



LUND UNIVERSITY
School of Economics and Management

Master's Thesis
FEKP01: Strategic Management
Autumn -2009

Drivers and Barriers for a Sustainable Energy Solution

Authors: Evans, Nicholas

Möller, Clemens

Advisers: Cederström, Carl

Kalling, Thomas

Abstract

TITLE:	Drivers and Barriers for a Sustainable Energy Solution
SEMINAR DATE:	January 15 th , 2010
SUBJECT/COURSE:	Master's Thesis in Business Administration/Strategy
AUTHORS:	Evans, Nicholas & Möller, Clemens
ADVISORS:	Cederström, Carl & Kalling, Thomas
KEYWORDS:	Swedish Energy Sector, drivers, barriers, renewable energy
RESEARCH QUESTION	What are the main drivers and barriers affecting the Swedish energy industry and its institutional logic?
PURPOSE:	The purpose of this study is to examine the drivers and barriers affecting the Swedish energy sector and its institutional logic.
THEORETICAL PERSPECTIVES:	The theories used for this paper give the reader an overview of the subject and include: Dominant Logic, Investment Myopia, Path Dependency, Porter's Five Forces and Governmental Intervention.
METHODOLOGY:	In order to complete the research a qualitative approach was used, which included interviews. To fulfil the purpose, the stated theories are used to analyse the findings.
EMPIRICAL FOUNDATIONS:	Interviews with numerous qualified and established persons in the Swedish energy sector.
CONCLUSIONS:	The critical role politics play in encouraging and inhibiting the implementation of environmentally sustainable solutions is monumental. Politics is simultaneously the most important driver and barrier to the industry's development, affecting; firms, consumers, research and collaborations.

Sammanfattning

TITEL:	Drivkrafter och Barriärer till en Varaktig Energilösning
SEMINARIEDATUM:	15 Januari 2010
ÄMNE/KURS:	Magisteruppsats i Företagsekonomi / Strategi, 15 ECTS poäng
FÖRFATTARE:	Evans, Nicholas & Möller, Clemens
HANDLEDARE:	Cederström, Carl & Kalling, Thomas
NYCKELORD:	Svensk energisektor, drivkrafter, barriärer, förnyelsebar energi
FRÅGESTÄLLNING:	Vilka är de huvudsakliga Drivkrafter och barrierer som påverkar den svenska energisektorn och dess institutionella logik?
SYFTE:	Syftet med denna studie är att undersöka de drivkrafter och hinder som påverkar den svenska energisektorn och dess institutionella logik.
TEORETISKT PERSPEKTIV:	De teorier som finns med i detta arbete, är utvalda för att ge läsaren en överblick i det behandlade ämnet och inkluderar: Dominant logik, Investerings- Myopi, Kreativ förstörelse, Stigberoende, Porter's Five Forces och teori om statlig intervention.
METOD:	För att genomföra arbetet har en kvalitativ metod använts, som dessutom innehåller intervjuer. För att uppfylla syftet, har uttalade teorier använts.
EMPIRI:	Intervjuer med kvalificerade personer som är etablerade i den svenska energisektorn.
SLUTSATS:	Den kritiska roll politik spelar, för att uppmuntra samt försvåra genomförandet av miljömässigt hållbara lösningar, är monumental. Politik är samtidigt den viktigaste drivkraften och barriären som påverkar företag, konsumenter, forskning och samarbete.

Table of Contents

1. Introduction.....	6
1.2. Background.....	7
1.3 The Past and Current Situation.....	7
1.4. Problem Discussion.....	10
1.5 Research Question.....	12
1.6 Purpose.....	12
1.7 Choice of Theory.....	12
1.8 Delimitations.....	13
1.9 Target Group.....	13
2. Theory.....	14
2.1 Porter’s Five Forces.....	14
2.2 Government Intervention.....	14
2.3 Path Dependency.....	16
2.4 Dominant Logic.....	17
2.5 Creative destruction.....	19
2.6 Investment Myopia.....	20
2.6:1 Incentive to Innovate.....	21
2.7 Theoretical Framework.....	22
3 Methodology.....	23
3.1 Subject Choice.....	23
3.2 Method Choice.....	23
3.2:1 Qualitative Approach.....	24
3.2:2 Inductive Approach.....	25
3.2:3 Descriptive Context.....	25
3.3 Data.....	25
3.3:1 Primary Data.....	26
3.3:2 Secondary Data.....	27
3.3 Critique of Sources.....	27
3.3:1 Validity.....	27
3.3:2 Reliability.....	28
3.3:3 Criticism of secondary data.....	29

3.4 Presenting the Findings.....	29
4. Findings.....	30
4.1 Workshop on Governance for a Low-Carbon Society.....	30
4.2 Interviews.....	34
4.2:1 Lars Nilsson	34
4.2:2 Lars Bruzelius	35
4.2:3 Christer Wallin.....	36
4.2:4 Göran Tillberg.....	38
4.2:5 Marie Fossum	39
4.2:6 Gunnar Norström	40
4.3 Summarising the Findings	41
5. Analysis & Discussion.....	42
5.1 Internal Factors	42
5.2 External Factors	44
5.3 Double External factors	45
6. Conclusion	48
6.1 Future Research	50
7. Bibliography	51

1. Introduction

International energy policy is facing major political decisions in the near future. Whether or not private firms in the different sectors affected by potential political resolutions (whatever these may be) are ready, willing or able to accommodate the new regulatory measures remains to be seen. Globalisation has been a major catalyst in orchestrating the changes that have taken place thus far, and will remain an important element in future changes. As is well documented in mass media, and pushed by lobby groups and politicians around the world, the globalising trend has had serious consequences for the environment. Everyday there are articles to be read regarding environmental damage caused by humanity's selfishness and ability to over-consume and waste. The constant worry about diminishing fossil fuel reserves, in combination with our dependence upon them, is a further hot topic and will remain so until the energy problems are solved, or at least temporarily quenched.

Enter the importance of renewable energy. Huge wind farms in Romania, solar energy parks in the Sahara, tidal energy in Scotland, geothermal sources in Iceland; the list of possibilities for procuring environmentally friendly energy goes on. However, there are still unresolved issues that must be tackled before these sources can fully be utilised. Notwithstanding our unbelievable dependence on the fossil fuel propelling our automobiles through the wasteland we are creating, we do not currently have adequate means to accommodate and distribute the energy that is gained through environmentally friendly methods. To spell it out in plain English; the current power grid simply does not satisfy the needs of the energy addicted world.

Interestingly enough, a report published by the American National Academy of Engineering, listing the 20 most important engineering feats of the 20th century, maintains that the most important technological innovation of the century is the electrification ([nae](#), 2009). Claiming that electrification has been the key to further technological development around the world, they make a strong case. However, one might wonder why the same technology as in the 1920's is being used to distribute energy to the needy. Have there not been any technological advancements in this field? Are the costs, both actual and the opportunity costs, of replacing or upgrading the existing grid too high, or is the inability to accommodate technological advancements too deeply rooted in the old-fashioned, yet extremely profitable, energy sector?

1.2. Background

This Master's thesis began with an application to the Institute of Economic Research at the University of Lund, where three groups of students were to be chosen to partake in the process of giving Ericsson, the Swedish IT giant, strategic advice for the future. Initial data had been assembled by one of the employed post docs, and was to be further categorised and organised by the student workforce. With the fourteen different vertical categories allocated to the different Master's groups, the process quickly turned to researching the different categories and deciding which had potential economic value for the future of Ericsson.

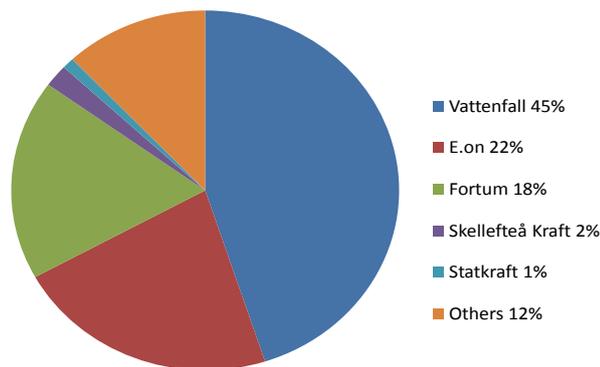
It is important to state that the heart of the Ericsson project engulfs the ICT usages and potential future developments within the different categories' ICT interests. ICT here stands for *Information Communication Technology*, which is a truly vague definition of almost everything that is even remotely high-tech. The authors of this study felt that, after doing initial reading and research, Sweden's energy sector was of particular interest. The energy sector is, as mentioned in the introduction, one of anticipated change, which is one of the reasons why it was chosen as the focal category. More on the limitations and contiguosness of the paper will follow in a later section.

1.3 The Past and Current Situation

As briefly touched upon in the introduction, the current power grids of the world are outdated. Erected throughout the 20th century, they are the dinosaurs of today's infrastructure. At the one end the grid is connected to various power stations, at the other end the consumer can simply plug in whatever he or she wants to use and enjoy the luxuries of the 20th century (The Economist, 2009). Sweden is no different. Historically speaking, the first energy regulatory laws governing the then modern infrastructure appeared in 1902 ([energimarknadsinspektionen](#), 2007). Up until the late 1970's the country was, similarly to Denmark, highly reliant on oil to produce electricity. After the oil crisis of the early 70's, however, a nuclear program was developed and implemented. Coal, gas and, as of the 1990's, even biomass have also remained major players in the country's energy production (Wang, 2006).

Turning the focus towards the more modern Swedish energy sector, it is important to note that, like most other European countries, the country liberated the energy sector from its monopolistic state in the mid 1996 ([energimarknadsinspektionen](#), 2007). Suddenly the Swedish consumer had different energy suppliers to choose from and Vattenfall, the

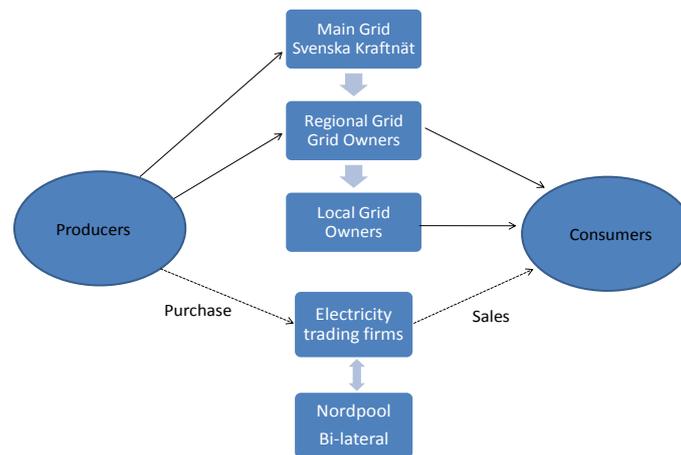
governmentally owned power provider, had new Northern European competitors to combat. Sydkraft, which later was bought by Eon, a German energy producer and provider, as well as Fortum, a newly founded Finnish group, all invested heavily in Swedish energy production facilities and the infrastructure supplying the end-users. There were, of course, further companies that showed interest in establishing business operations in Sweden— about 30. However, as the graph below shows, the five largest firms dominate the market with 85% of Sweden’s electricity production.



