanding of the electricity industry, its drivers and barriers and how AMR implementation facilitates business development and DSM solutions. The interviewees were able to provide us with first-hand information about industry status and insight into a complex industry on the edge of significant transformation.

We include quite extensive parts of the interview summaries in this chapter to provide the reader with the sufficient background and insight before our analyses later in the report. Not all parts of the summaries are equally relevant for our final conclusion, but nevertheless important for the overall understanding of the industry and its market dynamics.

The interviewees provided their thoughts mainly around the following issues;

- Drivers and barriers for AMR and smart grid implementation in Norway
- Important future competencies and partnerships
- The market post AMR, business models and customer focus
- Financing
- Redistribution of roles
- Competition and speed in the industry
- Positioning and innovation climate
- Choice of solution for communication
- Other markets and countries

7.1 Håvard Belbo, NTE

Executive Vice President of Strategy and Business development NTE, Sjøfartsgaten 3, Steinkjer. March 22nd, 2011

NTE is locally owned by North Trøndelag County Council, which is sole shareholder. NTE has several subsidiaries, including power production, grid and power supplier companies. NTE serves approximately 80 000 grid customers (NTE).

> "The driver for AMR is the need for controlling consumption. So far the AMR regulation is pushing a development towards smart grid due to the costs of peak loads. There is a socio-economic benefit of controlling consumption instead of expanding capacity for the rare peak loads. Advanced AMR is a better solution than building capacity for peak loads. We are interested in finding the business models that can enable profitable socio-economic solutions. We want to find commercial

solutions that are interesting to the grid company, to the power supplier, to the electrician and to the customer. And achieve a fair distribution of incentives, initiatives and rewards. The barrier is probably the energy industry itself. The grid companies are used to a pretty predictable environment.

I believe market understanding will become an important competency. The smart grid requires customer participation. We must have an even better understanding of the consumer side in the energy system than before. Many actors in this industry have taken positions distant from the customer. That sounds risky to me. And ICT competencies will of course be extremely important. We are developing this competence, both internally and externally. We have chosen *open innovation* as our approach to business development which means we have to look for partners. It is interesting to cooperate with a combination of different actors. At the outset we have had some solid solution suppliers, and we will also need these in the future. Independent consultants are also important to us. The third group consists of the small ICT-companies, and these are harder to monitor.

> "Advanced AMR is a more socio-economic solution than building capacity for peak loads"
>
> *- Håvard Belbo*

It is important to find feasible business models, not only technology, but *business models*. We see that customers need incentives, like pricing models, to behave differently. We can make it simpler and cheaper for the customer if we get access to controlling their consumption, when and how much. And we don't necessarily have to sell power in kWh, we can sell prepared solutions like temperature or lighting. A traditional power supplier only selling kWh will not survive the forthcoming changes. The new task is to sell solutions and we will be the ones operating the households at reasonable prices – the customer is only living in the house. You need an interface and an integrated provider responsible for everything like temperature, lighting and air quality. Your TV might become a more advanced display than today and provide a range of add-ons in addition to energy solutions. When and where electric vehicles are loaded will also have great impact on the future energy system. I am convinced the number of electric vehicles will follow an S-curve although we don't know exactly when this will happen. We expect a diffusion of electric vehicles comparable to other technologies like microwave ovens and color TVs. We think easy access to charging will be crucial for initiating the diffusion of electric vehicles.

Today, Statnett is buying energy options from the largest consumers like Hydro or Norske Skog. They're paying to retain the right to limit supply. This can also be a solution for household consumers. The local grid company can sell this option to Statnett and give the customer incentives for letting them control their consumption. This is a business model, which is interesting and profitable to us, to Statnett and to the customer. But this needs to be tested, because we don't know how the customers will react. We don't have sufficient knowledge about which business models the customers find attractive.

Keeping less profitable activities can be an important part of developing new energy systems. When NTE got its first power station in 1923 it was important also to have shops and electricians that could push electric articles to increase electricity consumption. Now, we have the same situation, it's all about utilizing the fiber and make the investment profitable by immediately providing the customer valuable solutions and start invoicing.

We have a lot of ideas and opportunities and we have to get them to market fast enough and well enough. We already have telephony, TV, movie rental etc. We can imagine alarm services and health care technology. There is a broad range of things to do related to energy and water consumption, and other household qualities that can be utilized by smart grid or smart house technology. The AMR technology can be sufficiently advanced to facilitate these services.

There is a possibility for a redistribution of roles in the industry. Today, the grid companies are responsible for metering and are supposed to make the information accessible for other parties. They are paving the way for another distribution of roles in this industry. We should try to think some steps ahead, we can imagine a model comparable to what we see in the aviation industry; a tax on the ticket and the operator takes care of the customer relation.

> "Many do not yet understand the importance of market and business development"
>
> *- Håvard Belbo*

In the short term, our biggest competitors are the power suppliers. Many actors are competing for the customer relations, and are eager to take positions close to the customer. All of these are our competitors. Another kind of competitors is the ones attempting to build the same infrastructure as us, such as fiber and telecom actors. Everybody interested in taking a dominant position within telecommunications are our competitors. It's a race to be first with fiber. Being second there is not good enough. But our potentially biggest competitors are the hidden competitors, be it Google, Microsoft or other. They are the ones developing new business models that potentially can put us out of action. This battlefield is still a little blurry to us.

The IT-industry has a completely different speed; it's a different world. They turn around in weeks or months, while we need decades for the same development. That is exactly why we consider it necessary to ally with IT-companies, to respond fast.

In the new market we want to take the position closest to the customer and use this position to establish solutions that benefits the rest of the energy system. We want to be the organizer for the different service providers. The customer can decide to which extent he wants to utilize our platform and structure. We want the customer to have a choice of display and the opportunity to choose solutions, similar to a smart phone with lots of services and applications. The infrastructure provider adapts for services from third parties. This is a platform that requires in-house equipment, a communication solution and a control unit. This platform must be open to third party solution providers and we can expect a range of different services.

> "We do not necessarily have to sell power in kWh, we can sell prepared solutions like temperature or lighting"
>
> *- Håvard Belbo*

It is a time of upheaval. We have gone through a phase of stable environment, and organizations bear traces of this. Business development is the fourth pillar in our corporation – production, grid, and market and business development. Despite the fact that this department was formed three years ago, many are still wondering what we are doing. I think it is a sign that many do not yet understand the importance of this business area.

It will be developed a communication solution on which you add services. The customers can watch and control their own consumption. We can offer services like reduced network tariff in exchange for controlling the water heater and heating in a household. An Internet communication facilitates a range of possibilities. You can communicate via internet protocol and utilize surfaces in your household and displaying consumption or letting service providers control your consumption. The grid companies will have access to cutting off supply. We consider IP the best solution, as the traditional solutions don't have sufficient capacity for the wide range of add-ons. A new world will open up in this area. Expansion of broadband based on fiber is our third largest investment after production and grid. We deliver fiber for Altibox, which is a service provider, so we can expect an exciting integration between broadband and the energy market.

Participation on conferences gives us important insight. In terms of fiber we're looking to South Korea. In terms of smart grid we have looked to Sweden and learned from their mistakes but we don't see any interesting business models there. Besides, the motivation for smart grid in Norway differs from the rest of Europe. We are looking at consumption patterns rather than implementing new energy sources into the existing system."

7.2 Jens Auset, Hafslund Nett.

CEO Hafslund Nett

Hafslund ASA, Drammensveien 144, Oslo. March 23rd, 2011

Hafslund ASA is owned by shareholders and listed on Oslo Børs. Hafslund Nett is one of the subsidiaries of Hafslund ASA and is the largest grid company in Norway. Hafslund Nett owns and operates the distribution grid in Oslo and parts of Akershus and Østfold, and the regional grid in Akershus, Oslo and Østfold. Hafslund serves approximately 545 000 grid customers (Hafslund).

> "Smart grid is a fusion of technologies. Earlier, a competency within electric power engineering was the dominant knowledge. Now, remote control and requirements for communication competence has increasingly become important. But these two areas of knowledge are still separated. We believe that the electric power engineers of the future will need more knowledge of computer science and communication.
>
> As a grid company we are obliged to deliver, and our industry and role is monopolistic. We are the premise setter, electricity or no electricity. It is an increasing focus on the customer, on reputation, and on the customer's opportunity to be a troublemaker if we don't behave decently. We are constantly doing surveys and trying to communicate with our customers despite we are not selling a product directly. We are doing campaigns and trying to tell our customers that electricity makes the everyday life work or that energy consumption affects the environment. We are communicating with the customer and we are hoping he will respond. What we are trying to measure is whether he finds Hafslund's products appealing. Maybe he will even prefer them. I think Hafslund is pretty active in customer communication compared to other grid companies. We used to have a security company and decided to move towards energy. It was an attempt to see if there was a natural connection between the two, see if we could get any synergies by using operators already being out in the field. There were no obvious synergies so we chose to focus on energy. The fact that other actors are linking these services now is probably because of the two-way communication requirement. If a third party company, say an alarm company, will have the right to utilize our communication path through the meter in order to reach the customer, an entirely new market will open up. Being a monopolist we are required to open up this channel, not only for our own internal service providers, but also all external service providers shall have the same right to use

"I don't see any reasons why we shouldn't be able to meet the deadlines for AMR"

- Jens Auset

this channel. It is possible we can charge this use, I don't know, but the price must be equal for internal and external service providers.

We have been somewhat reluctant, waiting for financing solutions giving us incentives for embarking on AMR and smart grid. We see that advanced functionalities and software can be implemented. These qualities enable tariffing and honoring of those smoothing out consumption patterns. This can in turn eliminate the need for building new lines or new production – at least today. Give them a good compensation! Today, the financing of AMR will clash with the financing of other grid investments, because it has to be dealt with through the same economic regulation. The economic regulations will however consider AMR and allow a model for depreciation, which gives a higher payback in the beginning of the life span. I don't see any reasons why we shouldn't be able to meet the deadlines for AMR.

When looking at NordREG's project on a common Nordic end user market by 2015, it is not unthinkable that we will see a redistribution of roles in our industry. The supplier centric market model appears to be preferred. And this means that the grid company will be a provider for third parties serving the end customer. The goal is to give the customer a better and cheaper product, and give him the opportunity to choose from all power suppliers in the Nordic countries. Implementation of AMR is a prerequisite for this new market; hence AMR is most important to us now. Through AMR the government will ensure the customers a more accurate invoice in the sense that the price the customer pays always shall be in accordance with the electricity price at the consumption time. Hence we believe our customers will receive a more accurate invoice. We have to utilize the opportunities in the AMR system in order to get better grid operations. What's in it for us? The improved grid capacity we can get from implementing AMR.

I think there are opportunities for software companies in this industry. It is natural to think of new in-house opportunities for smarter consumption and increased comfort levels, which thus give a lower electricity bill and better quality of life. The customer must be in focus for new development. You won't make any money if you can't convince your customers that your solutions are something they need. I think companies like Microsoft and Google are better at this than the traditional suppliers. They're better at interpreting customer reactions and responses and are responding faster to customer requirements by adapting products and services. I think the existing power suppliers are the ones experiencing the hassle.

"What's in it for us? The improved grid capacity we can get from implementing AMR"

- Jens Auset

In Europe, the grid companies are looking at the transformation as a small threat to future position. The customer is becoming more distant as he is being served by third party service providers and the power supplier. An increasing distance from the customer may seem daunting. We have largely solved this problem and so we don't see any major threats or competitors. But for grid companies where things are still more integrated, these changes can be perceived as undesirable. We have already separated out an operations center with good interface that regulates the business, and we have a good description of the service in terms of quality, requirements for response, etc.

A part of this industry is already on a fast-changing track. The power suppliers are increasingly selling themselves on TV. In one period, you could even buy power on gas stations and on Rema 1000, and this lead to a couple of new actors in that part of the industry. The new actors have not been equally present in the grid company end, but they are coming now! However, we have to keep in mind that the lifespan of the infrastructure and products in the electric power industry is much longer than for cell phone infrastructure or a software module. When building grids, we have a time horizon on 50 years. The time horizon for AMR infrastructure is 20 years, so it is obvious that the software must be updated in correlation with customer requirements. There will be an increased focus on the electricity product when the customer becomes more involved. The customer can be more active as we are accessible through interactive communication and through other responses.