Energimarknadsinspektionen. Utvecklingen på den svenska energimarknaden, vintern 07/08, 2008

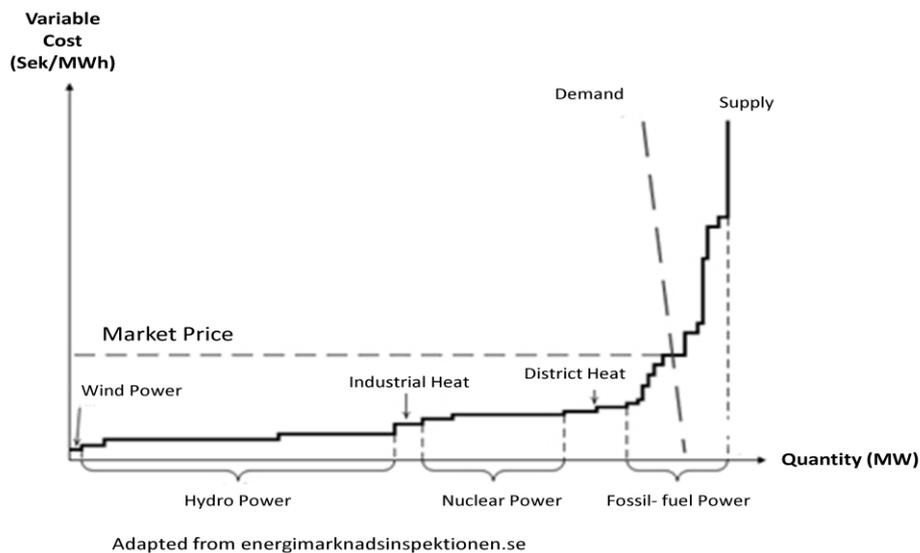
The controversial nuclear power question has dominated Swedish energy policy discussions for years. A referendum held in 1980 assisted the Swedish government in setting the goal of shutting down all nuclear reactors by 2010 (Wang, 2006). As the year 2010 begins, it is clear that there is still a ways to go before the country can rely on alternative, “cleaner” electricity suppliers and abolish all reliance on nuclear power. According to a report published in 2008 by Svensk Energi, the Swedish organisation that oversees the industry, roughly 42% of all produced energy stemmed from the 3 remaining nuclear power plants. The other major contributor (47%) to the electricity need of the country are the numerous (about 1900) hydroelectric facilities spread throughout the country. Wind energy can almost be seen as nonexistent in the country’s energy equation; showing up on the statistical data sheets with a measly 1,4%, the power source, whose importance seems to be blown out of proportion by mass media, truly has a long way to go before it gains a solid foothold in the wind-blown Swedish countryside. The remaining roughly 10% of the production quotas are satisfied by a number of different heat-driven electricity facilities; such as coal and garbage burning facilities.

No matter which production facility generates the electricity that is to be consumed in Sweden, the energy must first be bought or sold at Nordpool, the Nordic power market in Oslo, Norway. Here the producers and distributors decide on how much actual energy will be required for the following day (using the spot market), and the price at which the future electricity is to be bought and sold (using the financial market) ([Svenskenergi](#), 2009). Sweden, Norway, Finland and Denmark all take part in the market, which is beneficial to all. If one country or region should be in need of electrical assistance, another country can satisfy these needs. This all sounds very promising and as if the benefits for the consumer are immense, however, a certain amount of scepticism towards the convenience and efficiency of this modern market might be called for. The complexity of the system is shown in the figure below, which illustrates the different paths energy can take to reach its consumption destination.



Svenska-Kraftnät. Den svenska elmarknaden och Svenska kraftnäts roll.
Stockholm, Svenska Kraftnät, 2007

A further criticism of the current market situation is that there is no, or very little, incentive for the energy suppliers to produce “cleaner” electricity. Seeing as the price for electricity is set by the most expensively produced source, it makes sense for firms that produce hydroelectrically and thus cheaply, to also have coal production facilities. The inflated market price leads to minimal profits from coal production, whereas the profits reaped from price-worthy production facilities is, as the figure bellow illustrates, immense.



An example of the lack of motivation to become more environmentally friendly is the continued procurement and extraction of, among other, German coal by Vattenfall (Vattenfall.se, 2009). This begs the environmental question of what needs to be done to stimulate change.

1.4. Problem Discussion

It is inevitable that changes will occur in the energy industry. Environmentally and thus also politically and technologically, the industry has major forces interested in seeing future changes. But what exactly are the changes expected to affect the major players? How will they react to the imminent changes? Will they at all be prepared or willing to make the sacrifices to satisfy what climatologists view as necessary for future generations to survive on this warming planet of ours? The problems are many, the issues complex and the potential consequences of not changing disastrous.

Initial factors deemed as being of interest with regards to both stimulating and inhibiting drivers affecting firms in the industry exist on three different planes; external, internal and double external factors. External factors might include technological advancements and the ability to implement them as well as customer's behaviours, preferences and values. Internal factors can include the firm's ability or desire to acquire and manage alternative technical resources. Double external factors affecting the firms are things such as environmental disaster, public views or political decisions regarding economic subsidisation and penalisation.

Previous research on this subject matter is not particularly easy to find. Wang's paper (2006), (previously used as reference material), deals with the production of renewable electricity in Sweden. He discusses political barriers for implementing more alternative energy, such as wind, claiming that the inconsistent energy policies brought forth by government are the main barrier for the lack of progressive steps being taken towards a carbon-free Swedish society.

A recent dissertation by Rönnborg (2009) focusing on the Swedish energy sector also finds politics to play a prominent role in the industry. Claiming that power gained through political lobbying allows the dominating firms to be viewed as political actors themselves, he sets the tone for a study that is foreshadowed by political decision making. Furthermore, he states that employees of firms in the industry see it as beneficial for the market that only few large scale actors that have achieved a prominent size. He believes that this conviction also directs the investment decisions for production encompassing the dominant norm that all the actors seem to agree upon. Additionally, the largest distributors are almost fully integrated and all have the opportunity to optimise their production supply portfolios in order to maximise the price. To maximise the price in this manner is seen by Rönnborg as a mission by all producing firms in the business. Rönnborg has serious doubts that the market, under the current circumstances, can contribute with the change needed in the industry in order to increase the production for the future expected growth of demand foreseen by the European Union.

A third study of interest is an article by Poulsen and Ibsen (2007) concerning the de-regulation of the Danish telephone and energy markets. Mainly focuses on the path dependency of the markets it offers more of a historical analysis of a Nordic market than a current or even future evaluation of the situation. Further academic papers have unsuccessfully been searched for resulting in a slightly meagre number of comparable sources to compare findings and conclusions with. If this is because the ambition of this paper is too high, the subject not interesting enough or the academic possibilities envisioned by the authors exaggerated is unclear. Whichever the reason, the fact remains that very little has been published examining the Swedish energy and electricity market with regards to the above mentioned factors, which leads to the purpose of this study.

1.5 Research Question

What are the main drivers and barriers affecting the Swedish energy industry and its institutional logic?

1.6 Purpose

The purpose of this paper is to examine the drivers and barriers of the implementation of more environmentally sustainable, efficient Swedish energy solutions. Further, the goal of this research is to investigate the industry's logic and strategic factors that will become the base for future operations

1.7 Choice of Theory

To accomplish the purpose of this paper, theories are utilised and intertwined with the findings. This segment provides the reader with a brief overview of the theories that are taken from existing fundamental theory in Strategy research deemed as relevant to the study. The theories are chosen with regard to their relevance when trying to understand the drivers and barriers to change and innovation in the Swedish energy industry. Studying the Swedish energy sector with the assumption that "it is the relation between competencies, capabilities, logics and knowledge that is central in the analytical moment" (Kalling, 2007), three major dimensions must be taken into account, these are: Internal, external and double external dimensions.

Theories that are used to better understand the internal factors are *Dominant Logic* and *Investment Myopia*. The Resource-Based-View theory has not been included in the study as it is deemed to demand a too in-depth analysis of the firms, removing the possibility to allocate resources to understanding the remaining factors. External factors affecting the Swedish energy sector and its ability to innovate include *Porters Five Forces*, and *Path Dependence*. The double external dimension introduces the *Government Intervention* theory. Having a fundamental understanding of the theoretical framework used to analyse the market will benefit the reader in grasping the importance of some factors and the triviality of others.

1.8 Delimitations

End-consumer behaviour, views and preferences are of grave importance to the future of the industry; however, the extensive quantitative research that would be necessary to gain an objective view of their attitudes is deemed as too substantial for this study. A further limitation of this study is, as previously mentioned, the focus on the Swedish energy sector's situation. Being part of the EU and globally considered as an innovator in environmental issues and solutions, it is a country governed by European laws and regulations, while simultaneously driven by the desire to be technologically leading.

1.9 Target Group

This study is primarily aimed at stakeholders in the Swedish energy sector. Gaining insight into the strategic decision making process and organisational priorities of the three largest firms in the sector can be advantageous for many different NGO's interested in the future developments. Ericsson, as previously discussed, will also be very interested in the findings of this study, and hopefully be able to utilise the findings to better strategise for the future of their firm with respect to the changing energy market.

Academics within the field of Business Strategy will also find this study to be of interest, thanks to the intertwined theoretical and empirical analysis. Ground-breaking theoretical contributions are not to be found in this study, but links between other existing theories and links between theory and empirical data are enough of a reason for an interested academic to read this research.

2. Theory

To accomplish the purpose of this study, whilst satisfying the interests of the above mentioned target group, theory is necessary. This chapter gives a detailed description of the theories outlined in the choice of theory segment that will assist in furthering the understanding of the factors affecting the industry.

2.1 Porter's Five Forces

Michael Porter argues that competitiveness and profitability are a result of industry structure i.e. the five forces: "*Industry structure drives competition and profitability, not whether an industry produces a product or service, is emerging or mature, high tech or low tech, regulated or unregulated*" (Porter, 2008, p.80). Innovation viewed with this assumption is caused by existing competition rivalry or brought to an industry by new entrants with the aim to gain market share of the existing market. New entrants and existing competitors can differentiate, produce at lower costs or focus on a specific customer target group to gain competitive advantage (Porter, 1985). The Five Forces are usable in a holistic approach to an industry to see how the entrant threat, current competition and threat of substitutes work as drivers of innovation: The forces describe firms' long-run profit potential given the market situation. The five forces that shape industry competition, and thus strategy, are:

- Rivalry among existing competitors
- Threat of new entrants
- Customers' bargaining power
- Bargaining power of suppliers
- Threat of substitute products or services

Government is not included as a sixth force because it is not directly determining the profitability of the forces (Porter, 2008).

2.2 Government Intervention

Government Intervention is neither good nor bad for an industry's profitability. Therefore it should be treated as a factor as opposed to a sixth force (Porter, 2008). An example of government intervention is the patent which may increase barriers to new entry in the business and increases profit potential within a business (Porter, 2005).

The public benefits of new energy technology have been substantial throughout the last decades. Energy would be more costly, more polluting and less reliable if it weren't for technological advancement throughout the last decades (Fri, 2003). One successful example of government regulation is the one on refrigerators that lead to extensive improvements of refrigerators resulting in energy consuming reduction. However, Fri argues government intervention is often difficult to get right. The benefits of government investment in the energy industry are often elusive and they are more efficient when specific obstacles are targeted (Fri 2003). According to Fri, there are four main obstacles to innovation that governmental intervention can help overcome.

The first obstacle that governmental intervention can help overcome is the *reproducibility of innovations*. The reproduction of an innovation marginalises the benefits that the innovation brings to the innovator. Most often, patents work as a way to make the innovation benefit its innovator by protecting the innovation from reproduction. The patent prevents commercial use of the innovation by any other part than the innovator, although some innovations cannot be patented. The second obstacle that is overcome through governmental intervention is that the innovation in some cases produces results that *cannot efficiently and commercially be used by the innovator*. Since innovation is often incremental, cumulative, and assimilative the firm or innovator is sometimes not in the position that it can exploit an innovation commercially by itself. The reason for this may be that the innovation uses a new technology base which is not in line with the firm's strategy. The third obstacle to investments in innovation is *lack of knowledge in the new technology*. The fourth obstacle to innovation is when *it attracts no capital*. This can be explained by the innovation's unattractiveness to capital as a function of the risk of innovation (Fri, 2003).

Successful government intervention can help innovation overcome the above obstacles. Some examples taken from the US are advanced refrigeration, low emission windows and electronic ballasts (Fri, 2003). Fri suggests that future government intervention may increase in precision and success if predictions are made about the future energy services and how they will be provided for. He makes some speculations and uses them as examples of future characteristics of the energy market. Development of the smart grid is one of them. Smart Grid is a digital electrical system which enables intelligent distribution of electricity and interaction of the receiver of electricity. Fri argues climate change could create a greater demand for innovation than any environmental program before. One way for governments to

encourage innovation in the energy business, is to look for innovators that promote disruptive technologies and direct government investments at the obstacles that help them exploit myopic but disruptive opportunities (Fri, 2003).

Seen from an external point of view, Porter argues *government intervention* is neither good nor bad for an industry's profitability. Therefore it should be treated as a factor as opposed to a sixth force. The best way to treat governmental influence is to see how big it affects the five forces. One example is the patent which increases barriers to new entry in the business and increases profit potential within a business (Porter 2005). Government is an interesting factor for the energy business since it often interferes in which way the business should be developed.

2.3 Path Dependency

Path dependence is a theory that can be used to describe the engine of growth in an industry. The concept enforces the assumption that history matters when the future is to be predicted (David, 2000). A good way of explaining Path Dependence is by using an example. One frequently used example among researchers on path dependence is the computer keyboard layout known as QWERTY. It has been proven that this letter combination in the upper left corner of the keyboard is not the optimal one yet it is the standardized solution on the global computer markets, with exception of Germany. The imperfection of QWERTY keyboards is proven by the Dvorak simplified keyboard which, with its alternative key layout, was the keyboard used for the world record in speed typing.

Yet, QWERTY persists as a standardised keyboard layout. The QWERTY letter combination on all of the worlds commercial computer keyboards is the result of history; "...*markets drove the typewriter industry prematurely into standardization on the wrong system...*" (David, 1985, p. 336). The standardisation of QWERTY shows that historical events can result in standardisation of suboptimal technological solutions due to the urgency of time and the power of standards. The competition in Path Dependent economies proves to benefit the competitor that launches and spreads its product sooner than the competitors rather than the one with the best adapted user-friendly technology. Another aspect of the QWERTY illustration is that the beginning of a new competitive market and technology may determine

which company will hold the benefit of owning the standardised solution and enjoy the advantages of such a position.

Further, the benefit of being the winner of a Path Dependency standard race is suggested from the example of the two video recorders; the Betamax player from Sony and the VHS player from VCR. VCR won the race and became the global standard video recorder due to more licensing firms that would produce VCR's cheaper technology and the fact that the VCR technological alternative was faster in reaching a larger part of the market (Bulik, 2006). This example shows how the first technology race can determine one technology's total victory over a future market and leaves nothing for the competitor in second place.

Path dependence can also be understood by its contrary; Path Independence. A Path Independent process is one "*whose dynamics guarantee that it will converge to a unique, globally stable equilibrium...*" (Swann, 2005, p.158). The concept is also described as an evolutionary contingent non-reversible dynamical social and biological process (David, 2000).

The above definitions can be interpreted as whether a process of technology innovation is likely to dramatically change or if there are standards that are to remain the same. Another way to look at Path Dependency is to compare it to the contingent branching of a tree. Once a new branch develops, new branches will protrude from this new branch and the process will continue. Thus, Path Dependence enables predictability of a set of various outcomes as well as the growth of independent outcomes or solutions. The concept of Path Dependency helps to understand the "engines of growth and the conditions for dynamic efficiency" (Antonelli, 2005).

2.4 Dominant Logic

Dominant Logic is defined as "*a mindset or a world view or conceptualization of the business and the administrative tools to accomplish goals and make decisions in that business*" (Prahalad et al, 1986, p.491). It is a collective term that includes the theory of how management teams "should" make decisions in a given business.

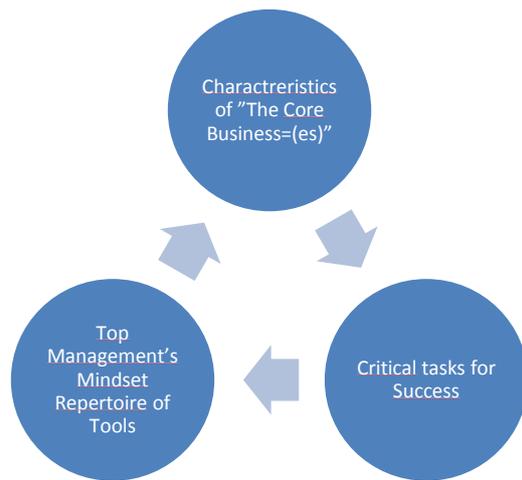
This analogy illustrates how difficult it is for senior decision makers within an industry to be open to new knowledge that changes their existing assumptions in order to be prepared for strategic decisions in other logics than the one in which they are at present. There are four theoretical streams on which Dominant Logic is based. The first is called the *power of*

paradigms which concludes that the general view of the “world” the way decision makers in an industry see it, is hard to change. Analogically it can be explained by the way people had a “permanent” view of the world being earth-centered until Copernicus declared it to be sun-centered (Prahalad et al, 1986).

The second is the *pattern-recognition process*, which means that when managers are faced with a decision, they search their memory for a similar decision that is reminiscent of the decision in question. Previous decisions are used in this way by managers as a reference and something they can relate to when important decisions are to be taken. This type of decision-making assumes that the industry they operate in contains the same conditions as when past decisions were made, be that in the same industry or not. A decision-maker can be compared to a professional chess player who can memorize several thousands of its previous draft and use it in future positions (Prahalad et al, 1986). If the rules of chess were to be altered, it would mean that the latter decisions were taken on assumption that the previous rules still apply. This can lead to wrong conclusions as conditions might have changed from one point in time to another, which could also result in another outcome than expected by the manager.

The third theoretical stream of Dominant Logic is *cognitive bias* which suggests that an analytical treatment of data as the basis of a decision is often replaced with personal experiences. Such individual contexts are in some cases irrelevant for a proper decision. In particular, the risks of cognitive biases are large when a manager switches industry in which he or she makes strategy decisions. Experience from one industry can sometimes be applied to another, in which it is uncertain whether the same conditions are present or not. The risk, however, is that the logic varies between sectors, leading to top managements’ erroneous appreciation of information (Prahalad et al, 1986).

The final theoretical approach is *operant conditioning*. According to this approach, reinforced behaviour is the underlying factor when decisions are made. If positive critique has previously been given as a result of a decision-maker decision, it is likely that a similar decision will be made. The choice that led to punishment or negative feedback, on the other hand, deters the decision-maker from repeating similar decisions. Individuals tend to create logic or principles that are used to simplify decision-making. In this way, decisions are likely to be based on old premises and logic whilst ruling out new opportunities (Prahalad et al 1986).



(Prahalad et al 1986)

The above figure illustrates how dominant logic is recreated. Dominant Logic underlines the risk that an organisation sustains knowledge and a strategic mindset from past business logics. Firms may seek to avoid undermined reinvention by decentralising the organisation, allowing decisions to be made at a management level where the most current knowledge of the matter can be found. Another way to deal with Dominant Logic is to be aware of the risk and experiment with new business logics while also considering past ones (Hamel, 2000).

2.5 Creative destruction

The idea of creating long-term competitive advantages deals with how companies successfully exploit opportunities in ways that other firms fail or do not intend to exploit (Besanko et al, 2006). It is in this sense that companies create positions in the market which give them competitive advantages (Porter, 1985). The above mentioned way for companies to attain competitive advantage is closely related to how Joseph Schumpeter, a renowned economist active in the first half of the last century, explains entrepreneurship as the "*ability to act on the opportunity that innovations and discoveries create*" (Besanko et al, 2006, p.121). Schumpeter criticises economists who focus on price competition as the most important benefit of the free market. He emphasises the way competition brings forward new products, new technologies and sources of organisation.

Schumpeter's theories have been used frequently to defend monopoly on the grounds that monopoly leads to concentration of resources such as power and financial means to create a higher rate of growth and larger investments in innovation. The managerial implications of Creative Destruction is that government policies and new technologies will make competitive

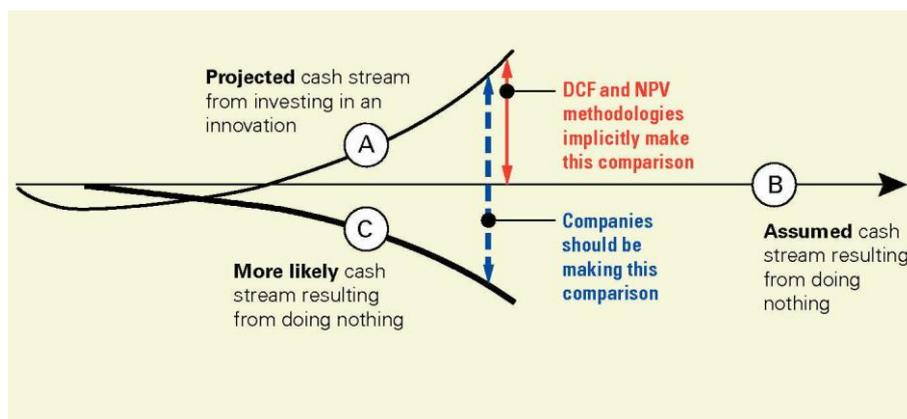
advantages obsolete. It is therefore important for firms to bridge competitive advantage and renew them before they have become outdated (D’Aveni, 1994).

2.6 Investment Myopia

Investment Myopia is a theory that points out how innovation can be inhibited by finance tools used in firms (Christensen et al, 2008). The way financial tools can play the role of “innovation killer” can be divided into three main standpoints according to Christensen et al. The first is the assumption that when making decisions concerning investments in innovation, the cash flow will remain constant, even if no investments are made. The figure below illustrates the principles used by managers when they evaluate investments.

Secondly, investment calculations are often exclusively based on Net Present Value and Discounted Cash Flow models without any concern of how the demand for capabilities of the company will emerge. Christensen et al suggest that capabilities have to be considered when investment decisions are made.

The third mistake based on financial paradigm is managers’ focus on short term stock performance, EPS, which makes them reluctant to invest in innovations that do not pay off instantly (Christensen et al, 2008). Since innovation is an incremental process (Fri, 2003) they often require a long-term investment horizon which makes EPS work preventively against innovation within firms.



Source: Harvard Business Review; Jan 2008, Vol. 86 Issue 1, p98-105,

The discounted cash flow-trap illustrates the way management takes a sustained cash flow for granted in case no investment is made. Christensen et al suggest that the no-investment will rather result in decreased future cash flow.

2.6:1 Incentive to Innovate

New small firms are more willing to innovate than larger corporations (Besanko et al, 2006). This is often explained by pointing out the bureaucratic nature and inflexibility of larger and older firms. Smaller firms are flexible as an organisation, which enables them to act and decide faster whilst decision-makers of large firms are myopic and ignore threats to their dominant market position.

According to Besanko et al, there are three rationales to not innovate. *Sunk cost effect*, meaning that a firm has already made large investments in specific technology that cannot be undone. If the firm also invests in new innovation, the sunk costs are in vain and will not be exploited to their full potential. One example used to illustrate sunk cost effects is the steel industry of the 1950's. Here, a new Austrian method (BOF) of melting steel was rejected by many American firms who were reluctant to innovate. Andrew Carnegie, the steel industry leader of the 50's, had the motto: "*inventions don't pay*", which had a large impact on the industry. Carnegie's policy to let others take the risk and costs for research and development are in line with sunk cost effects since he tried to avoid further costs than the ones already put down in production. The result of the conservative standpoint was an instalment of 40 million tons of melting capacity even though the technology was already out of date before installed. The cost advantage of the BOF technique enabled Korean and Japanese firms to penetrate the American domestic market (Besanko, 2006).