> "New actors have not been present in the grid company part of the industry, but they are coming now!"
>
> *- Jens Auset*

We are still heavily regulated by the government, but it is up to us how we collect data from the AMR. How we choose to utilize the rising possibilities are also up to us. We can expect some grid capacity, and AMR can be a unique opportunity to do something with the existing distribution grid. By placing extra sensors and extra communication you have established a grid with self-repairing abilities which facilitates more renewable energy and more electric vehicles and provides the customer with a better product. The customer is becoming more demanding; he accepts fewer black-outs and we as a grid company gets better control over the grid and can send a repair crew immediately to the right address.

Hafslund is working along three dimensions; technology, energy and environment. The innovative ideas are taken care of by Hafslund Venture.

To us there are different approaches to the question of communication platform for AMR. One is to actively advocate one solution or another. Or, we can look at it differently because we have a willingness to pay for every quality-assured measurement collected from our network that forms the basis of an invoice. This means that we in the extreme case can buy a quality-assured measurement, and be indifferent to how the task is performed. We own our customers' meters, and based on some communication solution these meters will deliver us a service – the quality-assured measurement ready for invoicing.

We have sold our fiber business, but reserved the access rights. We have a number of fibers in the fiber cable at our disposal for operational purposes.

When looking to other markets and countries we see that the framework conditions vary in different countries. We are constantly confronted with people and companies wanting to sell us analyses and benchmarking services to tell us where we stand relative to others. But the value of this is sometimes unclear."

7.3 Bård Benum, Powel.

CEO Powel
Powel ASA, Klæbuveien 194, Trondheim. March 29th, 2011

Powel provides company specific software solutions for production control of power generation, grid management, smart metering and technical infrastructure. Their solutions are independent of hardware (Benum). Powel aims to develop solutions, which provide strategic flexibility and rapid improvements within cost management, operation efficiency and customer services (Powel). Being a system and technology provider, Powel is located upstream in the value chain.

"Two elements drive the implementation of AMR and smart grids. First of all, governmental regulations force grid companies to introduce this. Additionally, we see that an increasing share of our customers is interested in how to utilize the fact that more information is accessible. That is essentially what is happening now; more information becomes accessible. The question is how the information from the grid and about consumption can be utilized in new contexts and how it can be merged with grid technology in order to create smart grid technology. We believe that this information combined with end consumer information will drive further development of smart grid technology. Distributed production from wind and solar and local production will also challenge the system and new technology will be required. To conclude, smart grid implementation is partly driven by regulations and partly driven by the fact that the actors see potential in utilizing accessible information. We are most interested in the latter.

> "I think it is obvious; the business perspective is crucial in order to make money"
>
> *- Bård Benum*

First and foremost, I think it is important to widen the perspective from only giving the customers an accurate invoice and incentives for controlling their consumption, because this can be used in a wider context in the grid. Customer information combined with other information will make the grid companies' operations more secure, more predictable and more efficient, and I think this will be important factors of success in this market. In Sweden we saw two waves; the first was implementing systems for fulfilling regulation requirements, the next wave was how to utilize the information cleverly? I think it is obvious; the business perspective is crucial in order to make money.

I think we will experience a polarization in the aftermarket of AMR, between those who have a strong consumer focus and those with a more industrial approach. The consumer focused will look for feasible solutions based on conscious and controllable consumption, while the industrial focused will focus on the grid company, the grid and supply services so that the grid companies' operations are undertaken more cost efficiently than before. Microsoft and Google are examples of actors focusing on the end customers.

Changes will occur downstream in this value chain. We will see a development of new products and services, also related to the electricity product itself. What are you paying for the electricity? To which extent are you buying electricity? Are you buying only from consumption or can you return or receive a compensation for the electricity you didn't consume? Additionally, you will get a communication path to every single household.

Today, when there is a breakdown, there is a lot of trial and error to find out where the error occurred and how it can be corrected. As you get real-time information in the consumer point and sensor technology in the grid, you'll get a much better overview of such situations. You might even be able to predict adverse events, and probably avoid them. We are convinced the grid companies are interested in such solutions when they see the opportunities in the wake of more accessible information.

I think the balance between the different actors can change; the products they offer can change and the business models can change. I think quite a lot can happen here, but as this is not our primary concern I won't speculate.

We have different competitors depending on the products and business areas. On data collection related to AMR and smart grid, it is the meter producers with own solutions. Our solutions are independent of hardware, so we can collect data from different producers. But there are not a lot of competitors in this segment. The second business area is grid information systems, a system mapping the entire grid for the grid companies. We have the majority share of the Norwegian market, but there are some large international competitors.

As opposed to other actors, we are present in several sections of this value chain, in collection of information, production and information systems. Hence we have the opportunity to combine knowledge and position ourselves with new products.

We are neutral when it comes to the choice of communication solution for AMR. It is not interesting to us. That is a part of the strength of our product; it doesn't only apply to different hardware technologies, but also on different communication technologies.

Despite the fact that Norway is not first in terms of AMR, I still think it is possible to take a position in the smart grid industry, as no one is far ahead in this market. We are conducting a large pilot in the Czech Republic for a company with 8 million customers across some countries. We are placing smart technology in 50 000 meters, and this indicates that we have an opportunity to take a strong position if we work right and determined".

7.4 Asbjørn Høivik, Lyse Energi.

Executive Vice President of Technology in Lyse Energi
Telephone interview. March 30th, 2011

Lyse is locally owned by sixteen municipalities in Rogaland. Lyse Energi is the parent company in the corporation and is responsible for taking care of ownership of wholly and partly owned subsidiaries. In addition to energy, Lyse also focuses on telecommunications, and has several wholly owned subsidiaries, including Altibox and fiber net companies (Lyse [1]). Altibox is a service provider and has an annual turnover of about one billion NOK (Høivik). Hafslund serves approximately 127 000 grid customers and 212 000 broadband customers (Lyse [2]).

Territorial concessionaires like NTE and Lyse also have infrastructural obligations, as county municipalities own these companies. They are commissioned to do business and provide development of public utility.

"EU is working on a plan for the communication technology for AMR. They are looking at the possibilities for creating a generic communication system and a generic platform with standardized interface on which all new services can be delivered. It is important to us to pay attention to this development and the drivers behind it. It is impossible for power suppliers to

> "We are not intimidated by the competition from other energy companies"
>
> *- Asbjørn Høivik*

assume responsibility for AMR from the grid companies as it is given in EU regulations.

When considering the position of the power supplier we are faced with three changes. First, there is a development towards a common Nordic end user market, in which the customers only will have contact with the power supplier and not the grid company. The grid company will become the facilitator and organizer for the new services. Second, in addition to supplying and invoicing power to the consumers, the power supplier will also be balance responsible. In the end the power supplier will be what in EU is called the aggregator, the actor accumulating the consumer flexibility and reporting this to the market. The third role of the power supplier is to be the ESCO, the Energy Service Company which provides energy savings solutions and other related services.

We are not intimidated by the competition from other energy companies. However, we do not want to expose ourselves too much towards ICT-companies, which we regard as our future competitors. We regard communication companies like Telenor our biggest competitors as we are obliged to offer an open interface on which third parties can provide solutions upon.

We can provide two thirds of all our customers in Rogaland with fiber net, directly or indirectly. Fiber is the superior solution for communication. We have already established a platform with today's four products, Internet, IP-telephony, HDTV and alarm services. So we already have an infrastructure with profitable services, and this can escalate to all kinds of possible solutions. With fiber, we have a highway with unlimited capacity in which there already is an economic foundation, and this makes us unique in our part of the world. The highway is ready, the platform is predominantly ready, and we are better prepared than many of our competitors and ready to accept the new world.

> "There is no doubt the best solution is fiber. The highway is ready and we are better prepared than many of our competitors."
>
> *- Asbjørn Høivik*

Traditionally, energy companies have not had an innovative reputation. In 2002 we embarked on gas, remote heating and broadband. I feel that Lyse is an example of a company that has done more than many comparable companies. We have people only specialized on innovation. We constantly seek to develop new products and to be innovative based on the platform we already have developed. As an example, we bought an alarm company, took over their existing customers, doubled the number and transferred the entire system to another technological platform completely superior to the prevailing. We have complete control over all sensors, so if a fire sensor is triggered, a fire truck is sent, and not a security guard. This product has been extremely successful. Our next area of focus is health. We

> are currently working on a project on health services based on this platform and we are cooperating with the university and R&D environments here in Rogaland, as well as SINTEF and the municipalities here.
>
> There is no doubt the best solution is fiber when discussing communication platform for AMR. Compared to Europe, Norway is in front. Sweden has also been progressive, but they have had another structure in the rollout of fiber."

7.5 Summary and key take-away

With four interviewees representing different layers of the Norwegian power industry, it is difficult to generalize findings. However, there are some thoughts and opinions that are common to all industry actors, and that we consider descriptive for the current power market.

It is evident that regulation and politics currently drive the AMR implementation, and that the need for controlling consumption was the initial trigger. According to Belbo, the barrier for AMR implementation is the industry itself; "the grid companies are used to a pretty predictable environment". Auset, representing Hafslund Nett, agrees that they have been somewhat reluctant, because they are waiting for financing solutions giving them incentives for embarking on AMR and smart grid. However he does not see any reason why the grid companies should not be able to meet the deadlines for AMR.

All the interviewees agree that an increased business and end user focus will be crucial in the future, and that ICT competency will be necessary. Customers will have the greatest power in the emerging market and to NTE any actor eager to take a position close to the customer is regarded a competitor. Main future competitors are hence ICT companies and software or application providers, and all of the represented companies are increasingly active in innovation activities to prepare for this partly blurry future. "Our biggest competitors are the hidden competitors. They are the ones developing business models that potentially can put us out of action" (Belbo). Both Google and Microsoft are mentioned as future rivals with potential disruptive models and services. The current power industry is in other words surrounded by great uncertainty and all the interviewees predict an upcoming redistribution of roles.

Based on valuable knowledge gained from extensive interviews, we consider further studies required in order to create a picture of how this industry will develop. The four key questions presented in our preliminary analysis are addressed in the following chapter. The first subchapter treats the forthcoming industry changes; the second discusses the different actors' exposure to market changes; the third is concerned with the market forces in the market post AMR implementation; and the fourth treats unrealized value.

8 Answering key questions

8.1 Key question I: Changes in the industry

Will the forthcoming changes in the Norwegian power industry be of a disruptive nature?

Our initial perception and preliminary conclusion that AMR will cause disruptive change in the Norwegian power industry has only been strengthened after further studies and conducted interviews. The general impression after interviewing industry representatives is that they are aware of changes altering the industry, both in terms of business models and in terms of distribution of roles. "A traditional power supplier only selling kWh will not survive the forthcoming changes" (Belbo). "I think the balance between the different actors can change; the products they offer can change and the business models can change. I think a lot can happen here (…)" (Benum). Their conviction that the entry of digital solutions will cause major changes and that new business models will be developed has triggered corporate emphasis on issues related to business development and how to handle the disruptive changes. "It is a time of upheaval. We have gone through a phase of stable environment, and organizations bear traces of this" (Belbo). Large incumbent companies used to a predictable environment are particularly exposed to disruptive change, and our impression is that the industry in general has chosen the Christensen's (1997) proactive approach, and are interested in utilizing the opportunities the changes cause, rather than defending own company against the threat.

8.2 Key question II: The different actor's exposure to changes

Who will benefit and who will suffer from a possible redistribution of responsibilities and roles in the power industry? Is such a redistribution likely to occur?

As a result of the implementation of AMR a redistribution of roles in the Norwegian power industry is predicted. Due to the disruptive characteristics of AMR and the uncertainty in the future market it is however difficult to elaborate on whom this redistribution will serve and whom it will hurt. Some responsibilities upstream the value chain are regulated by NVE, while activities closer to the end user are exposed to free market forces. We are certain that opportunities for new industry actors will emerge in this competitive retail market (see figure 8.1). In the following subchapter we will analyze the situation of the different roles in the value chain; what are their strengths, weaknesses, opportunities and threats as AMR is implemented in all households?