The replacement effect, points out that new entrants into a market can replace old dominating monopolists. According to the replacement effect theory, the incentive to replace another company is higher than to beat its own "former record". This viewpoint explains the unwillingness to "stretch" the organisation in order to regain the position as market leader (Besanko et al, 2006).

The efficiency effect explains that the loss in profit of a monopolist is larger than what a new entrant will gain in entering the market. The reason is that the entrant both take market share from the monopolist and tends to drive down the price. This implies that the monopolists incentive to innovate is higher than the incentive to enter the market (Besanko, 2006).

2.7 Theoretical Framework

The above theories are chosen with regard to their relevance when highlighting the drivers and barriers to change and innovation in the Swedish energy sector. Studying the energy sector's drivers and inhibitors to innovation or change calls for a wide range of theories to cover the three dimensions briefly discussed in section 1.5.

The *Dominant Logic* and *Investment Myopia* theoretical approaches will be used to better understand the internal dimension of the sector - that is, what is affecting the decision making within the respective firms? The external dimensions affecting the industry will better be understood with the assistance of *Porters Five Forces* and *Path Dependency*. The double external dimension requires an understanding of *Government Intervention*. The figure below offers a summary of the theories used.

Dimension	Theory	Summary
<i>Internal</i>	Investment Myopia	Implies that decision-makers tend to compromise long term investments for short-term financial goals.
	Dominant Logic	Suggests that senior managers memorise old decisions and use them as preferences when new choices are to be made, sometimes in lack of rational economical rationales.
	Creative Destruction	Deals with how firms can create long-term competitive advantages by successfully exploiting opportunities other firms do not.
<i>External</i>	Porter's Five Forces	Industry Structure drives competition and profitability, be the sector regulated or unregulated.
	Path Dependence	Suggests that a new technology might or might not lead to a new and dominating path in an industry.
<i>Double External</i>	Government Intervention	Helps to understand how governmental intervention may affect the decision-making in an Industry.

Linking all the dimensions together is a need for change to counteract the global warming effects that our current and past energy consumption rates have caused. Clay Christensen points to the fact that managers rarely use theory more than subconsciously because they find theory unpractical. However, "theory helps understand what causes what and why" and therefore helps an outcome be more foreseeable (Christensen interviewed by Knight 2005).

3 Methodology

3.1 Subject Choice

Sweden, being as technologically advanced as it is, is relatively far down on the list of countries leading the way in technological, more specifically ICT related, investments in the energy sector (Digital Planets, 2009). Given that Sweden's population is not very large, the per capita ICT spending might be more indicative of the country's global position. Even here the country does not stand out from its Western European counterparts. The natural resources of the country that are used to produce electricity, mainly hydro, give Sweden advantages compared to other European states. This begs the question why investments in the future of electricity and energy production is not more prominent. Norway, another highly hydro dependant energy producer, has an investment rate per capita that is more than four times as high as Sweden's. To gain a deeper understanding of the barriers and drivers of the market along with the ambition to make educated guesses of the future of this very sector, upon which we are so dependant, is of interest to many stakeholders and was thus seen as an interesting topic to tackle.

The empirical data will concentrate on three major players; Vattenfall, Fortum and Eon. These firms are all internationally active and will hopefully be able to give quality data that will assist in gaining insight in the past, present and future market situation. The choice to study these firms is based on their accessibility. Eon, with its Swedish headquarters in Malmö, is very accessible and was very interested in cooperating with the authors. Vattenfall, based in Stockholm, also very willing to cooperate in the study, and being such a major player in the continental energy supply, is also highly interesting. Fortum, the Finish energy supplier is also interesting to the study in that they differ from the other two in terms of size, recent organisational restructuring and level of co-operation with other firms and sectors. The decision to solely focus on the Swedish market, and gain a deeper understanding of the factors affecting the industry is a conscious decision based on physical location, understanding of market and business philosophies and time constraints.

3.2 Method Choice

This section aims to clarify the method and procedure used in this study. A brief discussion on types of data gathering methods as well as the data itself will also be given. Further, the approach, method and target will be made clear.

3.21 Qualitative Approach

The qualitative approach to gather data is based on words rather than the numerical processes of the quantitative approach. Qualitative research is based upon either observations of or interviews with individuals who are affected by the topic of research (Bryman & Bell, 2003). In the case of this study, interviews are the most fitting approach for gaining insight in the industry. The people in the know are not the end-consumers, all though they are of interest with regards to consumer behaviour and morality issues concerning the view on clean energy, but the individuals making strategic decisions in the firms. Interview subjects can contribute with specific and unique information about the situation, which can be both positive and negative for the study. A positive aspect might include a deeper insight and understanding of the market and the situation at hand, while a negative aspect would be the further complication of the situation and effects this might have on the analysis of the data (Jacobsen, 2002).

According to Jacobsen, it is beneficial to use case studies when trying to understand a specific situation. The situation that is to be understood in this study is more extensive than specific. Nonetheless, a form of case study is utilised here to try to grasp the current and future situation and scenarios affecting the energy sector. In addition to the case studies and comparison of the different company's strategies and philosophies, an analysis of environmental, political and consumer factors will be used to gain a complete understanding. Being a relatively technologically advanced, progressive society one might be able to generalise the findings from the Swedish market to other more developing markets, even though case studies normally do not permit generalisations (Jacobsen, 2002).

Some criticisms of the qualitative approach from researchers who prefer the quantitative method are the following: Qualitative research is subjective, hard to replicate, difficult to generalise to different areas of interest and generally lacks transparency (Bryman & Bell, 2003). The subjectivity of the approach, it is claimed, is due to the researchers personal interpretation of what is of importance. Further, a personal relationship with the interview subjects can lead to a distorted view of the situation and its relative importance. The fact that qualitative research studies are hard to duplicate and hard to generalise go hand in hand. Subjects interviewed in different studies and by different researchers will not give identical answers that might also be subjectively analysed differently leading to different results. The lack of transparency the qualitative method is accused of having refers to the thought process behind the choice of subjects and the difficulty in describing the analytical process (Bryman

& Bell, 2003). Being aware of the accusations that encompass the methodological approach of this study will hopefully help in avoiding some of the traps.

3.2:2 Inductive Approach

As previously mentioned, this study uses personal interviews as the prime data source for the analytical process. Using an unstructured technique, these interviews are loosely based on questions intended to give the interview subject as much room to go off on tangents as possible. He or she is given the opportunity to speak freely about subjects of interest, relevant to the field of study of course, and encouraged to give personal, as well as industry points of view. A typical conversation starting question might be: “Do you anticipate any significant changes to the energy industry in the foreseeable future”? As a researcher, it is of importance to enter into such interviews with an open mind. No prejudices towards any of the subjects or subject matters are crucial for gaining complete insight and understanding of the situation, which in turn, allows for the production of relevant and applicable theory (Jacobsen, 2002). It is also important to note that these types of interviews can lead to a very wide range of data, which can be difficult to sum together into conclusions.

3.2:3 Descriptive Context

According to Jacobsen (2002) there are two fundamentally different approaches when completing such a study; the descriptive and the explanatory approach. This being a qualitative study, the study aims to describe the situation whilst gaining and conveying a deeper understanding of which factors affect the energy sector. Using the explanatory approach would call for concrete hypotheses that are to be tested. Having a relatively short amount of time to complete the study, the researchers decided it would be most academically advisable to use the descriptive approach.

Qualitative studies are often descriptive by nature. Details, it is argued, are an integral part of understanding the context of the situation (Bryman & Bell, 2007). Another key to a successful understanding of the studied phenomenon is the ability to see things through the eyes of the interviewee. Here, however, one must be careful not to fall into the subjectivity trap that has already been discussed.

3.3 Data

This paper will compile both primary and secondary data sources in an effort to gain a full understanding of the subject at hand. The secondary data, gathered from academic articles,

newspapers, websites, etc, will compliment the primary data that is primarily gathered through personal interviews (Jacobsen, 2002)

3.3:1 Primary Data

According to Bryman & Bell (2007), an interview is the most widely employed method for gathering data in qualitative research. When employing interviews as the primary form of information in a study, there are a number of alternative interview approaches to choose from. Group interviews, intensive interviews, structured interviews or standardised interviews are some of the alternative means by which a qualitative researcher can obtain primary data from his subjects. For this study the researchers decided on using an unstructured interview technique that allows the subject to speak freely while the interviewers have a list of topics they would like to discuss.

This interview technique allows for a certain level of understanding or rapport to be built up between the subject and the interviewing party. The unstructured interview technique is often similar in character to a regular conversation (Bryman & Bell, 2007). Of importance to unstructured interviews is that the interviewer has a thorough understanding of the subject matter being discussed. The interviewees of this study are all well established in their fields and have a far more in-depth understanding of the factors affecting the industry than that of the researchers. Thus, it is important for the researchers to absorb as much information as possible and try to keep the subject from digressing too far from the interview topics (Jacobsen, 2002).

Subjects for the interviews are chosen with respect to their knowledge of the industry, strategic understanding of the past, present and future of the energy sector and their hierarchical position in the respective firms or institutions. The interviews, which aim to last for roughly one hour, in this study will be held face to face as opposed to over the phone. Subjects are often more likely to talk openly about the issues at hand when seated opposite the interviewee (Jacobsen, 2002). The presence of the interviewer also ensures that the subject concentrates on the conversation and is not mentally side-tracked or distracted by things in his or her environment.

Another source of data that will be taken into account in the empirical and analytical sections of this study is the information and viewpoints gathered from the opening session of the High Level Workshop on Governance for a Low-Carbon Society. Held at the University of Lund on December 3rd 2009, this accumulation of concerned leaders from the worlds of academia,

politics and industry, discuss issues of interest for this study such as the policies required for a more environmentally friendly future, technological solution and the process of changing society's mindset. The researchers intend to jot down notes and potentially interesting quotes from the different presentations; however, it is very unlikely that there will be any interaction between the researchers and the subjects, leading to data that might be seen as having a low grade of reliability and validity. A type of ethnographic observation of the speakers, attending listeners and media coverage will hopefully add another element of analysis to the study.

3.3:2 Secondary Data

As briefly mentioned in the introduction to this data section, secondary data will also be used in this study. Complimenting the primary data sources, the secondary data will be comprised of both academic and non-academic articles from newspapers, databases and journals. Further, governmental reports including forecasts, analyses of the past and both actual and potential policies will be woven into the empirical and analytical sections of the paper to aid in gaining a complete understanding of the entire industry.

3.3 Critique of Sources

There are three prominent criteria that must be taken into account in academic studies such as this one: Reliability, replication and validity (Bryman & Bell, 2007). Replication has already been touched upon above. In qualitative studies it is often difficult to ensure that the conclusions are replicable due to the potentially distorting subjectivity of the interviewer and the inevitability that different interview subjects will have different views and explanations to similar questions. Reliability is concerned with the repeatability and consistency of the study, while validity deals with collecting appropriate data for the study (Jacobsen, 2002). These two are discussed below and will be followed by a brief critique of the secondary data used.

3.3:1 Validity

Validity, according to Bryman & Bell (2007), is the most important criteria of research, is concerned with the integrity of the generated conclusions. When divided into two major categories, internal and external validity, it is easier to grasp what exactly validity is about and how one can ensure that the study employs sound data leading to results that are valid.

External validity concerns the fact whether or not a study can be generalised. Often used as a measure of the quality of a research study, external validity aims to ensure that the selection of studied objects is representative of the issues being studied (Bryman & Bell, 2007).

Qualitative studies seldom aim to be generalised across industry borders, this study being no different (Jacobsen, 2002). As previously stated, it is the ambition of the authors to use conclusions from this research to produce generalisations for industry sectors in other countries or districts.

Internal validity, unlike external validity, is very prominent and important to qualitative studies (Jacobsen, 2002). To assess whether or not one's study has internal validity, it is important to first compare the conclusions with those of other researchers, and secondly to be critical of the conclusions that arise from the study (Jacobsen, 2002). Leading up to this process, it is of course important that the right data is acquired. Acquiring the wrong type, or even incorrect, data can lead to false conclusions and thus no validity. Here it is of utmost importance that one chooses interview subject with a good understanding of the topic being researched.

Having found appropriate data sources and interview subjects, does not always guarantee that the information gained from them is high-quality (Jacobsen, 2002). Interview subjects can vary in terms of their level of engagement, level of knowledge or willing to cooperate with the researchers. A further issue affecting qualitative research studies, like this one, is the technique used to interview the subjects. Had a more structured interview technique been used, the results might have been considered to be less valid, seeing as the researcher is only given the answers he or she is looking for. The more open approach used here ensures that the interview subjects supply more information than in the prior case (Jacobsen, 2002).

3.3:2 Reliability

As briefly touched upon above, reliability deals with the repeatability and consistency of a study. This in turn is reliant on the subjects being interviewed, the interviewer, the location and the questions being asked. Interview subjects react to all types of different stimuli that can be both purposefully and accidentally conveyed by researchers (Jacobsen, 2002). The so-called interview effect is one be to wary of when conducting interviews. Is the subject being affected by factors the researcher is (un)consciously doing? Appearance, clothing, body language, aggressive or passive interview technique etc, can all lead to compromised data (Ibid). It is also of importance to be aware of the fact that as the research process progresses, a deeper understanding of the complexity of the many factors affecting the industry may become clear to the researcher. The emergence of a deeper understanding of the industry's circumstances may potentially affect the interviews to some degree. This can be hard to

combat for the interviewer, who is likely to become more and more engulfed in the topic as time and interviews pass.

The context in which the subject is observed or interviewed is also of importance to the reliability of a qualitative study. Observing or interviewing a subject under circumstances that are unfamiliar can lead to flawed or incomplete data (Jacobsen, 2002). For this reason the subjects have all been interviewed in their respective offices or places of work. How this has affected the researchers, who have entered into a world that is unfamiliar to them, is as of yet unclear. Minimising both the context and interview effect, the study aims to further gain reliability through the fact that the interviews are recorded. This ensures that no detail is missed when analysing the data and making concluding arguments.

3.3:3 Criticism of secondary data

Secondary data, the data collected from articles and other literature, is used for background information, understanding of the problems and possibilities affecting the industry and relevant data. Chosen from critically reliable sources such as academic journals and other literature, reliability and validity can be hoped for, but not ensured. The legitimacy of governmental reports cannot be questioned, however, it is important to keep in mind that they might be slightly angled or tainted depending on which political party or interests are being represented.

3.4 Presenting the Findings

The gathered data from interviews, literature and reports will be combined with the author's views and comments about the energy sector in the chapter titled *Findings*. A discussion of the factors deemed as most important by the authors reduces the amount of superfluous information, focusing on the issues at hand. It is likely that the validity of the study will be considered to have been compromised, but the reasoning behind this method of summarising data, has its advantages. The focus on the subject, without numerous digressions on irrelevant tangents, is the factor that is most important to this approach. Further it becomes easier for the reader to follow the argumentation in the concluding sections and assists in retaining his or her interest. The analytical section of this study also combines the author's views with the gathered data. Here, the findings are tied to the relevant theoretical frameworks and ideas resulting in a better understanding of the complicated issue that is the Swedish energy sector.

4. Findings

This chapter focuses on the results of the conducted interviews that were executed in accordance with the methodological approach explained in the previous chapter. The findings reported in this section will be used to draw conclusions in the remaining chapters. As mentioned above, the different data types have been intertwined with a certain degree of subjectivity resulting in a more open discussion than would be the case if only gathered data were presented.

4.1 Workshop on Governance for a Low-Carbon Society

Gathering in the historical Main Assembly Hall at the University of Lund, the assembled delegates from different fields of academia, politics and industry discuss the future of the world and its climate. The agenda is full of workshops, discussions, formal dinners and open sessions, of which only the latter are open to the public. Sharing the floor with the delegates, are interested members of the community, press and local student associations all gathered when the session is opened by the Rector of the University who gives a brief introduction of the university and its history.

The first speaker of the afternoon is Anders Wijkman, a Swedish politician and former Member of the European Parliament, who currently is the vice president of The Club of Rome, a global think tank organisation concerned with sustainability and innovations therein, his list of achievements and interests is impressive. His presentation deals with the challenges of becoming a low carbon society. More specifically, he talks about the complicated political issues concerning the issue. Criticising the current human/nature relationship and the unsustainable force with which we are consuming natural resources, he is adamant about the fact that climate change issues must be tackled globally. For this to occur, he argues, binding resource-targets must be set through governmental cooperation, which at the moment is far too inefficient in coming to conclusions.

There is a need for cooperation not only in politics, but also between different industries and professions. Mr Wijkman argues that a systems approach is required to protect the intertwined globalised system of both today and tomorrow. Architects need to work closer together with building engineers, ICT companies with automakers, farming associations with all of the above and so forth. Also of importance is that policy makers take a systems approach into account when creating incentives for more sustainable solutions. Summarising his presentation, he calls for a change in global mindset, and suggests energy companies take

the lead in this matter by changing their offerings from a product based view, to one more focused on a systematic service approach. The services that are supposed to revolutionise the industry through collaborations are not discussed by Mr. Wijkman, leaving the assembly guessing at what exactly is meant by invoking a service approach.

It may be easier said than done to change the mindset of the entire globe. Different interests, levels of economic development, infrastructure, belief systems, natural resources and many more factors affect the “mindset” of different nations and their inhabitants. The Darwinism that exists on national or regional levels is a state of mind that must be addressed before any collective mindset alterations can take place. The reasons may be human selfishness, inability or stubbornness. Whichever they may be, Dr. Michael Weinhold, the Chief Technology Officer at Siemens Energy, foresees that the near future of the global energy consumption will not be very different from that of today. He is the second presenter of interest at the convention and his German “no-nonsense”, factual approach to the subject differs greatly from that of the other presenters.

Siemens’ research suggests that the European energy demand in 2030 will be 15% higher than the current demand and that, sadly enough, more than 50% of this energy will originate from fossil fuels. This begs the question what the percentage of green energy in the rest of the world in the year 2030 will be, and what will be done to promote greener solutions while taming the increasing demand. Dr. Weinhold has some suggestions with regards to what can be done to extend the life expectancy of our planet. He, much like Anders Wijkman, believes that it is high-time for cross-border and cross-functional cooperation. Further, he argues that the efficiency levels must be raised in every phase of the energy sector; production, distribution and consumer markets. Raising production efficiency is a tricky issue that he believes will need considerable governmental research funding along with the cooperation of the major energy producers.

Increasing the efficiency of the distribution of energy is something Dr. Weinhold sees as a first imperative step towards a more sustainable society. He refers to the implementation of Smart Grids as the key factor to a raised distributing efficiency and explains the need for an infrastructure that is able to cope with the inconsistency of renewable energy sources. Of course he is also aware of the need for a change in behaviour on the part of the consumer, but is more sceptical towards humanity’s ability, or desire, to change its mindset than Mr.

Wijkman. Thus, Dr. Weinhold calls for more efficient end-consumer products and services to be available.

It is often argued that the automobile is the biggest culprit with regards to CO₂ emissions, which might very well be true. However, the fact that the buildings of the world stand for roughly 20% of the total global emissions and a massive 41% of global energy usage seems to get far less attention. Dr. Weinhold thinks there is an enormous potential to conserve energy in buildings and agrees with Mr. Wijkman when he states that a combined effort and cooperation between different professions and industries will be needed to realise more efficient solutions. Further, he suggests that energy consumers will also become producers in the future, which he chooses to label as *prosumers*. Integrating the prosumers with the Smart Grids of the world is what the Siemens executive sees as the biggest potential energy saver of the near future.

Is it really that easy? What happens when the sun does not shine or the wind dies down? If prosumers are no longer feeding into the grid and only tapping into it for their energy needs, the energy will have to be produced elsewhere. This, Dr. Weinhold argues, will be the most difficult issue to resolve concerning the development and implication of a new smarter power grid system. According to him the solution lies in ICT, lots of it. Interesting how Siemens is very active in developing ICT solutions in cooperation with Nokia and how it is deemed and marketed as the future of global energy worries to politicians and the general public.

Marketing potential solutions to politicians and suggesting alternative paths towards a more sustainable energy future of the world is easy, but whether or not these alternatives will be implemented remains to be seen. Mr. Ervind Hoff, a Norwegian lawyer representing the Bellona Foundation, an NGO concerned with, among other things, the sustainability of the world's environmental issues, is sceptical towards the implementation of successful solutions. Also speaking at the convention, he looks back at his time in and around politics and confirms Anders Wijkman's concerns about the inefficiency of political decision making. He points to the fact that more than 50% of the global CO₂ emissions are generated by only three economic regions (Europe, United States and China), and questions the necessity of having 192 different parties attending the climate summit in Copenhagen in December 2009. How are decisions to be made when so many different interests, be they of climatic importance or not, must be satisfied?

Mr. Hoff is determined when he states that the only obstruction to a more sustainable future is the political arena. He claims that the technology for alternatives to fossil fuel energy exists, does, however, not go in to detail as to which alternatives these might be, nor how they are to be utilised. The vagueness of this rather blunt accusation towards politicians the world over is, however, later justified by Mr. Hoff with the phrase “we need to let a thousand flowers bloom”. By this he is referring to the fact that society has yet to see which technological advancements will be most successful at reducing CO₂ emissions, or be most widely accepted as the premiere solution. One might argue that ever changing technological advancements will always see better, smarter and more efficient or lucrative solutions resulting from the scientific energy research that is being, or ought to be, heavily funded.

A result of some of the scientific research within this field is the development of CCS technology. CCS stands for *Carbon Capture and Storage*, which does exactly what the title suggests, namely; capture CO₂ emissions from coal power stations or other types of CO₂-heavy industries, and store the gases in a “safe” manner. Pumping the gases underground where they can not harm the protective Ozone Layer and contribute to global warming is a simple scientific solution to our global problem. Lars Nilsson, a professor in Environmental and Energy Systems at the University of Lund, who is the final speaker of the day at the Workshop on Governance for a Low-Carbon Society, is an advocator for this implementable solution and sees the public view on the matter as the only barrier to its success. The current public view towards CCS is one of scepticism and fear.

According to Lars Nilsson, the general scepticism directed towards CCS is with regard to the unforeseeable outcome of having tons and tons of gases pumped into the ground. What will become of these gases in one, two or five hundred years? What will happen if they seep out? Who will pay to repair the damages if something should go wrong? The questions are justified and many, but Mr. Nilsson is convinced that the immediate solution to the global emissions problem is the implementation of this technology. This brings us back to the question that emerged from Mr. Hoff’s presentation regarding the choice of solution and the timing at which a decision to implement a sustainability alternative is to be made or further postponed until a better option presents itself.

4.2 Interviews

In the section below, the interview subjects are presented and the most relevant information from the interviews is rendered. The subjects, and the material gathered from the interviews with them, are each presented in respective sections, simplifying the understanding of different perspectives and assisting in getting a more clear view of the situation.