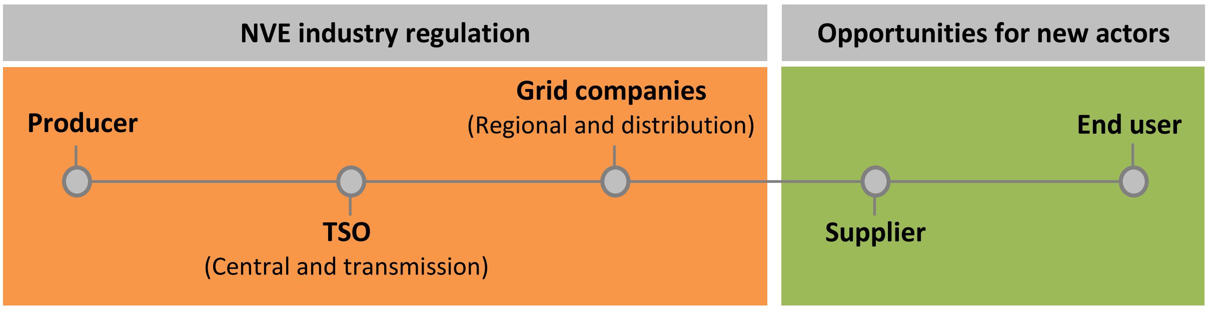


Figure 8.1: Illustration of the Norwegian electricity value chain, regulations and opportunities.

8.2.1 NVE

NVE is the regulator and premise setter for a range of changes that in different ways affect actors in the value chain. The regulatory decisions that are made may have both positive and negative consequences in the different parts of the industry. NVE is not very relevant for this form of analysis due to the nature of its business operations. As a market player they have no competitors, no superior power and hence in principle no opportunities nor threats. However, we do believe that NVE should prepare for a social pressure of greater magnitude than previously experienced if they do not modify their existing demands for subscription models. Grid companies offering reduced network tariffs in exchange for consumer flexibility is an example of such socio-economically beneficial subscriptions that NVE is currently preventing (see Pilot project profile: Market Based Demand Response at Malvik Everk).

Strengths	The upper authority in the Norwegian electrical power industry.
Weaknesses	Conservative, tradition based and old fashioned.
Opportunities	Allow new business models and thus be perceived as more open to innovation and creative thinking.
Threats	Media pressure due to the lack of willingness for new subscription and business models.

8.2.2 Producer

As our preliminary study (Platou and Sleire, 2010) unveiled, power producers in Norway are in a very fortunate, profitable and stable position. AMR in the simplest form will not have a great impact on the producers' situation in the market, but we do believe that they may experience small changes as AMR further develops. With increased distributed production (DP) in the distribution grid demand from large producers may decrease. For the producers of renewable sources such as wind and solar, business potential will increase as these energy sources more easily can be integrated in the grid. The producers already involved with solar and wind power will hence see opportunities in the aftermarket, while the large hydropower producers should prepare for increased competition from local production fed into the grid.

Strengths	Safe, stable and profitable position in the market. Political support.
Weaknesses	Restricted freedom of action due to local or central government ownership.
Opportunities	Increase renewable energy production as this more easily can be integrated in the grid.
Threats	Increased distributed production in the grid means increased competition.

8.2.3 TSO and grid companies

This kind of analysis is less applicable also to grid owners due to the monopoly they operate in. The monopolistic business environment is considered both a strength and a weakness to these companies. They have no competitors, but they are strictly regulated through income caps set by NVE. As the main stakeholder of the AMR infrastructure they own the consumption data from all end users, and we see a great opportunity related to the value of this information. There is also an opportunity in improving the various grid companies' image, and we suggest that the monopolists present AMR to the society from a view favorable to them, and thus establish some goodwill with the end user. Market players within fiber grid infrastructure will be the grid companies' biggest threat as speed is the main issue for this activity. The first company to lay fiber in the ground will be the main concessionaire in the given area. Regarding the future business potential of owning these fiber grids we heavily weight this threat.

Strengths	Monopoly. Reduced O&M costs due to smarter grids. Own the consumption data.
Weaknesses	Income cap regulation. Restricted freedom of action due to regulation. Extensive investment costs as a result of AMR infrastructure. To some extent a bad reputation.
Opportunities	Improved goodwill with the end customer. Subsidizing AMR and its functionality. Income potential due to valuable end user information.
Threats	Fast moving fiber grid concessionaires.

8.2.4 Supplier

Suppliers operate in a free competitive market and their main strength is the existing customer base. Because the number of end users changing supplier still is relatively low, we take this as a sign that customer loyalty (conscious or unconscious) is high. There are few suppliers today that offer services or products beyond power sales and we consider this concentration a weakness in the competition against new actors with a wider market perspective. The existing suppliers are the market players we expect will experience the most serious threats in the AMR aftermarket. They have the opportunity to offer new products and to expand their customer base, but we believe the magnitude of the threats may exceed the potential upside of the opportunities. There will be an increased pressure on retail prices due to the common Nordic end user market, energy efficiency may reduce sales and new actors with extensive ICT knowledge will enter the industry.

Strengths	Existing customer relations. Customer loyalty to some extent.
Weaknesses	Narrow market focus, purely power retail. Lack of extensive ICT knowledge. Low margins.
Opportunities	New strategic products. Expand customer base through common Nordic end user market.
Threats	Increased price pressure due to common Nordic end user market and increased customer consciousness. Third party service providers with innovative strategies. Energy efficiency and local production may reduce sales.

8.2.5 New actors

We are certain that there will be new entrants to the industry and that these actors will redefine existing market dynamics. These companies and service providers will experience the greatest opportunities, and fewer threats as they enter the industry on their own terms. Their strengths are ICT and innovative skills, as well as their ability to move fast. They have the opportunity to offer unexpected products and to introduce disruptive business and payment models. The main threats to these new entrants are other new comparable entrants, as well as the risk of NVE introducing new regulations in this end of the value chain.

Strengths	ICT knowledge. Innovation, flexibility and speed. Possible existing customers from other industries.
Weaknesses	Unknown brand in the electricity market.
Opportunities	Taking the customer oriented role. Unexpected products and services. Application (“apps”) market. New payment models.
Threats	The existing suppliers’ customer relations. Competitors with similar background and strategy. Possible new NVE regulations.

8.2.6 End user

For the end user the key words are information and education. The end user will become more powerful as he becomes more aware of his electricity consumption. When the common Nordic retail market is realized the consumer further increases its power by being able to freely choose among suppliers from all the Nordic countries. The main weakness is the end user's dependence on electricity, slightly reducing their market power. The consumers' opportunities are infinite if AMR is realized to its full potential, with open communication platform and room for additional service applications. The threat in this case will be unsecured data storage and insufficient privacy protection. There is also a risk that the consumer's electricity bill will increase if the household does not change or shift its load; new payment models can motivate end users to shift load to off-peak hours by making the electricity cheaper in this period, or they may keep the off-peak prices constant and instead increase the price of peak hour load. For the latter the consumer is required to change its behavior to avoid an increased bill.

Strengths	Consumer power. Consciousness and information about consumption. Correct billing. The right to choose supplier from a common Nordic retail market.
Weaknesses	Vulnerable due to the dependence on electricity.
Opportunities	Controlling consumption through a digital brain in the house. A simpler life if all digital services are concentrated on one platform. Reduced network tariff by selling consumer flexibility. More sophisticated technological competence.
Threats	Insufficient privacy protection and data storage. May be punished for peak hour consumption, as opposed to rewarded for consumption in off-peak periods.

8.2.7 Summary: The power supplier's position is threatened by new entrants to the industry

After examining the different roles in the industry it is evident to us that the supplier is the most exposed player in the Norwegian electricity market after the implementation of AMR. This is partly due to a narrow market focus, in an industry layer with low margins, and mainly due to increased competition. Their margins will further confine when competition grows fiercer, and new entrants will contribute to a disruptive change in the market. Suppliers need to take advantage of its existing strengths to meet these imminent threats, by strengthening customer relations and thus further increase customer loyalty. They must have a clear and articulated strategy before the common Nordic retail market is realized to be able to keep its existing customers and attract new. By seizing the opportunities in the aftermarket and introduce new products they may be able to diminish their weaknesses and hence appear as a stronger competitor to the new market players.

The situation that producers and grid companies encounter we believe will be more manageable, as long as they are aware of its strengths, weaknesses, opportunities and threats. Producers are relatively distant from the retail market and are likely to remain profitable and unchanged. They should however be aware of the possible threat of local production and possibly engage further in renewable energy as this more easily can be included in the grid. As for grid companies they should take advantage of their experience within networks and grid operations to counter the threat of fiber grid concessionaires. By establishing goodwill with the end user through AMR subsidizing or subscriptions with reduced network tariffs the grid companies will improve their image and hence reduce their weaknesses.

As mentioned in the preliminary analysis new entrants will not experience the disruptive market changes that existing market players encounter. To new players AMR may be considered an incremental innovation and this is their main opportunity. This clear advantage is also the reason why we do not see grave threats for new entrants. By always being a step ahead of the existing market players the new players will obtain first mover advantages that will overshadow their weaknesses. Comparable competitors with similar advantages do however constitute a threat to new entrants. Within a few years after full AMR implementation we expect to see an industry shake-out and a consolidation of the market, and to win this race new entrants must take advantage of their strengths; innovation skills, flexibility and speed.

From the above analysis we conclude that a redistribution of roles in the electrical power market is probable, but it greatly depends on NVE regulations. It is likely to believe that new entrants will assume customer responsibility from existing suppliers, and that the pure retail role is in danger of extinction. Today's suppliers should prepare for fierce competition and disruptive business models in the aftermarket of AMR. We see great potential opportunities for new entrants – third party service providers and ICT companies – but also these actors must prepare for a competitive environment where their innovative skills will be challenged.

8.3 Key question III: Market forces post AMR implementation

Which are the most important market forces and what is their strength and direction?

As discussed in the preliminary analysis, the power industry has some characteristics making it vulnerable to disruptive change, possibly caused by ICT-companies. As these inevitable market changes occur a new industry of digital solutions and third party service providers will emerge. Any industry is normally affected by five market forces, consisting of new market entrants, product or service substitutes, suppliers[14], customers and a competitive internal industry force. How will the competitive landscape look in this new industry, and which market actors will possess the greatest power? Below we will analyze the different market forces and the power they represent in *the emerging industry of digital solutions and add-on services to the AMR infrastructure*. The result is summarized in figure 7.2.

8.3.1 Analysis of market forces and their magnitude

New entrants. A sophisticated AMR will open the door to the power industry for both existing and new ICT-companies. Barriers to enter the market are low due to low or negligible initial costs. The only requirement is a minimum of ICT knowledge and a new business model or good idea for an application to AMR, given a sophisticated AMR and platform. None of these features require extensive financial resources. Before the eventual industry shake-out and market consolidation we therefore expect a range of new entrants of varying success. New entrants represent significant market power.

Substitutes. There are no substitutes to the actual electricity product, but there exists substitutes to the additional services connected to the product. For instance, one service might provide the end user with the ability to control electrical appliances and systems in the household from his or her cell phone. A substitute will thus be a web based solution, requiring a PC rather than a cell phone. Other substitutes are today's solutions of manually controlling it yourself or have your neighbor to do it if you are away from home. Still, there will be services superior enough to almost eliminate the threat of existing substitutes. As solutions become more integrated and we see new market dynamics, there will be an increased complexity in the solutions offered. Substitutes is a relevant market force.

Suppliers. In a service based market suppliers have little power. The service providers will be self-supplied and are hence only dependent on internal resources, innovation and knowledge. If regarding suppliers as the actual content providers for digital solutions and applications they still have limited power, as these systems mostly are off-the-shelf products or easily replicated programs comparable to solutions in other markets. Suppliers have limited market power.

Customers. In a customer oriented and service based market end user adoption is crucial for success. With low entry barriers there will be a range of service providers to choose from and the customer hence possesses great power. The industry players may consider introducing subscription models with high switching costs or lock-in effects which will reduce customer power. As market dynamics are yet unknown we regard the customer as superior in this industry. The end customer is *the most powerful actor* in the new industry and the determinant for how the industry will develop, and hence represents the strongest market force.

[14] Note that the term "supplier" in this chapter refers to any supplier in the emerging industry, and is not necessarily equivalent to the power suppliers mentioned elsewhere in the paper.

Industry rivalry. As a result of the above we consider this industry to have a considerable internal rivalry. The market will be dynamic, characterized by innovation and high velocity; there will be a constant race towards building the most sizeable customer base, providing the best solutions and maintaining the best customer relations. We predict fierce rivalry up to the expected industry shake-out when services will become more standardized and the market may consolidate. Internal rivalry is a considerable market force.

8.3.2 Summary: The customer is the most powerful actor

As the above figure illustrates, customers and new entrants have the greatest power in the aftermarket of AMR and hence customer relations and innovative thinking stand out as the most important competencies for potential industry actors. As a result, business models that differentiate your company from your competitors, or lock in your customer would be strategies worth considering. Particularly early movers in this industry should establish subscription models with high switching costs for the customer to secure a loyal and growing customer base with limited power. To overcome the threat of industry rivalry speed is of great significance and we recommend moving first – or at least early – to start building a brand in the industry and position your company for first mover advantages.

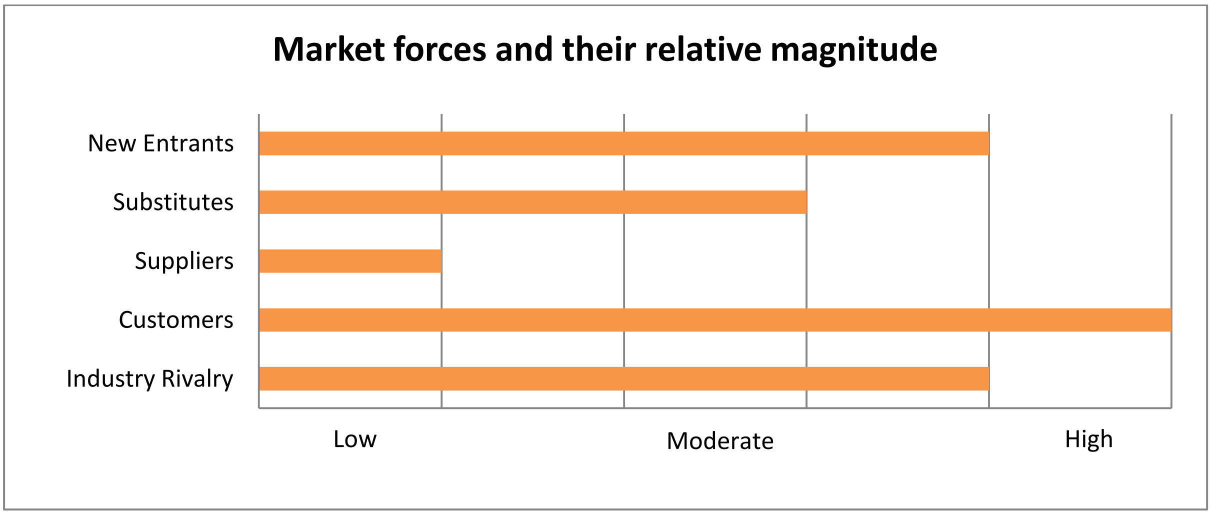


Figure 8.2: Market forces and their relative magnitude

8.4 Key question IV: Central factors for value for business development

What is of unrealized value in the power industry today, and what can be sources of value in the future? To whom is this valuable?

We consider identification of unrealized value crucial in order to predict future feasible business models. Value is a fundamental factor for a business model. Hence *unrealized value* represents an opportunity for new business models. In order to address the last key question stated in the preliminary analysis, we will in the following present aspects with unrealized value, and to whom this is valuable and represents opportunities.

> "A business model describes the rationale of how an organization creates, delivers, and captures value."
>
> *- Alex Osterwalder*

8.4.1 Sources of unrealized value

End customer relations. As the end customer is becoming increasingly powerful in the market post AMR, a position close to the customer can be of great value. Access to customer information, control of certain communication channels and an established customer relationship are all valuable factors in a changing environment. Today, the customer relates to both the supplier and the grid company[15]. Traditionally, and today, no company has a position very close to the customer. Being the prime contact point for the customer can be valuable when new business models are developed, and information is necessary in order to make the customers adapt the innovations. The actor positioned close to the customer can control some direct communication channels that provides customers with information. Both grid companies and third party service providers can capitalize on this relation.

End customer flexibility. A certain share of household electricity consumption does not affect end customers' comfort levels and represents a valueless pure cost to the customer. Household electricity consumption can hence become more lean and efficient by reducing this share. This share indicates the *end customer flexibility*, the amount of electricity customers can give up without compromising their comfort levels. This flexibility is possessed by the end customer but is also valuable to grid companies interested in controlling load and reducing peak loads. Power suppliers only have incentives for getting access to flexibility if the cost of placing too small bids on NordPool exceeds the lost revenue of customers reducing consumption. Additionally, the multitude of end customer flexibility has a socio-economic value for the country as a whole in terms of the energy savings potential. Releasing this flexibility is done through giving grid companies access to controlling certain household appliances driving excess consumption[16]. End customers can sell flexibility in exchange for a reward by giving up complete control and give external parties access to controlling a share of their consumption. The combination of accessible technology and increasingly demanding and conscious customers can accelerate solutions based on utilizing this flexibility.

Information and metering data. Implementation of AMR and two-way communication enables collection of infinite amount of data and information about household consumption and consumption patterns. Information about when electricity is consumed, to which appliances, and about the customer can have commercial value when developing new

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[15] In the case of one corporation comprising both the grid company and supplier, this does not necessarily apply.

[16] SINTEF and Malvik Electric Utility conducted a successful pilot on this between 2006 and 2008, but NVE did not approve further implementation beyond the test period (SINTEF [2]).

Pilot project profile: Market Based Demand Response at Malvik Everk

Between 2005 and 2008 SINTEF Energy Research conducted a research project called Market Based Demand Response (MBDR) on behalf of Statnett (TSO). The main goal of the project was to "stimulate to increased marked demand side flexibility and thereby contribute to a more efficient power market"[17]. The project comprised several pilot tests and the one regarding AMR was carried out at the DSO Malvik Everk as their household customers already had two-way communication (Grande, Sæle and Graabak, 2008).

The grid company collected the customer's consumption data every hour and even got access to remotely control the customer's water heaters. The grid company could then disconnect power to the water heater during daily peak load (and price) hours without affecting the customers' comfort. The customers also got time-of-day network tariff which gave them incentives for load shifting and reducing consumption during peak hours. The customers were also equipped with a simple token illustrating the peak hours in order to remind the customers to reduce consumption during these hours (Grande, Sæle and Graabak, 2008).

The project resulted in significant reduction in consumption during peak hours, also due to customer initiatives. Both stakeholders and customers were satisfied with the project and the outcome. The accumulated potential related to this type of control is significant (SINTEF [1]). However, the Norwegian Water Resources and Energy Directorate (NVE) did not approve Malvik Everk's request for continuing the new grid tariff (SINTEF [2]).

[17] Grande, Ove S., Hanne Sæle and Ingeborg Graabak (2008), "Market Based Demand Response Research Project summary", SINTEF Energy Research, p. 4.

business models. Current guidelines suggest that this data and information belong to the grid company, and hence the grid companies possess significant amounts of valuable data. Access to this information can trigger the development of new business models. Information about the customers' patterns of behavior is valuable as such knowledge enables development of services directly aimed at certain customer segments. How this information will be utilized is still unclear, but the information is valuable to grid companies, the end customer and third party service providers. However, to which extent this information has commercial value depends on current legislation on privacy protection.

8.4.2 Summary: Value is found in customer relations, customer flexibility and information and metering data

We have identified three valuable factors in this supply chain; relations to end customers, end customer flexibility and information and metering data. Common to all factors are that they are end customer oriented. The new key player in this industry is the end customers and we predict that he will be the focal point for new business model generation and the most significant determinant for the future trajectory of development in this industry.

After analyzing today's power industry we see a transition towards a more customer oriented market in which the suppliers and service providers seem prepared to serve an increasingly demanding customer base. Two-way communication with the grid company through AMR provides the customer with information and facilitates customer participation. The end customer will be the determinant for the adoption of new solutions and for the success of new business models. Customer relations is hence an important source of currently untapped value in the industry. In the following chapter we will analyze our findings in light of presented theory, and in that way be more qualified to provide our strategic recommendations to the reader.

9 Further analysis in light of presented theory

After collecting additional and qualitative data about the industry and important players' view of the future, we have answered the four key questions of our thesis; we considered upcoming industry changes; different roles and their current position; the future market forces and we have identified unrealized value in the value chain.

Findings from key question I. The industry will face a disruptive change as a result of the implementation of AMR.

Findings from key question II. A redistribution of roles in the electrical power market is probable, although it depends on NVE regulations. There exists opportunities for new entrants to assume customer responsibility from existing suppliers, and today's suppliers should prepare for fierce competition and disruptive business models in the aftermarket of AMR.

Findings from key question III. We see a transition towards a more customer oriented market as the customer possesses the greatest power in the aftermarket of AMR. However, switching costs and forced customer loyalty will reduce the customer's power and enforce the power suppliers' position. The end customer will be the determinant for the adoption of new solutions and for the success of new business models.

Findings from key question IV. Three valuable factors have been identified; relations to end customers, end customer flexibility, and information and metering data. We predict that the customer will be the focal point for new business model generation and the most significant determinant for the future trajectory of development in this industry.

Before presenting our overall results we want to view our findings in light of the presented theory in chapter 3. When looking to our preliminary analysis, some of our initial beliefs were confirmed when working closer with the industry.

9.1 Innovation opportunities

According to Porter (1990) innovations create competitive advantage when you (i) perceive a new market opportunity or when you (ii) serve a market segment others have ignored. This can be done through transferring your innovations into new markets. To the development of AMR and its aftermarket, this particular aspect of the innovation process becomes very relevant. We have found that ICT competencies will be crucial in the new industry and that new entrants are likely to possess these skills. The required technology is known, but not yet applied to the Norwegian power market. Innovative business models based on this technology can therefore create competitive advantage. In the preliminary analysis we anticipated that new entrants would have advantages in the emerging industry due to these innovation opportunities, and this was confirmed when addressing key question III. In line with Porter's literature innovative new entrants and ICT companies can obtain a competitive advantage in the power market by (i) *serving this new market opportunity*. In chapter 8.4 we found that customer relations, end user flexibility and metering data were three unrealized valuable features of the emerging market. All of these three categories represent (ii) *markets not yet served by existing market actors*, which is another innovation opportunity providing competitive advantage.

Companies are more likely to stifle innovations when the potential innovation involves expertise from different industries or knowledge of different technologies (Kanter, 2006). The existing market players, and power suppliers in specific, are in a vulnerable position in the aftermarket of AMR because they lack sufficient ICT skills and they are used to operating in a static business environment (see chapter 8.2). According to Leifer et al. (2000) radical innovations restructure marketplace economics and displace current products. We believe that when new players enter the market there may be a redistribution of roles in the industry as the new business models potentially will be of a radical nature. We suggested a similar outcome in our preliminary analysis and after studying the industry closer and conducting the interviews we are more confident that AMR implementation *will* facilitate radical innovations and that suppliers currently represent the most vulnerable industry role. This is supported both by Kanter's literature on innovations requiring expertise from new industries and by Leifer et al.'s view on radical innovations and market restructuring.