4.2:1 Lars Nilsson

The same Lars Nilsson who participated in the above described workshop, where he among other things called for the public acceptance of CCS, was interviewed in the lunch room adjacent to his office at the University of Lund. As discussed in the methodology chapter, the interview had an open and relaxed tone resembling a conversation. Initially Mr. Nilsson discusses the current unsustainable energy consumption levels and possible alternatives to the problem, where he again advocates the potential of CCS technology and the advancements in the field. He claims that this is the best current solution to the CO₂ emission problem and advocates that the technology ought to be employed on every coal power station around the globe. He continues with the global perspective when he suggest that the more distant future of the energy industry must incorporate many different yet untapped renewable sources such as African solar power and the wind power of the North Sea. He sees the potential of a Super Smart Grid, where different regions contribute with different forms of energy at different points of time, depending on the varying supply and demand curves, as the best solution to the inconsistency that often accompanies natural power sources. To allow such resource allocation the electricity grid must be expanded across nation borders and with intelligent automatic functions that create a smooth supply of energy and allow the electricity to be sent to where it is needed the most at any given point in time.

Taking a more Scandinavian look at the energy sector, the Nordic market mechanisms are also brought into the conversation with Mr. Nilsson. He is very sceptical towards the current mechanism, which he summarises as follows: If the electricity that is being sold on the energy spot market, Nordpool, has been produced in a coal power plant in Denmark, it will naturally be more expensive to produce than hydroelectric power from Norway. Not only does it cost more to produce, but the burning of fossil fuels is, as known, also far more environmentally damaging than water turning turbines in their natural environment. This drives up the price on all electricity, even that that is produced through cheaper, cleaner sources. It follows that the energy producers that produce energy cheaply reap great, even

gross, financial profits, but those producing electricity in an environmentally expensive manner are not penalised for their inefficient and nonchalant behaviour towards their surroundings.

4.2:2 Lars Bruzelius

Lars Bruzelius, an independent managing consultant who has worked with Vattenfall and the energy industry for over 20 years was interviewed at his home, where he also bases his consulting firm. Mr Bruzelius' comments are valuable in the sense that he brings a historical perspective. Moreover, his comments can be seen as unbiased since he can speak more freely about the energy industry than current employees in the industry can. When asked why the energy sector can be seen as slow-developed, compared to, for example, the financial sector, Mr. Bruzelius describes infrastructure as the single most important factor. He believes that the current infrastructure will have to be greatly developed over the coming 50 years if sustainability is to be achieved.

An interesting historical anecdote is offered by Mr Bruzelius as a potential explanation to the economic crisis the global economy finds itself in today. Claiming that 40 years after every modern groundbreaking shift in technology a recession must be overcome by expanding the infrastructure, he makes an interesting point. He points to the Industrial Revolution at the turn of the 18th century and the economic crisis roughly forty years later in 1837. Alleging that the expansion of the railway infrastructure, which was brought about by governmental initiative, assisted in bringing the economy back around, it is an interesting observation. Similarly, he points to the Great Depression of 1929 and the forty year prior invention of the automobile as an example. Politics again took a dominant role in the expansion of infrastructure, this time designed to assist motor traffic. Mr. Bruzelius is well aware that there are other factors affecting the economies of the world and their fluctuations, but believes that infrastructure has played a prominent role.

What then is the solution to the current global economic recession, and more importantly, can a technological shift some 40 years ago be espied? This is the direction the conversation with Mr. Bruzelius takes, and it is suggested that IT became a wide-spread tool from the early 1970's onwards. He believes that governmental intervention and political initiatives will be called upon to upgrade IT infrastructure to assist in hurdling the economic hardships we find ourselves in as of the year 2008. One could argue that the Internet is already a very widespread infrastructure. However, one must question whether cyber space can be seen as

infrastructure or if something more concrete, such as a smarter, ICT orientated grid is necessary to solve our infrastructural qualms.

Mr. Bruzelius is cautious in stating that there are enough incentives to initiate a revolutionary shift in infrastructure, and claims there must be an economic motivation behind the alternate approach. After all, he argues, economics is the essential driving force behind anything that is even vaguely considered in today's political or industrial arenas. With regard to the industrial fear of developing new renewable or clean energy sources, he states that the time it takes to pay off the extremely large investments in new production facilities, in combination with the uncertainty of future political decisions of alternative technologies, is what is holding energy firms back. An example of this would be the investment in a nuclear power station and the need to be able to plan 70 or 80 years in advance to be sure the investment will be worthwhile.

4.2:3 Christer Wallin

Christer Wallin works as the chairman of Lund Energy, which is a municipally owned company engaged in both energy production and the infrastructure supplying its customers in the region. Mr Wallin is also a member of the City Council and his comments are of interest as they represent a local industry and political view of the energy sector. Already early in the interview Mr. Wallin describes the dominating energy distributing firms on the Swedish market, Fortum, Vattenfall and E.on as good marketers, but that their ambitions can sometimes be questionable in reality. He points towards the numerous collaboration efforts by the major firms, suggesting that they are simply used as marketing schemes to affect the end-consumer's view of the initiatives taken by the respective firms. Mr. Wallin believes that the major electricity producers do everything possible to appear as if they are environmentally conscious, simultaneously doing little to better the situation. An example of hiding environmentally questionable energy production behind a non-transparent surface, are the new coal power plants. These coal plants are said to be carbon emission-free and called Schwarze Pumpe power stations. They produce energy through brown coal. The carbon dioxide is separated from the other waste dust and made into a liquid form. Than this liquid is systematically transferred into the bedrock. The Schwarze Pumpe that Vattenfall uses is produced and developed by Siemens (Siemens 2009-12-30).

Mr. Wallin adds that CCS technology used in Schwarze pumpe might improve in the future and eventually revolutionises the energy sector. An obstacle to such a development is that

research projects require huge investments and hence involve very high economic risk. The industry is also very politically driven, which leaves the market with imperfect information about future policies regarding subsidisation or taxation. Furthermore, it is difficult for inventors to get their money back if they cannot sell their new innovations on a wide scale soon after the innovation is completed.

Mr. Wallin believes that if anyone is potentially interested in a Smart Grid; it is the end consumer. However, he points to three major issues that must be tackled before an acceptable solution presents itself as worthy for implementation. Firstly, end consumers must perceive it as a cost saving alternative. If they are to pay for certain technical equipment that will connect them to the grid, and furthermore have to invest in new appliances that are smarter, it will have to be economically beneficial. Secondly, the pricing must be such that the price varies in a home at a certain time known as "differential rate". (Such a price system was used for the Swedish market before the current Nordpool system was introduced). Thirdly, appliances and household safety must become more intertwined. He points to the fact that it is hazardous, in form of fire hazards, to have a dryer running at night simply because electricity happens to be cheaper.

Further, he believes that customers ultimately have to be the investors in Smart Grid functions, since energy consumption reduction and end consumer cost savings is the strongest argument that will assist in obtaining the goal of sustainability. He questions today's situation that does not allow customers to cut costs by switching electricity distributor. A household cannot be bothered to hassle with numerous different service providers to save a measly few hundred crowns. Receiving one bill from E.on for the electricity, another from Lunds Energy for the use of the power grid, and a third that will help them optimise the Smart Grid solution, is simply far too inconvenient. The inconvenience of invoices, says Christer Wallin, increases the threshold to customers to be willing to buy into the idea of a Smart Grid solution.

Taking a more political perspective of the situation, Mr. Wallin believes that new taxation alternatives are called for that benefit end-users and stimulate more responsible consumption. Regarding production, he believes that even here a more hard-nosed taxation system is required to help the producers become more environmentally conscious. If this means that the trading with carbon certificates become more commonplace, both nationally and internationally, then so be it. Like most other interviewed subjects he also refers to the need

for greater political investments in the science behind renewable resources and the need to push the development forward.

4.2:4 Göran Tillberg

Göran Tillberg works for E.on as the Head of Innovation for the Nordic Marketing Department, which concentrates on business development including strategy, mergers and acquisitions and government relations (relationships with politicians in Brussels and in Sweden as well as political lobbying). In addition, Mr Tillberg's department is also responsible for the Nordic markets' social responsibility, which includes the external environment such as climate and influences on nature.

Comparing the state-owned Vattenfall and Fortum to E.on, Mr. Tillberg believes there is very little that differs between the firms' approach to doing business. If there are any differences to be deciphered, it might be with regard to the owners' expectations for their return on investment (RoI).

When questioned whether the RoI of publically owned E.on might affect the long-term investment policy in future energy solutions, Mr. Tillberg is quick to disagree. He points out that E.on will invest 58 billion SEK between 2006 and 2013, adding that they were the firm that invested the most in the financially tricky year of 2008 in all of Sweden. Of the total 58 billion SEK investment, 9.5% is in wind power development, 8.6% in hydroelectric power, while nuclear power accounts for 24%. Nuclear energy investments will increase energy output by 10%. Additionally, Tillberg mentions that an upgrade of old technology is almost always more cost efficient than investing in entirely new technology. The investment in new facilities is seen as a far too uncertain investment for reasons that have already been addressed. A further 31% of the planned investments will be funnelled into electricity infrastructure. Here, he explains, investments in the expansion of the grid and long distance electricity meters are deemed as imperative. In addition, the grids are to be dug into the ground as a preventive measure in response to the damage caused by Hurricane Gudrun in 2005, where reparations cost the firm roughly 2 billion SEK.

Concerning the expansion and renovation of energy infrastructure, Mr. Tillberg believes that local energy production, where consumers take advantage of local renewable energy, is the solution that will become most important. Instead of expanding the existing grids from the North of Sweden (where major production facilities are located) to the south (where the majority of energy is consumed), Mr. Tillberg wants to see more local production. This is

very much in line with the corporate strategy and, sadly enough, not backed up by any significant proposals as to where this energy will be efficiently produced, or whether or not it will gain the acceptance of consumers and politicians.

Regarding the acceptance of end-consumers, Mr. Tillberg states that a previous effort to offer energy that was guaranteed to stem from CO₂-neutral sources, at a premium price, mind you, was a total failure. Consumers are simply not willing to pay a higher price for their electricity, no matter how environmentally friendly they strive to live in their daily lives. He believes that environmentally friendly alternatives that are not noticed by neighbours have a far more difficult time being accepted than products or services that are – electric cars, for instance. Gaining the acceptance of politicians, on the other hand, is something that is continuously lobbied for by the energy firms. Mr. Tillberg claims that lobbying has become a major part of an energy executive's job description, which in turn is made easier if the firm is owned by the government.

4.2:5 Marie Fossum

Marie Fossum is a former management consultant who had worked extensively in IT and financial industries before recently joining Fortum and the energy sector. Ms Fossum is a manager in the Business Development unit that has recently been established by the CEO, who also is a new face in the firm. Ms Fossum does not go into detail as to why the recent organisational changes have brought in new faces, nor why many former employees have been bade farewell, but hints at the fact that the board sees the actions as necessary for ensuring a profitable future.

Since her employment with Fortum began, Ms Fossum has spearheaded different types of collaborations with external parties towards more sustainable energy solutions. The following are some examples of current collaboration projects in which the firm is involved. The development of a pilot version of a Smart Grid in collaboration with ABB in Djurgården, a Stockholm suburb. An electric vehicle re-fuelling station in southern Stockholm in collaboration with Preem, a Swedish gas station chain. In cooperation with Skanska, Fortum launched a joint project to create solar cells that will help reduce the energy demand of households. Other collaborators include, Mitsubishi, with whom electric car refuelling processes are being researched and Stockholm Parking that currently owns 60% of Stockholm's parking lots, where parked electric car refuelling solutions are being developed.

She believes that since the energy industry itself rarely is responsible for commercialised product development, innovation must come from external firms such as the ones that Fortum works with. According to Ms Fossum, Fortum chooses its business partners with regard to common values. Accordingly, all firms with which Fortum cooperates have a strong eco-profiling. Further, joint projects enable Fortum to learn from other businesses about how to capitalise on new areas of interest. This viewpoint differs slightly from one offered by Göran Tillberg (E.on) who believes it is better to restrictively wait until new business areas are fully developed and *then* adopt them into the firm's network of cooperation partners.