9.2 Disruptive change

The entry of new technology which solves customer needs in new ways can result in a disruptive change in accordance with Christensen's (1997) theory. As stated in the preliminary analysis (chapter 6), AMR and additional digital solutions can fulfill existing customer needs in a simpler, cheaper and more convenient way and hence arrange for a disruptive change in this industry. The disruptive change is typically caused by small, innovative and flexible companies.

In our previous analyses of roles and market forces we predict that flexibility and innovative skills are of great future value and that these qualities are door openers for new entrants to this changing industry. The Norwegian power industry is facing changes, and Christensen (1997) states that innovative and flexible companies are better at both exploring new innovations and adapting to new situations.

In our analysis of the different actors' exposure to changes (chapter 8.2) we predict a shift in market power, a shift in valuable characteristics and a shift in competitive advantage. Christensen (1997) states that competitive companies spotting disruptive change in time can choose between defending the company against the threat or to utilize the new market opportunities. Based on the interviews (chapter 7), we conclude that the competitive part of the industry is aware of the potential disruptive change, and that they are interested in utilizing the new market opportunities, but that uncertainty about the future is their main challenge.

AMR has the disruptive characteristics previously mentioned, and according to theory, the cyclic pace for improvements follows implementation. Partly because of simple initial characteristics, incumbent firms tend to underestimate the potential in disruptive technologies. We consider this a potential trap for the companies choosing to utilize the new market opportunities following AMR. Due to uncertainty about the future, market scope and coming business models, we believe it is easy to underestimate the importance of developing a system today which is sufficiently sophisticated to handle future opportunities.

9.3 Market entry strategies

Lieberman and Montgomery (1988) state that there are three ways to achieve first-mover advantages; through leadership in product and process technology; through the preemption of assets; or through development of buyer switching costs. In an industry such as the power industry post AMR implementation we believe that the most relevant category out of the three is *buyer switching costs* because customer relations will be a decisive success factor. In our analysis of market forces we therefore suggested that subscription models resulting in switching costs for the customer would be preferable, as it partly reduces the customer's power and it enforces the power supplier's position. Customer switching costs will also compel customer loyalty. Current power suppliers need to prepare for the entry of new players who might assume all customer responsibility.

To further evaluate market entry strategies we need to differ between today's power suppliers and the future power suppliers – which may be the same as the current or they may be represented by new innovative market players with greater ICT skills. In our preliminary analysis we predicted that the future business models in the power industry will be of a radical or disruptive character. This prediction has been further confirmed during our analysis process. To the existing power suppliers these new business models may alter current business environment and customer relations, while for the new entrants these business models may already be known and perceived as common. Especially if we imagine future business models similar to those we see in today's communication and mobile phone industry, the ICT companies may have great advantages as these models are familiar to them. In line with Min et al.'s (2006) study of pioneer positions versus fast second positions, power suppliers would benefit from moving second, and new entrants will benefit from moving fast and hence obtain first mover advantages.

Table 9.1: Translated survival rates for business models

Translated survival rates	Incremental business models	Radical business models
First mover	High	Low
Fast second mover	Medium	Medium

The challenge is however to successfully commercialize ideas and new business models. When looking to Markides and Geroski's literature (2005) the new entrants are likely to be *colonizing* the markets, but there is still an opportunity for the existing power suppliers to be the *market consolidator*. Markides claims that the competencies required for these sets of activities – colonizing and consolidating – are conflicting, but we see that some possible new entrants are in the fortunate position where they possess both abilities. We believe that large, established ICT companies (e.g. Telenor or Microsoft) both have the innovative skills required to move first, and the experience and resources to consolidate markets. As concluded in chapter 8.2 these kinds of companies constitute a great threat to the current power suppliers.

In the Norwegian power industry power suppliers will qualify as *internal* companies, and new entrants as *external* companies from Claude-Gaudillat and Quélin's theory (2006). According to this literature it will be beneficial for existing power suppliers to (i) develop ICT competency internally, (ii) building partnerships with other firms, or (iii) to access ICT competency through market transactions. In this case the resources required are soft – ICT knowledge, innovative skills and customer service skills – and *alliances*, as opposed to acquisitions, will therefore be the best way for existing power suppliers to gain access to these new resources. By allying with a flexible and innovative ICT company the existing power suppliers suddenly have the same prerequisites for success as the threatening large ICT companies previously mentioned. The emerging industry is greatly surrounded by uncertainty, and strategic alliances are therefore further supported by Dyer, Kale and Singh (2004) as they diversify risk to a greater extent than acquisitions do.

9.4 Diffusion: Adoption or rejection

There are four main elements in the process of diffusion according to Rogers (2003). In the case of implementation of AMR and additional digital solutions, we can regard these as the first element; the *innovation*. Besides *communication channels* and the *time dimension*, the *social system* is the fourth. In our preliminary analysis (chapter 6) we stated that the social system when implementing AMR comprises all Norwegian households.

When analyzing market forces in the emerging industry following AMR (chapter 8.3) we concluded on the significant power of the end customer and his role as the determinant for adoption of new solutions and for the success of new business models. Walker et al. (2002)

stresses the importance of balancing the companies' desires with the customers' willingness to adopt the solutions. From our interviews we got the impression that the existing industry players are aware of this importance and that they wish to improve their performance on this issue. We hence regard mapping the customers' behavior and willingness to adopt new solutions to be of great value when developing new solutions.

Today, end customers have little or no knowledge of the forthcoming changes and innovations. Rogers (2003) suggests that this can trigger uncertainty which in turn motivates the customers to seek information. As diffusion is a social process, being the credible informative link to the customer is a valuable position. Once again we see the value of being close to the end user in the increasingly customer oriented industry. This actor can easier control communication channels and tailor information and solutions to the customer's desires.

The decision to implement AMR is an authority innovation-decision (see chapter 3.4.2) which in general experience fast rate of adoption. In the case of AMR, this authority innovation-decision enables additional digital solutions and add-on services we can regard collective and optional innovation-decisions. However, these latter decisions are contingent; they are dependent on the decision to implement the AMR and the AMR platform. The authority innovation-decision of implementing AMR in all households creates a fundament for a larger market with an extensive customer base.

In the following chapter, we will present our results through assessing three different scenarios for the relationship between grid companies, power suppliers, third party service providers and end customers. Different business models apply to each of the three scenarios, and based on the conducted analyses of current roles, future power distribution and unrealized value, we will illustrate some possible future market scenarios, business models and solutions we can envision feasible.

RESULTS AND CONCLUSION

10 Results

From our analysis we found that the industry is facing disruptive changes, and especially existing power suppliers need to secure their position in the market. After identifying unrealized value, it is evident that a range of business opportunities will emerge in the aftermarket of AMR and the key competencies for attaining these opportunities are ICT knowledge and innovative operations. Last, we are certain that the end customer will become the most powerful player in the industry. Preparing for the future by envisioning possible models for customer relations will hence be of great importance.

In this chapter we will discuss possible ways for utilizing the identified sources of unrealized value from a business perspective. How can companies utilize end user information and metering data? What kind of business models may be feasible for employing end user flexibility? Further we will assess different future scenarios for customer relations. In these scenarios we will take our above findings into consideration, and look at the interplay between grid companies, power suppliers, third party service providers and end customers. Before embarking on the presentation of possible solutions, we will list some assumptions on which these scenarios are based.

10.1 Conditions for further analysis of future business models

In the following design of possible scenarios and business models in the wake of AMR implementation we rely on certain assumptions. The assumptions are listed and discussed below.

We assume that the future power market model will be a supplier centric model.

As previously mentioned, the supplier centric model is a likely outcome of the common Nordic end user market (see 4.3.3). In this model, the end customer will only have a single contact point (supplier) as opposed to today's dual model (supplier and grid company). Both Belbo (7.1) and Auset (7.2) support the understanding of the supplier centric model as the preferred option in the implementation plan of the common Nordic end user market.

We assume an open standardized IP-based communication platform provided by the monopolistic local grid company on which power suppliers and third party service providers can add solutions.

In the interaction with the end customer there are three levels of technological solutions. The ground level is the AMR platform the grid company (DSO) is required to serve its customers due to governmental regulations. The customer can relate to one or more providers of power and additional solutions and also choose from a range of content providers. Applying Rogers' (2003) theory on types of innovation decisions, it becomes clear that the AMR platform is an authority innovation-decision. The customer's choice of power suppliers and service providers is an example of a collective decision in which the customer has a say in the decision, whereas the choice of content providers is an example of optional innovation decisions.

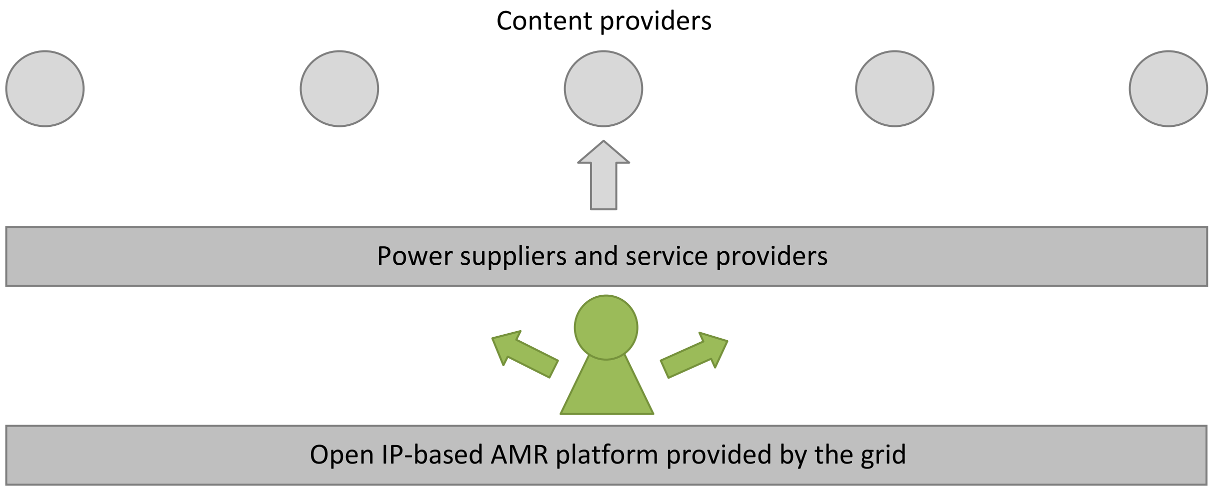

Figure 9.1: Technological solutions and customer relations

The development of sophisticated communication platforms has begun, and according to Belbo (7.1), several companies have already developed such a platform. According to Høivik (7.4), Lyse has already developed a platform for providing today's services. Høivik also referred to EU's initiative towards a generic platform with standardized interface on which all new services can be delivered. According to NVE's consultative paper of February 2011 (see NVE consultative paper on AMR, February 2011), the grid companies are obliged to arrange the AMR functionality for third party service providers. The AMR shall facilitate a range of new end customer services and other service providers shall have access to communication over AMR (NVE [4]).

We assume that every household will have a sophisticated AMR attached to a platform synchronized with all the customers' accessible screens like smart phone, TV, iPad etc., in line with the illustration below within foreseeable future.

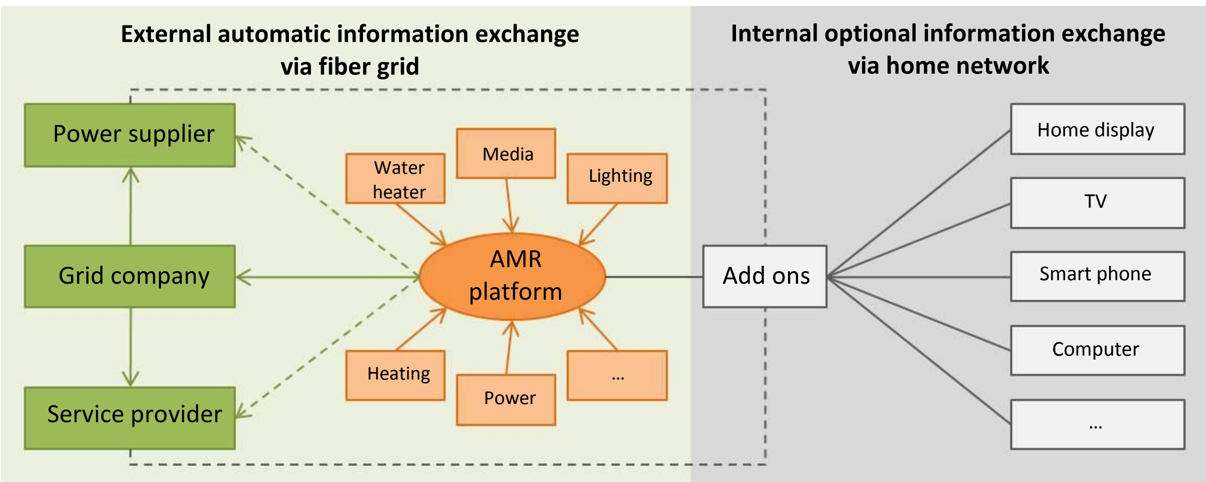

Figure 9.2: AMR communication system

Customers have the right to get AMR with display. In the consultative paper, NVE also suggests that the end customer is responsible for carrying the cost of display as well as the cost of the communication module between AMR and display. Grid companies are required to impart tariff information, and power suppliers are required to impart pricing information to this display (NVE [4]). Implementation of AMR in Norway has been shown high priority from the Ministry of Petroleum and Energy (Regjeringen [1]).

10.2 Add-ons based on accessible information and metering data

A new AMR platform allows for uniting several standardized and customized digital household services. Today these services comprise for example internet, TV, telephony and alarm services. But we can imagine an almost unlimited growth of new solutions. We will here consider possible solutions for utilizing the unrealized value found in access to end customer information and metering data, as presented in 8.4. We assume that all customer information sent to the grid company also is accessible to the customer on his household display and on all his other screens like smart phone, TV, computers etc.

10.2.1 The AMR as the center of customer information

The AMR will be the center of information about the customer's consumption and his metering data. Every end customer's consumption will be measured at least every hour. One can thus develop patterns for consumption and possibly link these patterns to for example geographical and demographical factors. Dependent on the sophistication of the AMR it can possibly also register the activity level in different rooms and which appliance consuming power at what time. This base of extensive information constitutes the fundament for creating valuable customer specific add-ons tailored for certain segments.

10.2.2 The AMR platform as a fundament for new solutions

The open IP-based AMR platform provided by the grid company can arrange for several other services, both existing and prospective. The add-ons based on accessible information and metering data represent a subset of all possible solutions which rely on this generic platform. We can imagine these solutions being developed by service providers already utilizing the AMR platform, but also by external actors using this information as a gateway to this industry. These add-ons are tailored for use on the AMR platform. The growth of the add-on market is dependent on an accessible platform and that metering data is made accessible for all interested parties, independent of whether the information is accessible from the AMR directly via an outlet or indirectly via the grid company. We can also envision the growth of a market of applications similar to what we see for iPhone today. Applications are simpler downloadable services with high degree of customization, and the customer can easily and freely choose his services and buy them online without further contact with a supplier.

10.2.3 Examples of add-ons

Add-ons we can envision comprise information about current and historical consumption sent to all accessible screens; remote control of household settings like lighting, heating, air quality or music; alert services about power prices and consumption etc. The opportunities are infinite. Intelligent solutions can for example automatically reduce temperature and lighting in some rooms when registering high activity in others; or tailored services and marketing on the customer's screens based on which room they are in. Power consumption in similar households can be compared, and power suppliers can create different power subscriptions with different pricing models tailored for different consumption patterns and quantities.

10.2.4 Summary: Accessibility determines the scope of the opportunities

The AMR platform facilitates access to customer information which is already identified as an unrealized value in this value chain (see chapter 8.4). The combination of frequent measures and information exchange serves as a base for developing intelligent household services, but also customized applications. We see great opportunities for business model innovation and unique customer relations in this market, but the market growth depends on to what extent metering data are made accessible to all interested parties.

10.3 Flexibility

End customer flexibility is an unrealized gold mine, and it remains to find feasible business models for utilizing this value. The end customer is the actor possessing the asset, and power suppliers and local and central grid companies can have incentives for accessing this flexibility. Selling end customer flexibility is equivalent to the end customer selling access to controlling power consumption from certain household appliances in exchange for a reward. This results in four different models depending on which actor is buying the flexibility from the end customer.

10.3.1 The end customer sells flexibility directly to his local grid company

The local grid company can reward the customer for example through reduced network tariff or by subsidizing a sophisticated AMR which arranges for a range of present and future add-ons which will benefit the customer. If the grid companies can charge royalties from third parties for utilizing their communication platform, this can imply additional future benefits. The flexibility is valuable to the grid company as it can contribute to reducing peak loads and increase grid capacity.

10.3.2 The end customer sells flexibility directly to a power supplier

The power supplier can reward the customer by for example a lower invoice. Different models for invoicing can be developed, for example bulk purchase in advance with the right to return excess capacity. However, the value of the flexibility for power suppliers depends on their costs related to inaccuracy in power bidding at NordPool. Buying end user flexibility will only be beneficial to the power supplier if the aggregated consumption reduction constitute a lower cost than the fees associated with having to increase their power demand at NordPool on a short notice. This is in line with the opportunities for power suppliers identified in the exposure analysis (chapter 8.2).

10.3.3 The end customer sells flexibility directly to the central grid company

The central grid company can reward the customer for example by subsidizing a part of their network tariff to their local grid company. The central grid company has socio-economic incentives and can utilize scale advantages from the multitude of households releasing flexibility on a national level. This can slow down the need for building grid infrastructure and hence bring economic gains. Today, however, NVE is not allowing the TSO to trade power and is thereby impeding this model.

10.3.4 The end customer sells flexibility directly to an intermediary for resale to power suppliers or grid companies.

New business models can develop in the interface between the end customer and the above listed actors. New actors can enter and profit on distributing end customer flexibility to grid companies and power suppliers. Also this model is difficult to execute in today's market due to regulations and restrictions.

10.3.5 Summary: Socio-economic business potential, but impeded by NVE

From the four models listed above, it is evident that there is both an unrealized business potential and a socio-economic effect associated with utilizing end customer flexibility. However, NVE is impeding the process by prohibiting grid companies to trade power and refusing creative subscription models. The industry is undergoing a transformation and regulations are partly lagging behind in the process.

10.4 Scenario for customer relations in the power retail market

Customer relations will become a crucial success factor in the power retail market after the implementation of AMR. We consider this as one of the most valuable activities for players in the industry, but how can this currently unrealized value be tapped and utilized? In the following subchapters three scenarios for customer relations – the way customers relate to power supplier and service providers – will be presented, illustrated and exemplified. It is important to keep in mind our previously presented assumptions for the future market. The presented scenarios are somewhat theoretical, and it is likely that they will be adjusted to more feasible business models if implemented.

10.4.1 Scenario 1: Fully separated activities

The first scenario is comparable to today's situation and represents a market where AMR is implemented in its simplest form. The household has one power supplier and one or more content providers independent of the power supplier. These content providers may deliver internet, telephony, television, alarm services, etc.

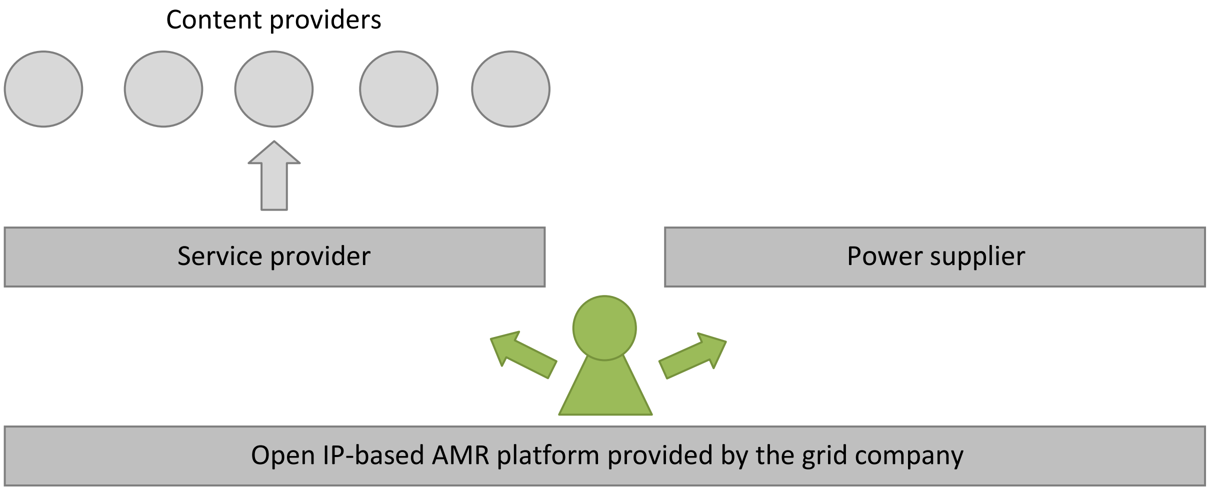

Figure 9.3: Customer relations scenario 1

Invoicing	The customer receives at least two bills; one from the power supplier and one for each additional service provider.
Business potential	Retail margins will decrease in the future common Nordic end user market and from chapter 8.2, we concluded that power suppliers will benefit from widening their business area from retail solely. There is great profit potential in the additional service market but in this scenario the power suppliers are excluded from these activities.
Customer relation	To the customer this model is clear and common. The customer relation is similar to the relations we see today, and the power supplier thus face very few changes in their customer interactions.
Practical example	The customer chooses Ustekveikja Energi as his power supplier and Get as service content provider – a subscription including broadband, digital TV and telephony. The two industry actors are

	independent of each other.

10.4.2 Scenario 2: Concentrated activity bundling

In the second scenario we imagine a concentrated bundling of activities and services, illustrated with an extreme form of supplier centric model. In scenario 2a the power supplier assumes responsibility of all the end user's digital services and forms alliances with content providers. In scenario 2b a service provider will be the customer point, and power retail will be a part of the content. All services will be bundled and available through the AMR platform. The household relates only to one industry player.

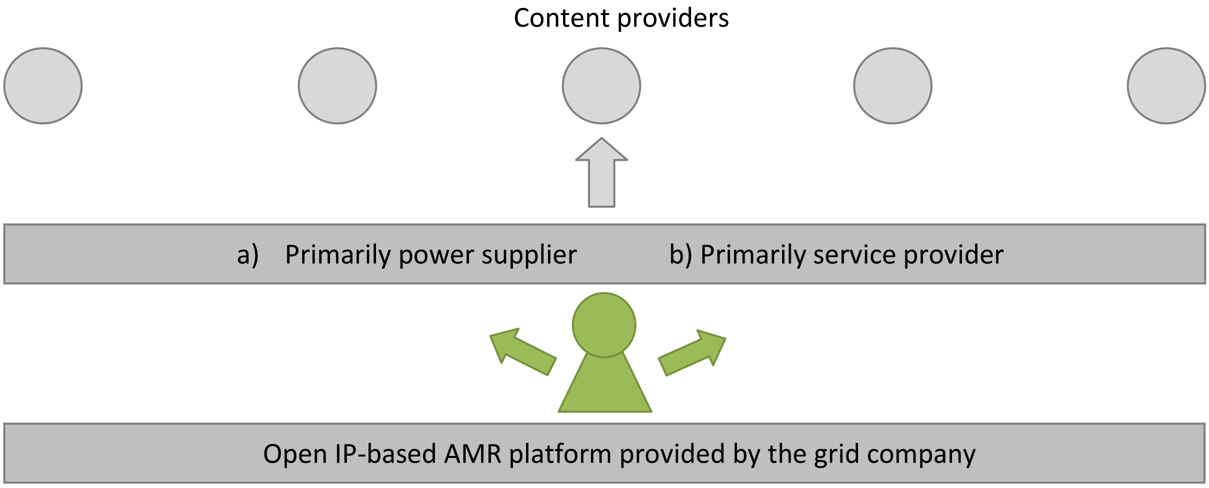

Figure 9.4: Customer relations scenario 2

Invoicing	The customer receives one common and specified bill
Business potential	For the supplier the profit potential will be great if they seize the opportunity; they will be involved in a range of new activities and is solely responsible for all customer relations. There will be economies of scale and probably additional synergies associated with these kinds of alliances. However, there is the possibility that an external player, a service provider, will enter the market and assume this customer oriented role. To new entrants this scenario hence represent a great opportunity, while for suppliers this scenario is both representing an opportunity and a severe threat of being outcompeted in the most important future operation – the customer service.
Customer relation	To the customer this model will be very simple and he can relate only to one company for both power and digital services. However,

	according to Håvard Belbo (chapter 7.1), when power suppliers get too powerful the end users may get intimidated and reluctant to trust them. In scenario 2a the power supplier will be a nearly monopolistic customer point, and they should be careful not to exploit this position. In scenario 2b a new actor assumes responsibility for customer relations – including power sales. With reference to Belbo's statement scenario 2b might be perceived as less intimidating to the customer, and power suppliers need to address this possible threat.
Practical examples	a) A customer chose Lyse Energi as its supplier, which in turn is the distributor of Altibox solutions. The customer hence pays its electricity consumption together with its broadband costs, its digital television, telephony and its alarm service to Lyse Energi. The power supplier is responsible for specifying the invoice and allocating the income to the respective content providers. b) The customer chose Telenor as service provider which again is the distributor of the electricity to the household. The power supplier hence loses all customer contact as new actors enter this industry.