It does not go unnoticed that the majority of Fortum's collaborations have some type of link to electric cars. Ms Fossum is a strong believer in their future potential and adamantly criticises the Swedish government for not following the lead of the French, Danes or Norwegians where substantial subsidies are offered to commuting consumers who choose environmental alternatives.

Turning to more external issues, Ms Fossum believes that the current subsidisation and penalisation structure of today's energy industry is what is holding renewable energy sources back from becoming more wide-spread. This returning theme is brought up by numerous other persons in the study, suggesting that it is of grave importance and will be further discussed in the analytical section of the paper.

4.2:6 Gunnar Norström

Having spent more than twenty years in the governmentally owned firm Vattenfall, Mr. Norström is very knowledgeable with regards to the industry and all its aspects. Currently working with corporate strategy he also has a good understanding of what awaits the energy sector in the future.

When asked about the importance of a Smart Grid, he claims that this is only a very fluffy term for something that already exists. It is already very much a possibility for production facilities to customise their output to better match the demand. He is also very sceptical towards the vagueness of the definitions offered for what a Smart Grid actually is. Is it simply a box that will allow end consumers to choose when he or she will choose to run inefficient appliances? Does it incorporate the storage capabilities of electric cars? If so, what if one needs to use the car parked in the driveway and its batteries are empty? He offers many more examples of uncertainties regarding the definition of what a "so called" Smart Grid will entail, and chooses to point to mass media as the culprit to the misconception among the

public. An area where he does believe that grids will become smarter, however, is the field of detection. Detecting where exactly a problem in the grid has occurred, and being able to locate it with a failure margin of only a few metres, will allow distributors to save vast amounts of economic resources that are currently wasted in trouble shooting budgets.

Turning the discussion towards the potential of renewable energy, Mr. Norström is convinced that governmental subsidisation is the only way to bring these alternative solutions into a more prominent market position. Again and again the discussion returns to simple economic supply and demand theories, where cost plays a major part. The energy sector is no different. He argues that all the environmental activists in the world will not be able to change the fact that people will want to take hot showers in the morning, dry their clothes in energy-guzzling dryers or take advantage of other modern luxuries that are taken for granted in Western society. The only way to make people more environmentally conscious, and not just stating that they are environmentally conscious, is to affect their wallets. The taxation of dirty energy to pay for the subsidisation of clean energy is, according to Mr. Norström, what is required for any substantial changes to occur in the way humanity produces and consumes energy.

4.3 Summarising the Findings

The foreshadowed dilemma of potentially gathering too much information to efficiently categorise the findings and come to conclusions can be counteracted by giving the reader a brief summary of the findings. The interviews conducted and summarised above are all relevant and fruitful, but which factors can be seen as most relevant? A recurring aspect during the interviews is the price factor. From the price the consumer pays to the price the companies are willing to pay to implement more sustainable alternatives, price, and thus profit, is of fundamental importance to the sector. A further important issue, be it vague or implemented for alternative reasons, is the collaboration efforts called for by politicians and implemented by the firms. Although science is said to have developed solutions capable of taming the natural resource consumption, there is a sense of anxiety among actors within the industry. An uncertainty mainly based on two factors – future political decisions and future technological developments – is what seems to be inhibiting firms from successfully collaborating across industrial and national borders.

5. Analysis & Discussion

The willingness to change the current structure of the energy sector is divided. As can be deduced from the above empirical data, the desire to restructure the Swedish, and, for that matter, the Global, energy sector is well represented, while the lack of incentives to do so, holds new innovative solutions at bay. Everybody seems to be waiting for somebody else to take charge of the problem; the industry giants expect politicians to utilise governmental incentives and intervention policies to address the issues, while the politicians want the industry to implement existing renewable production technology and have a hard time in making decisions that satisfy all parties.

The following is a discussion of the three different layers of factors affecting the industry, where the empirical findings are intertwined with the theoretical approaches previously discussed. Beginning within the firm and the interior factors, the discussion continues to broaden incorporating external and finally double external factors.

5.1 Internal Factors

Internal issues affecting the firms within the industry are often connected to profit. Profit seems to be considered as the most important aspect of running a business, which is in accordance with Porter's theories. However, the myopia, which is a synonym for short-sightedness, of the industry is not beneficial to society and the environmental issues we are facing. E.on claims to be investing vast quantities of money in innovative ideas and renewable alternatives, but how long-term are these investments and how large are they in proportion to investments in already existing technologies? It turns out that E.on's investments in renewable technologies are low in comparison to the amount they chose to make in revitalising established production facilities. The reluctance to invest in new alternatives or sustainable solutions seems to be linked to the uncertainty of the future. What will political decisions be grounded upon in the future? What technologies will become dominant, and what regulations and external costs such as carbon dioxide emission prices will appear on the market? Who is willing to invest in something that might become obsolete within a decade or two? In addition, customers have proven not to be willing to pay for environmentally produced energy when given the alternative. The questions summarising the uncertainties are many. Mr. Bruzelius' point that today's investments in new facilities have a pay-off period of roughly 70 years only adds to the companies' uncertainties and fear of dedicating resources.

Fortum's investments in collaboration projects with established firms from different industries is in line with the recommendations of Mr. Anders Wijkman, who calls for a more integrated approach to solving our environmental problems. The environment is an advanced ecosystem that requires an advanced systematic approach, and collaboration between firms from different sectors is the only way society will be successful in combating the changing environment. It is interesting how Göran Tillberg, the Head of Innovation at E.on Nordic, chooses to see new technological developments, such as wind power, as candidates for purchase rather than collaborators, which is a somewhat old-fashioned view of how to conduct business, bridging the gap from Investment Myopia to Dominant Logic. According to Mr. Tillberg, investing in existing, old-fashioned technologies, notice the percentages in the above interview, is much more cost efficient than setting up new production facilities or alternative solutions.

The energy sector is dominated by an old-fashioned, conservative thinking that has forced firms to restructure their organisations and bring in new leaders. Fortum and Vattenfall are prime examples of Swedish energy firms that recently have appointed new CEOs. These CEO's will be faced with a daunting task when it comes to changing the mindset and approach to doing business, and will likely be forced to do so by replacing employees in prominent positions with fresh-thinking young professionals. Marie Fossum is an example of a new employee within Fortum who was brought into the company from the management consulting sector, where she previously had a completely different business focus. This is also very noticeable during the interview with her, where, opposed to some of the other interview subjects, she has an aura of willingness to change and has an abundance of ideas. Old-fashioned old men thinking inside the box is what otherwise seems to dominate the logic within the industry.

Gunnar Norström is an example of a more old-fashioned approach to doing business. During the interview he repeatedly returns to supply and demand graphs and the major importance these economic mechanisms play in deciding strategic alternatives. His pessimism towards Smart Grids in combination with his inability to foresee potential future energy production solutions adds to the sense that the industry is dominated by a logic that is outdated. One might argue that this view is also very well-founded and that the afore mentioned uncertainties only add to the pessimism, but the fact remains that the established decision-makers have a certain way of going about their business decision-making and thought

process. Mr Norström's views can be linked to the Dominant Logic theory which confirms Rönnborgs results mentioned in section 1.4.

5.2 External Factors

External factors here refer to market related aspects of the industry, which can only partially be influenced by the respective firms. Using Porter's Five Forces to understand the offered products, the market competition, the suppliers of technologies and the mechanisms that drive things forward is the most straight forward approach to understanding the external forces. Combining this theoretical approach with that of Path Dependency and Creative Destruction will enable a representative picture of the industry's aspects to be drawn.

Let us begin by examining what it is the end-consumer actually purchases and what the importance of differentiation for him or her might be. On numerous occasions during the interviewing process, the difficulty to interest the consumer in the offerings of the firms was discussed. That electricity is a commodity, which, when functioning correctly is taken for granted by consumers, and when not, is absolutely catastrophic for today's society, is a pretty fair assumption that was repeatedly discussed. A further assumption that was discussed, and which will likely be supported by the reader, is that consumers do not care where their energy comes from as long as it is cheap and reliable, price being paramount. Seeing as the price is regulated on the spot market in Oslo, Nordpool, it is difficult, if not impossible, for companies to compete in the most important un-differentiable aspect of the market.

A more current differentiable aspect firms might use to gain competitive advantages is by proclaiming that solely renewable energy sources are used in the production of electricity. This, however, is uncontrollable for the consumers who simply want to see their fridge functioning correctly and cannot trace the origin of the product that allows it to do so, which mean a certain degree of trust or political control would be called for. Further, E.on's attempt to offer a guaranteed environmentally friendly alternative to consumers was an utter failure, confirming consumers' unwillingness to compromise economy for environmental causes. If a firm does choose a "clean" approach to differentiation, they must invest in new technologies, which, according to Mr Tillberg almost always costs more than investments in existing technology. The resulting question is naturally; which technology does one invest in? Suppliers of new technologies have little incentives to supply the sluggish industry with new alternatives for numerous reasons, all affecting their bargaining power. As discussed in the section dealing with internal factors, the uncertainty of which technologies will become the

norm, which will potentially be subsidised by future governmental policies and which will be accepted by the public all affect the dependency of the path the sector will take.

Returning to Porter's forces, it is important to note that the threat of new entrants to the industry is regarded as small by existing actors, allowing the established firms to continue to dominate the industry and the logic therein. This is largely due to the enormous investments required to become established, not to mention an understanding of the rather complex market and the human capital resources required to do so. The nearly nonexistent threat of substitute products or services does not exactly force the existing firms to become more efficient either, and even if, as Mr. Wijkman suggests, new, as of yet indefinable services are offered by the energy producing firms, these are likely to be reproducible, hence not leading to sustainable competitive advantages.

Creative Destruction theory advocates the ability to act on new technological breakthroughs, and use them to gain competitive advantages, rather than low-price strategies. Ms Fossum, Mr Tillberg, Mr Norstöm and Mr Wallin all agree that it is impossible to compete with a low price strategy. Eon's failed attempt to compete with environmentally friendly energy offerings reaffirms this. Ms Fossum sees an opportunity to enter into collaborations in the automotive industry, where electricity is expected to replace fossil fuels used today, as a possible method to creatively destroy the current mundane market logic.

Mr. Hoff, a speaker at the Workshop on Governance for a Low-Carbon Society, suggests that the science for a more sustainable approach to our increasing energy problems already exists, but that it is the political piece of the puzzle that is restricting the implementation. Seeing as the interviews repeatedly returned to encompass the political arena and the importance of the decisions that are made therein, it might well be; that the current solutions deemed as sufficient by Mr. Hoff are not quite ready to bear the full weight of the global demand just yet. This view is participated by Rönnborg who questions the market's ability to expand in a way that will be necessary to meet with a future increased energy demand.

5.3 Double External factors

The double external factors affecting the Swedish energy industry, and all stakeholders therein, are many. The fact that the firms have little power over these factors, which include political decisions, climate change and the public view of the industry, might be questioned by more suspicious members of the public, but must presently be assumed. A recurring trait throughout this thesis is that of the importance politics plays, *and will play*, in the future of

the ever more globalised energy industry. Cooperation over borders, international, national and regional governmental policies and regulations, not to mention the inability to come to important decisions regarding global CO₂ goals are all of paramount importance to the industry. Suppliers rely on, or as Schumpeter believes, are dependent upon, politicians to lead the way towards a technological solution that will allow the sector to have a sustainable relationship with the world we live in.