10.4.3 Scenario 3: Fragmented activity bundling

The last scenario we present is a fragmented bundling of activities and services, but is still based on the principle of a supplier centric model. A power supplier can still assume responsibility for some services, but the end user may have several suppliers. In this scenario we envisage that producers of electrical appliances will enter the market as allies to power suppliers. The customer can hence have a separate power subscription for his white goods and another subscription for household heating. In our previous analyses we found that the supplier should be enforcing their position in the market, and that alliances with ICT competent actors would be beneficial. We further stated that customer power in the market could be reduced by creating subscription models where the end user experience switching costs. This model addresses these issues, and allows for alliances and partnerships where the power supplier can partly subsidize the purchase of electrical appliances, and cover it through a lock-in subscription for electricity consumption with the end user. Hence the supplier's position is more secured and the customer's power is partly reduced due to the forced loyalty to certain suppliers. The scenario is comparable to what we see in the cell-phone industry, where end users can buy subsidized phones when committing to a given subscription program. By paying the subscription price and fees for the given time period the customer covers the supplier's partnership costs.

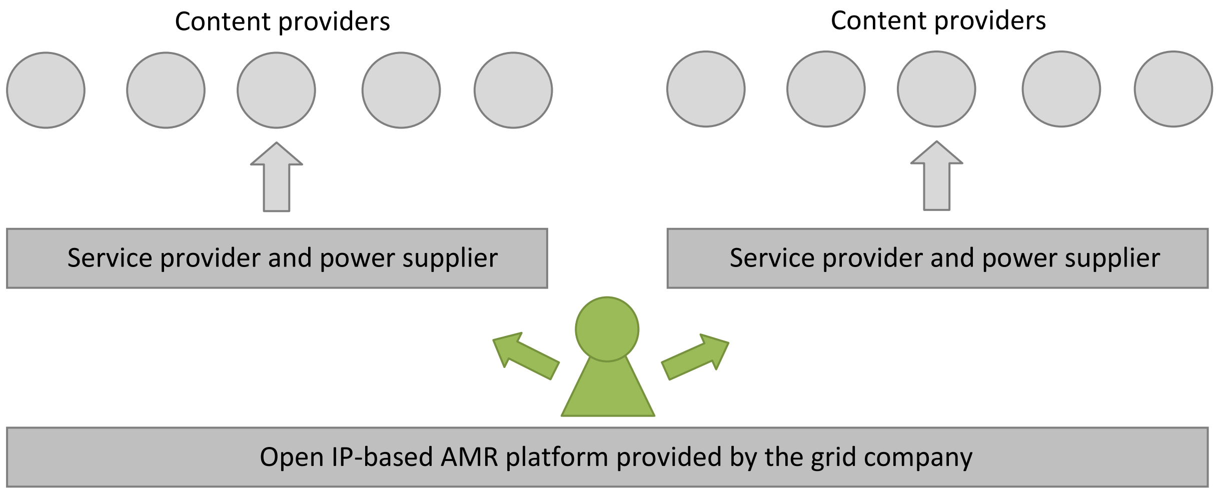

Figure 9.5: Customer relations scenario 3

Invoicing	The customer receives multiple invoices, depending on the number of separate subscriptions he has entered.
Business potential	Similar to the concentrated bundling model, there is a business potential for the power suppliers when involving in new activities. When allying with a popular appliance producer they can now book parts of a customer's consumption for a given time period and we consider this predictability valuable. When looking back to the industry force analysis in chapter 8.3 we concluded that it was necessary for the power suppliers to increase customer loyalty and create switching costs for the end user, for example by a lock-in subscription, to succeed in the new market. In this model this aspect is covered through partnerships with appliance producers.
Customer relation	The customer has several contact points and hence each supplier will become less powerful compared to scenario 2. Because the end user becomes more conscious of its supplier, he also becomes more demanding with regard to customer service. As a result we believe that each supplier will be brought closer to its customer. In terms of customer loyalty we consider this a valuable feature to the supplier. Branding, marketing and information become increasingly important in such a fragmented market.
Practical examples	a) A customer buys a white goods package from Whirlpool, and gets a reduced price on the products when committing

to a 3-year electricity subscription with Eidsiva Energi. Eidsiva Energi will hence charge the electricity consumption on these products, and both Eidsiva Energi and Whirlpool will profit from the alliance.

b) Further, the customer buys its discounted media center (TV, decoder, DVD-player) from LG with a 2-year power subscription from NTE Kraft. The content to the media center (digital TV and video on demand) is also provided by NTE Kraft throughout the subscription period.

10.4.4 Summary: A combination of scenario 1 and 3 will be likely

From a customer's perspective scenario 2 is the simplest and scenario 3 is the most complex. However, a fragmented industry is always more competitive and this again favors the customer. If willing to put in the extra effort of administrating all the different subscriptions, we believe that scenario 3 will be more economic for the customer.

From a power supplier's perspective scenario 1 is quite business limiting and due to a predicted consolidation we expect only a few large suppliers in the Nordic region to survive in this kind of market. Scenario 2a makes the supplier extremely powerful, but the operations and responsibility become extensive and complex. Additionally, Belbo's statement on customer reluctance towards one extremely powerful actor opposes this model. All existing power suppliers should however keep in mind the threat of scenario 2b, and new entrants should work to seize the opportunity of taking the customer oriented role. In scenario 3 the competition is fierce and power shifts towards the customer, but the power suppliers' business potential is great due to customer lock-in possibilities.

When predicting the future in a short to medium run we believe that the most likely scenario will be a combination of scenario 1 and scenario 3. We are convinced that there will be a bundled and fragmented market where power suppliers assume more responsibility and increasingly involve in new activities. However, due to loyalty and administrative hassle we envision that every consumer still has one main power supplier that distributes the power for household heating, for lighting and for remaining electrical appliances which he does not have separate subscriptions for. Hence the end user still has the opportunity to buy a subsidized electrical appliance with electricity subscription from other suppliers if desirable, but can also choose not to commit to a new subscription. In the latter case the main power supplier will charge the customer for the consumption related to this product, like it is in today's market. Also for additional services, like broadband, telephony and digital TV, we predict there will be an option for the customer, whether he wants an independent content provider (similar to the practical example in scenario 1) or wants to enter a subscription with a given power supplier for this service (similar to the second example in scenario 3). In this combination scenario there is thus one main power supplier to every household, but also a varying amount of competing suppliers in the same house which the customer has chosen to enter individual deals with.

10.5 Implications for stakeholders

10.5.1 Policy makers

The Norwegian Water Resources and Energy Directorate (NVE) must develop future-oriented regulations and hence enable development of flexible and sophisticated system solutions. Currently NVE is the main obstacle for implementing innovative and socio-economic subscription models, for instance for utilizing end customer flexibility. We believe that a Norwegian regulator should promote models beneficial to the majority of the society, and not impede them. Despite the Norwegian focus in our thesis, the forthcoming changes are not limited to Norway alone. A European standardization for platform development is expected although not yet implemented, and so keeping an international focus is also of importance.

10.5.2 Scientists

When analyzing an industry under transformation and surrounded by uncertainty we found it of great importance to reveal unrealized value in the value chain for predicting the starting point for developing successful business models. However, we could not find any available framework for how to reveal this value. We regard such a framework relevant for future research within similar industries and recommend scientists to develop a system for identifying unrealized value in a supply chain. Additionally, the lack of customer information and customer behavior and willingness to adopt AMR and additional solutions can also constitute a starting point for further relevant research within the electrical power industry.

10.5.3 Managers

With reference to the statements in the conclusion above, managers should focus on finding the right strategy for accessing key competencies given their current situation. They need an articulated strategy for where they are going, which positions to take, and how to reach that position after implementation of AMR. Being able to spot the disruptive changes and predict their impact as well as knowing the art of entering partnerships with the right actors will provide a competitive advantage. The market actors dependent on customer adoption of new technology must make sure to provide customers with sufficient information in order to reduce uncertainty and stimulate adoption.

11 Final conclusions

11.1 A forthcoming industry revolution

The power industry *will* experience a revolution as a result of smarter metering and smarter grids. Regulations and accessible technology will arrange for a disruptive change in how customer needs are fulfilled. Existing technologies outside the power industry will exceed today's generic ways of providing and metering power consumption and enable the integration of several technologies. This will result in a broad range of tailored customer solutions at a better price provided through new business models. Uncertainty might lay restrictions on development and investments, and can make it easy to underestimate the potential in future solutions and business models. Underestimating this potential is a danger when developing a system for the future today. Further, we are certain that the end customer will be emerging victorious from the industry revolution. He will receive a more accurate power invoice and integrated home and household comfort solutions at a better price. The end customer's relations to existing and future power suppliers and service providers will be redistributed, and we can envision three different scenarios for the structure of these relationships: One scenario with separated customer responsibilities, one with concentrated customer responsibilities and one with fragmented concentrated customer responsibilities. Flexible actors possessing the key competencies within innovation and ICT are also likely to succeed in the coming industry, whether they are existing actors or new entrants.

11.2 Future opportunities

Existing technology will serve as a fundament for new business models and we will see a high degree of innovation. Prevailing industry culture is traditional, and somewhat inflexible due to several decades of a predictable environment. There hence exist opportunities for new external market entrants to outcompete current industry actors. Several existing technologies will be synthesized into integrated solutions. These technologies comprise for example internet, telecommunication, energy and software. The market opportunities are approximately unlimited, but make demands for *flexible* companies with key competencies within *innovation* and *ICT*. Today's suppliers are most exposed to the changes, hence also most vulnerable. The stated key competencies are prevalent in other industries and we predict external actors possessing these competencies to have great opportunities in the future power industry. To existing power suppliers it will be beneficial to ally with companies possessing ICT and innovative skills, due to the upcoming disruptive changes and the nature of the desired resources. However, for innovative and flexible new entrants we rather recommend moving fast to secure first mover advantages in the emerging market.

11.3 End customer is the key to future success

We are certain that the end customer will be the final determinant of the outcome of new solutions and business models; customer adoption is the key to success in a market experiencing a high degree of innovation. All sources of unrealized value are related to the end customer, whether it is the end customer flexibility, the end customer relations or the access to information and metering data. The industry is prepared and willing to take actions and make new solutions for the end customer, but the end customer is currently unaware of the forthcoming changes and his future opportunities. The diffusion of new innovations is dependent on customer adoption, but customer adoption requires sufficient amounts of information.

12 Bibliography

Abernathy, William J., and Kim B. Clark. "Innovation: Mapping the winds of creative destruction." *Research Policy,* 14(1) (1985):3-22.

Auset, Jens. Interview by authors. Oslo, March 23rd, 2011.