As discussed in the theoretical section covering governmental intervention, it is often difficult to be sure that the right decisions are being made. It is simply hard to be sure that one has taken all points of view into account and made fair decisions accordingly. Choosing a potential technological solution over another is a good example of the type of dilemma facing policy makers. What happens if the solution not chosen to become dominant ends up being far more reliable, price worthy, or has more potential for further development? The Schwarze Pumpe technology exemplifies such a decision where alternatives are yet to be found and environmental consequences yet to be fully understood. Further, there is the ever important aspect of popularity within politics that is not to be underrated. Harming the political party's position in the eyes of the voters or economic contributor, is something that forces policy makers to be very careful in their decision making, inhibiting drastic changes to policy to be made. Mistrustful consumers might argue that the inability to commit to progressive changes might also be linked to the fact that, at least in Sweden, the government owns 100% of the leading energy producer, specifically Vattenfall, and thus reaps large profits from this lucrative sector.

Conspiracy theories aside, it is made clear in a number of the interviews undertaken during this study and in accordance to the theoretical teachings; that governmental intervention must be taken for changes to occur and for the development of a more sustainable energy policy. What then might these potentially hit or miss interventions entail? More economically binding resource-targets is what Mr. Wijkman calls for, whereas Mr. Nilsson advocates higher taxation of environmentally unfriendly energy producers. Conflicting this view are Mr. Hoff, Ms Fossum, Mr. Norström and Mr. Wallin who all believe that an expanded subsidisation system is required from political leaders to accelerate change and progressive thinking. A combination of taxation and subsidisation is what might be called for to push the incentives to innovation to a new level that will eventually lead to environmental sustainability. In effect, the simplistic view offered by Mr. Norström, that the entire energy sector is steered by supply and demand, and thus price, seems to be a reoccurring factor.

Trying to convince the public, or firms for that matter, to change their habits because it “is” the right thing to do, simply does not seem to work. Economic measures are what gets people’s attention and must be used by governments to try to entice structural change in the industry.

The previous attempt to economically challenge the industry through taxation has, according to Lars Nilsson, backfired onto the market. The main reason for this is the current Nordic market mechanism in Oslo. Seeing as the end-consumer pays for the final KWh that is necessary to satisfy the demand of the market, he is often paying the price of coal power for all energy consumed. Coal power is the energy source that is used as the last resort to fill the demand quota. It is far more expensive to produce, than say hydro or nuclear energy, and is also punished with the cost of emission certificates. These extra costs are then covered by the end-users, while the companies producing cheaper renewable energy (the same as the ones producing energy through coal power) enjoy the benefits of having a differentiated production portfolio. Re-enter the mistrusting consumer who would like to know why he must pay the price of coal powered energy, which is up to 15 times higher than hydro power, for all the energy he or she consumes. Not exactly punishing the culprits he would argue. Evidently, the firms (governments) that are producing energy cheaply are reaping enormous profits due to the margins created when prices are set according to the last KWh required.

Why indeed? The suspicious consumer makes a good point. The taxes paid on end-user energy usage are high as they are; why should the consumers also pay inflated prices that result in even higher incomes for the state? If this money, or at least parts of it, was being pumped back into the industry through different subsidisation efforts for new scientific and innovative research to assist in attaining the yet unclear future emission goals, it would be a different story. Maybe the political lobbying efforts referred to by Mr. Tillberg are too successful in convincing leaders to act on what is most beneficial to the firms, which are still mainly owned by governments. The fact that it is hard to get governmental intervention and incentives *right* remains a pillar in this discussion.

6. Conclusion

This study's purpose has been to gain a better understanding of the drivers and barriers affecting the Swedish energy sector and future environmental sustainability therein. Whether or not new infrastructure is called for to accommodate future demands and production facilities, and whether these are based on renewable sources is very reliant on politics and the resulting policies. Whichever the solution, it is clear that something must be altered for decision-makers to be able to create and implement the changes required for extending the lifespan of the globe.

The complexities of the issues affecting the industry are truly overwhelming, the drivers and barriers equally so. The findings of this study suggest that there is a difference between the external and the double external actors in how they perceive, and relate to, the energy industry. Internal actors are focused on the industry and are unable or unwilling to see beyond the industry's boundaries in order to find industry-bridging solutions. Uncertainty in what future policies regarding environmental goals, technologies, taxation and subsidisation add to the ambiguity that firms in the sector feel towards long-term investments. Double external actors have a wider perspective on how solutions can take shape when firms from different industries collaborate in finding solutions. However, they are vague when they express the way cross-industrial boundaries ought to be implemented.

Politics play the part of both driver and barrier simultaneously. Drivers include: Subsidisation of research into new technological developments, goals for future CO₂ emissions and taxation levels of environmentally damaging pollution. Political barriers affecting the industry, on the other hand, include; the inability to reach agreements concerning environmental goals, subsidisation of short-term rather than long-term solutions and the maintenance of the current price mechanism that does not encourage "clean" energy. Politics ought not to be the only party blamed for the lack of innovation; established firms must become more proactive in ensuring the production of "cleaner" energy, removing themselves from the current reinvestment logic that dominates the industry.

Collaborations between different firms, sectors and professions ought to also be encouraged and developed, enabling a systematic approach to combat global warming. Making buildings, automobiles, industries, and just about everything else in today's society more energy efficient is a prerequisite for reducing the rising energy demand. This challenge must be tackled across both professional and national borders, ensuring the end-consumers are offered efficient solutions that are powered by renewable sources.

End-consumers also play an important role in the motivation and search for environmentally sustainable energy solutions. The consumer mindset of solely seeing price, rather than origin, as the deciding factor with regards to their consumed energy, can only be seen as a barrier to the implementation of more environmentally sustainable energy solutions. The current price mechanism neither favours the consumer nor the environment, and must also be seen as a barrier for the implementation of more environmentally friendly alternatives. The price mechanism is in turn intertwined with political actions and decisions, completing the circle of uncertainty surrounding the energy issues affecting today's society.

6.1 Future Research

Future research subjects of interest surrounding the issue of environmental sustainability breach all disciplines of academia and science. Examining consumer behaviour and their decision making process with regards to price vs. origin of energy, is an interesting business research approach to the subject. This study will demand a thorough quantitative approach and calls for extensive resources.

Further, gaining a better understanding of the different collaborations, their importance, potential and market value is an interesting field of study. This could be combined with the idea that collaborations are solely marketing schemes designed to positively affect the consumer in believing that steps towards change are being taken.

The complexity of the issues surrounding the political drivers and barriers affecting the industry is a further research approach of interest. Combining this approach with the barriers within politics itself such as political cycles, profit interests, donation dependence and the inability to come to agreements regarding global goals, this research question would include many aspects of political science.

7. Bibliography

Books:

Antonelli C. (2005), "Path Dependency, localised technological change and the quest for dynamic efficiency", in Antonelli et al. *New Frontiers in the Economics of Innovation and New Technology –Essays in Honour of Paul A. David*. Cheltham, UK: Edward Elgar, pp. 50-69.

Besanko, David. Dranove, David. Shanley, Mark. Shaefer, Scott (2006), *Economics of Strategy*: Hoboken, NJ, USA: John Wiley & Sons

Bryman, Allen. Bell Emma (2007), *Business Research Methods*: Oxford, USA: University Press.

Bryman, Allen. Bell, Emma (2003), *Företagsekonomiska forskningsmetoder*: Malmö, Sweden: Liber.

David, Paul A. (2000), *Path Dependence, its Critics and the Quest for Historical Economies*: Oxford, UK: All Souls College, Oxford & Stanford University.

Jacobsen, Dag Ingvar (2002), *Vad, hur och varför?*: Lund, Sweden: Studentlitteratur.

Kalling, Thomas (2007), *Kärnkompetens - specialisering eller diversifiering -förnyelse och specialisering av kompetens*: Malmö, Sweden: Liber.

Hamel, Gary (2000), *Leading the revolution*: Boston, USA: Harvard Business School.

Rönnborg, Petter (2009), *Det där ordnar marknaden... : Gothenborg, Sweden: BAS*

Swann, Peter G.M. (2005), "Is the World Flat or Round? Mapping changes in the taste for art", in Antonelli et al. *New Frontiers in the Economics of Innovation and New Technology – Essays in Honour of Paul A. David*. Cheltham, UK: Edward Elgar, pp. 158-187.

Articles:

The Economist. (2009), "*Building the Smart Grid*", June 4th, Vol. 391, Nr: 8634, pp. 15-18.

Bulik, B. S. (2006), "*Betamax vs. VHS all over again?*", Advertising Age, Vol. 77 Nr: 15, pp. 20-20.

Christensen, C. Kaufman, S. Shih, W. (2008), "*Innovation Killers*", Harvard Business Review, Vol. 86, Nr: 1, pp. 98-106

David, P. A. (1985), "*Clio and the Economics of QWERTY*", The American Economic Review, Vol. 75, Nr: 2, pp. 332-338.

Fri, R. (2003), “*The Role of Knowledge: Technological Innovation in the Energy System.*”, Energy Journal, Vol. 24, Nr: 4, pp. 51-75.

Grant, R. M. (1988), “*On ”Dominant Logic”, Relatedness and the Link between Diversity and Performance*”, Strategic Management Journal, Vol. 9, Nr: 6, pp. 639-642.

Ibsen, C. Poulsen, L. (2007), “*Path dependence and independent utility regulation: the Case of Danish Energy and Telecommunications Regulation*”, Scandinavian Economic History Review, Vol. 55, pp. 41-63.

Knight D. (2005), “*Three Trips Around the Innovation Track: an Interview with Clayton Christensen*”, Emerald Group Publishing Limited, Vol. 33 Nr: 4, pp. 13-19.

Porter, M. E. (2008), “*The Five Competitive Forces That Shape Strategy*”. Harvard Business Review, pp. 78-94.

Porter, M. E. (1985), “*Competitive Advantage: Creating and Maintaining Superior Performance*”. New York, Free Press.

Porter M. E. (1980), “*Competitive strategy: Techniques for Analyzing Industries and Competitors*”. New York, Free Press.

Prahalad C.K, Bettis Richard A. (1986), “*A New Linkage Between Diversity and Performance*”. Strategic Management Journal, Vol. 7 Nr: 6, pp. 485-501.

Wang, Y. (2006), “*Renewable Electricity in Sweden: an analysis of policy and regulations*”, Energy Policy, Vol.34, pp. 1209-1221.

Wernerfelt, B. (1984), “*A Resource-Based View of the Firm*”. Strategic Management Journal, 5, pp. 171-180.

Electronic References:

www.svenskenergi.se/upload/Statistik/Elåret/Elåret2008.pdf. (11-03-2009)

www.books.nap.edu/catalog.php?record_id=10726#description. (11-08-2009)

www.energimarknadsinspektionen.se/upload/Rapp.orter/El/Utveckling%20av%20n%c3%a4t%20tariffer%201%20jan%2097-1%20jan%2008.pdf. (11- 16-2009)

www.books.nap.edu/catalog.php?record_id=10726#description

www.berr.gov.uk/files/file40613.pdf. (11-16-2009)

www.vattenfall.se/www/vf_se/vf_se/518304omxva/518334vxrxv/522894vatte/523104vxrxv/index.jsp. (11-18-2009)

www.vattenfall.se/www/vf_se/vf_se/518304omxva/518334vxrxv/522894vatte/523224histo/index.jsp. (12-20-2009)

Interviews:

Bruzelius, Lars. Consultant (11-27-2009)

Fossum, Marie. *Fortum* (12-08-2009)

Nilsson, Lars J. Ph.D. Environmental and Energy Systems Studies. (11-03 -2009)

Norström, Gunnar. *Vattenfall* (12-01-2009)

Tillberg, Göran. *E.on.* (12-03-2009)

Wallin, Christer. *Lunds Energi* (12-09-2009)

Participants of the High Level Workshop on Governance for a Low Carbon Society (12-03-2009)

Nilsson, Lars J. Ph.D. Environmental and Energy Systems Studies.

Weinhold, Michael. Ph.D. Electrical Engineering. Head of Innovation. Siemens AG.

Wijkman, Anders. Former Member of the European Parliament.

Hoff, Eivind. Head of Brussels advocacy office. Bellona Foundation.