Belbo, Håvard. Interview by authors. Steinkjer, March 22nd, 2011.

Benum, Bård. Interview by authors. Trondheim, March 29th, 2011.

Bower, Joseph L., and Clayton M Christensen. "Disruptive Technologies: Catching the Wave." *Harvard Business Review, 73*(1) (1995):43-53.

Bryman, Alan. *Social Research Methods*. New York: Oxford University Press, 2008.

Christensen, Clayton M. *The Innovator's Dilemma: When New Technologies Cause Great Firms to Fail.* Boston, MA: Harvard Business School Press, 1997.

Claude-Gaudillat, Valérie and Bertrand V. Quélin. "Innovation, New Market and Governance Choices of Entry: The Internet Brokerage Market Case." *Industry and Innovation* 13(2) (2006): 173-187.

Dagens IT. "Strøm-sjokk for Telenor." May 06, 2009. http://www.dagensit.no/article1663494.ece

Department of Energy. The Smart Grid: An Introduction. http://www.oe.energy.gov/DocumentsandMedia/DOE_SG_Book_Single_Pages(1).pdf

de Wit, Bob and Ron Meyer. *Strategy – Process, Content, Context*. 3rd ed. Thomson Learning, 2004.

Dyer, J. H., Kale, Prashant and Singh, Harbir. (2004). "When to Ally & When to Acquire." *Harvard Business Review* 82(7-8) (July-August, 2004): 108-115.

E24. "60 mister jobben i Telenor-datter." March 12, 2010. http://e24.no/makro-og-politikk/60-mister-jobben-i-telenor-datter/3561282

Enbysk, Liz. "Is the U.S. losing the smart grid race? And who's winning?" Smart Grid News, October 14, 2010. http://www.smartgridnews.com/artman/publish/Technologies_Metering_News/Is-the-U-S-losing-the-smart-grid-race-And-who-s-winning-3149.html

Energinet.dk "EcoGrid EU". Energinet.dk website. http://www.energinet.dk/EN/FORSKNING/ECOGRID-EU/Sider/EU-EcoGrid-net.aspx

European Commission. European SmartGrids Technology Platform. European Commission, Directorate-General for Research (2006) . http://www.smartgrids.eu/documents/vision.pdf

Gellings, Clark W. "The Concept of Demand-Side Management for Electric Utilities." *Proceedings of the IEEE* 73(10), (1985): 1468-1470.

Grande, Ove S., Hanne Sæle and Ingeborg Graabak. "Market Based Demand Response Research Project summary", SINTEF Energy Research, TR A6775 (2008).

Hafslund. "Hafslund Nett". Hafslund website. http://hafslund.no/om-hafslund/artikkelarkiv/les_artikkel.asp?artikkelid=330

Høivik, Asbjørn. Telephone interview by authors. Trondheim, March 30th, 2011.

IEADSM, International Energy Agency Demand Side Management Programme. "About us". IEADSM website. http://www.ieadsm.org/Content.aspx?ID=3

Jennings, Jason and Laurence Haughton. *It's not the BIG that eat the SMALL …it's the FAST that eat the SLOW – How to Use Speed as a Competitive Tool in Business*. New York, NY: HarperCollins Publishers, 2001.

Kanter, Rosabeth M. "Innovation: The classic traps." *Harvard Business Review*, November 01, 2006.

Kirschen, Daniel S. *IEEE Transactions on power systems*, 18(2), (2003):520-527

Koordinationsudvalget for Fremtidens Elsystem. Rapport: Kortlægning af den danske elbranches Smart Grid FUD-indsats. Energinet.dk and Dansk Energi (2011).

Lee, Gwendolyn K. and Marvin B. Lieberman (2010). "Acquisition vs. internal development as modes of market entry." *Strategic Management Journal* 31(2) (2010): 140-158.

Leifer, Richard, Christopher M. McDermott, Gina Colarelli O'Connor, Lois S. Peters, Mark Rice, and Robert W. Veryzer. *Radical Innovation: How Mature Companies Can Outsmart Upstarts*. Boston, MA: Harvard Business School Press, 2000.

Lieberman, Marvin B. and David B. Montgomery. "First-mover advantages." *Strategic Management Journal* 9 (Summer 1, 1988): 41-58.

Lyse [1]. "Forretningsområder." Lyse website. http://www.lyse.no/forretningsomraader/category13757.html

Lyse [2]. "Finansiell informasjon." Lyse website. http://www.lyse.no/omlyse/okonomi_2/

Markides, Constantinos C. and Paul A. Geroski. *Fast second. How Smart Companies Bypass Radical Innovation to Enter and Dominate New Markets*. San Francisco, CA: Jossey-Bass, 2005.

McKinsey & Company. McKinsey on Smart Grid (2010). http://publicleadershipusa.org/clientservice/electricpowernaturalgas/downloads/MoSG_Full_Book_Smart_Grid_VF.pdf

Min, Sungwook, Manohar U. Kalwani and W. T. Robinson. "Market pioneer and early follower survival risks: AContingency Analysis of Really New Versus Incrementally New Product-Markets." *Journal of Marketing* 70, (January 2006): 15-33.

Nilsson, Hans. "Demand Side Management (DSM) - A renewed tool for sustainable development in the 21st century." IEADSM Workshop Series: Brugge (2007).

Nord Pool Spot. “Area prices”. Nord Pool Spot website. http://www.npspot.com/reports/areaprice/Post.aspx

NordREG [1]. Nordic Energy Regulators. “Market Design: Common Nordic end-user market.” Report 3/2009.

NordREG [2]. Nordic Energy Regulators. “Implementation Plan for a Common Nordic Retail Market.” Report 7/2010.

NTE. “Fakta 2009.” NTE website. http://nte.no/index.php/fakta-2009

NVE [1]. Johnsen, Tor Arnt (red.). “Kvartalsrapport for kraftmarkedet 1. kvartal 2010”. Report 20/2010

NVE [2]. “Nettleie og tilknytning.” Norwegian Water Resources and Energy Directorate (NVE) website. http://www.nve.no/no/Kraftmarked/Nettleie/

NVE [3]. “Kraftsystemet.” Norwegian Water Resources and Energy Directorate (NVE) website. http://www.nve.no/no/Energi1/Kraftsystemet/

NVE [4]. “Avanserte måle- og styringssystemer (AMS). Høringsdokument februar 2011”. Document 1/2011.

Osterwalder, Alex and Yves Pigneur. *Business Model Generation*. Self published, 2009. http://www.businessmodelgeneration.com/downloads/businessmodelgeneration_preview.pdf, p. 14.

Platou, Rikke S. and Maren Sleire (2010). “Stability and Change. The Future of the Power Industry.”

Porter, Michael E. “The Competitive Advantage of Nations.” *Harvard Business Review* 68, no. 2 (March-April 1990).

Powel. “Om Powel.” Powel company website. http://www.powel.no/om-powel/

Proff. “Cinclus Technology AS.” http://www.proff.no/proff/search/companyRoles.c?freeText=&bc=&c=963246862&org=963246862

Regjeringen [1]. Olje- og energidepartementet. “Tar krafttak for automatisk strømmåling (AMS)”. Regjeringen website. http://www.regjeringen.no/en/dep/oed/pressesenter/pressemeldinger/2011/tar-krafttak-for-automatisk-strommaling-.html?id=630569

Regjeringen [2]. Olje- og energidepartementet. “Overføringsnettet”. Regjeringen website. http://www.regjeringen.no/nb/dep/oed/tema/fornybar-energi/overforingsnettet.html?id=444385

Rogers, Everett M. *Diffusion of innovations.* 4th ed. New York: Free Press, 1995.

Rogers, Everett M. *Diffusion of innovations.* 5th ed. New York: Free Press, 2003.

SINTEF [1]. "Bakgrunn og resultater". SINTEF website. http://www.sintef.no/SINTEF-Energi-AS/Xergi/Xergi-2008/Nr-1---mai/Bakgrunn-og-resultater/

SINTEF [2]. "Markedsbasert forbrukstilpasning". SINTEF website. http://www.sintef.no/SINTEF-Energi-AS/Xergi/Xergi-2008/Nr-1---mai/Markedsbasert-forbrukstilpasning/

SmartGrids [1]. "Definition." Smart Grids website. http://www.smartgrids.eu/?q=node/163

SmartGrids [2]. "Mission and Objectives". Smart Grids website. http://smartgrids.eu/?q=node/28

Smart Regions. "European Smart Metering Landscape Report." Österreichische Energieagentur – Austrian Energy Agency (AEA) (2011).

Spencer, Aron S. and, Bruce A. Kirchhoff. "Schumpeter and new technology based firms: Towards a framework for how NTBFs cause creative destruction." *International Entrepreneurship and Management Journal* 2 (2006):145-156.

Statnett. "Kraftsystemet". Statnett company website. http://www.statnett.no/no/Kraftsystemet/

Strauss, Anselm and Juliet M. Corbin. *Basics of qualitative research: Grounded theory procedures and techniques.* Newbury Park, CA: Sage Publications, Inc., 1990.

Strbac, Goran. "Demand side management: Benefits and challenges." *Energy Policy* 36 (2008).

Tatapower. "What is Demand Side Management?" Tatapower company website. http://cp.tatapower.com/cip/cpnew/dsm/demand-side-management.php

Walker, Rhett H.; Craig-Lees, Margaret; Hecker, Robert and Francis, Heather. "Technology-enabled service delivery: An investigation of reasons affecting customer adoption and rejection." *International Journal of Service Industry Management 13*(1) (2002):91-106.

APPENDIX

13 Appendix I – Interview guide

AMS og smart grid i Norge

1. Hva vil drive og hindre utvikling og innføring av smart grid-teknologi i Norge?
2. Hvilke konsekvenser tror du at en etablering av smart grid i Norge vil få?
3. På hvilken måte vil AMS gi din bedrift fordeler? Er det gunstig at nettselskap er ansvarlig for AMS?
4. Hvor viktig er AMS og smart grid for dere?
5. Hva vurderer dere som de mest aktuelle og beste kommunikasjonsløsningene for AMS?
6. Er det aktuelt for kraftleverandørene å overta ansvaret for AMS fra nettselskapet?

Konkurransesituasjon

7. Hvilken kompetanse tror du vil være viktig i din bransje i fremtiden?
8. Hvilken egenskap anser du som den viktigste for å lykkes med det nye markedet som oppstår i kjølvannet av AMS?
9. Hva gjør dere for å forstå kundesiden?
10. Hvem anser du som deres største konkurrent(er)?
11. Hvem vurderer du som de mest innovative/fremtidsrettede/fleksible aktørene i bransjen? Både nasjonalt og internasjonalt. Henter man/dere impulser fra andre land og markeder?
12. Hvor store endringer tror du det blir? Vil dere oppleve en revolusjonær endring i omgivelsene?
13. Hva vil bli det neste store innenfor smart grid-løsninger?
14. Hvem vil være store aktører i denne bransjen i fremtiden? Vil dere ha de samme konkurrentene? Hva med for eksempel Microsoft og Google?
15. Hvordan er forholdet mellom strømkunde og kraftleverandør i det nye markedet?

Posisjonering

16. Hvilken rolle har dere tenkt å ta i det nye markedet?

Tjeneste- og produktutvikling

17. Hvilket innovasjonsklima er det i din bedrift og hvordan er innovasjonsaktivitetene strukturert i bedriften?
18. Hvilke nye produkter og tjenester utvikler dere som en følge av endringene i markedet? Evt. hvilke typer produkter og tjenester er dere forberedt på å utvikle?
19. Hvor sentralt står kunden i forhold til tjeneste- og forretningsutvikling?
    a. Hva ønsker kundene seg, og hvor villige er de til å endre sin oppførsel?

Kompetanseutvikling

20. Hvordan vil dere gå frem for å utvikle og tilegne ny kompetanse? Vil det bli aktuelt med allianser med andre bedrifter, og i såfall hvilke? Eller er intern utvikling mer realistisk?
21. Hva er deres viktigste kilder til informasjon i forkant av strategiske og forretningsmessige beslutninger?