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Organizational interactions in the energy sector regarding growth and environment

Case study of Mälarenergi AB

Tutor:

Magnus Linderström

Authors:

Nominchuluun Nyamdavaa 820608

Sam Amirebrahimi 811222

ABSTRACT

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Authors:

Nominchuluun Nyamdavaa
Engerbrektsgatan 19
72216 Västerås
073 – 696 93 69

Sam Amirebrahimi
Centrallasarettet Ing.21
72189 Västerås
073 – 907 74 91

Tutor: Magnus Linderström

Title: Organizational interactions in the energy sector regarding environment and growth – case study of Mälarenergi AB

Problem: Energy sector has been much debated regarding growth and environmental issues. Energy situation in 2020 sets an emergency that a New Energy Policy has to be made immediately in order to meet the growing energy demand without compromising the environment. Thus the energy sector is strictly regulated by national and international level policies. It is interesting to investigate how organizations interact with each other in the sector regarding growth and environment.

Purpose: Aim of this thesis is to describe the inter-organizational relationships in the Swedish energy sector and analyze how organizations interact with each other depending on their attitude towards sustainable development. The research involves a case study of a local energy company Mälarenergi AB and different actors in its institutional field and how the company acts according to its interests in forming relationships with others.

Method: This thesis is an interpretive case study which aims to research the link between understanding and action. Organizational and institutional theories are used as theoretical framework. Empirical data will be collected through qualitative semi-structured interview with organizational members as well as secondary data that are collected through literature, documentation, archival records and previous researches.

Result: The Swedish energy sector is a complex field that consists of different actors and complicated relationships. The sector is mainly affected by national and EU-level decisions thus a local energy company is regulated by national and EU-level environmental policies. Interactions with other actors are fundamental in Mälarenergi's institutional field. Organizations form co-operations and collaborations in order to achieve environmental goals as well as to conduct joint R&D activities. The environment pressure made it clear that the organizations have to work together in order to maintain a sustainable growth in the energy sector.

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"Knowing is not enough; we must apply. Willing is not enough; we must do."
Wolfgang von Goethe

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1. INTRODUCTION

Energy gives personal comfort and mobility to people, and is essential for the generation of industrial, commercial and societal wealth. On the other hand, energy production and consumption (including heat and electricity production, oil refining and final uses in households, services, industry and transport) place considerable pressures on the environment. These pressures include the emission of greenhouse gases and air pollutants, land use, waste generation and oil spills. They contribute to climate change, damage natural ecosystems and the man-made environment, and cause adverse effects to human health. The exploitation of energy sources and the development of new technologies for energy use are central to the modern industrial development. But during the rise of environmental and sustainability issues the energy sector has become much debated.

Sustainable development in the energy sector could be seen as a chess board game; many actors are involved ranging from politic, economic, market and research to associations and private parts and any move of any actor would impact on the others changing the course of the game. In the chess game sometimes bigger characters are needed to be sacrificed in order to win. Winning of sustainable development might require giving up on things that are important to us today like cars and electric appliances. Within this concept, the game has to be played considering tomorrow's moves not only today's. What did we sacrifice so far in the game of sustainable development?

In our focus on the energy sector, growth and environment are complementary but yet contradictory, which means from the view of society and nature, it is an inseparable relation but the growth threatens natural environment. The relationships established in the energy field amongst the different actors are important idea to understand the social, health and environmental consequences.

In this thesis we aim to first identify the conflicting concepts of environment and growth through literature study, and then analyze how they are reflected on the organizational interactions. We find it interesting to focus on the Swedish energy sector, with an empirical focus on local energy company Mälarenergi AB. The Swedish energy sector sets a good example due to its efforts on sustainable energy production and distribution as well as low emissions. This thesis presents narrow down approach of energy sector from international and European context to national, regional and local level. We study how local energy company interacts with other actors through all those levels regarding growth and environmental issues.

1.1. Company Background[1]

Mälarenergi AB is a local energy company in Västmanland region in Sweden and solely owned by Västerås city. The company was started around mid 1800s and operates as local energy producer and distributer in and around Västerås city. Net revenue is 2, 4 milliard SEK. Revenue can vary depending on the electricity prices. The company has 559 employees and the CEO is Kenneth Jönsson. Mälarenergi has four subsidiaries which are Mälarenergi Elnät AB, Mälarenergi Stadsnät AB, Mälarenergi Vattenkraft AB, and Mälarenergi Försäljning AB. The company's business areas include heating, power, water, and service as well as electricity distribution. The company provides district heating and district cooling for more than 90% of all households in Västerås.

1.2. Problem Discussion

Energy sector is regulated by the government and affected by policy decisions on EU and international level. First we look into current energy debates in the EU and how these debates are brought to Swedish context. We take political discussion of the energy, growth and environment debate because it provides us with an insight of how organizational interactions are formed in the higher level.

In 'Europe's Energy Position: Present & Future' market observatory report (2008), the energy demand in 2020 is projected according to current trends and policies (Baseline) and in the case of taking action (New Energy Policy) to achieve agreed EU targets on climate mitigation, namely a reduction of 20% in greenhouse gas emissions compared to 1990, along with a 20% share for renewable in the final energy demand by 2020. The Baseline includes current trends and policies as implemented in the Member States up to end of 2006. The New Energy Policy scenario assumes vigorous implementation of new policies to make substantial progress on energy efficiency for reaching other energy and climate targets. The 20% renewable energy resources and greenhouse gas targets are assumptions for the New Energy Policy.

The EU energy situation in 2020 sets the scene for political decisions to be made (urgently) today.

The report emphasizes that compared to a 'do nothing' approach, Europe's energy demand will decrease if the New Energy Policy is vigorously implemented and there will be less reliance on fossil fuels in 2020 than today. However, it is stated that the energy security will still depend on the primary energy sources which consist of oil, gas, coal and uranium. Concerning energy sources, two trends are evident: 1) indigenous resources and the resulting

[1] For more information, see section 4.2.

reserves in the EU/EEA are declining; 2) the world's resources/reserves are getting concentrated in the hands of a small number of countries.

According to the report, electricity plays a crucial role in the economic and social development and it is a key sector for the EU economy and constitutes an essential component of EU energy security. Electricity has become predominantly commercial however energy security is public good and public authorities bear a responsibility for a market design that is conductive to ensuring that sufficient power will be on offer in order to meet future demand. As it is stated in the report, private actors will make the necessary investments but public authorities are ultimately responsible for a market design that fosters energy security and encourages investments. Thus, EU deals with major challenges to ensure that its generation capacity is adequate in the future:

1) Promoting clean generation and making capacities available on time to produce enough electricity at affordable prices

2) Ensuring reliability with a view to greater diversity of input fuels.

Diversity is described as multifaceted concept; it could be characterized as an energy mix between fuels and technologies which is subject to appropriate switching capacities.

The concept of energy security in Europe encompasses a wide range of issues including energy efficiency, diversification of energy supply, increased transparency of energy demand and supply offers, solidarity among the EU Member States, infrastructure and external relations.

In January 2007, European Commission presented its energy review under the title 'An Energy Policy for Europe' (New Energy Policy) including package of proposals aimed at producing a radical change in the EU's commitments. The main proposals included support for renewable energy sources and reducing greenhouse gas emissions.

EU's energy policies are of importance to our study because the Swedish energy markets are affected primarily by national and EU decisions, although global agreements are becoming increasingly important. Year 2009 is crucial to energy sector because with Sweden's presidency of EU, the Swedish Government promotes five overall priority working areas in which climate, the environment and energy holds the first place.

Swedish climate strategy has been progressively developed since the end of the 1980s through decisions made within the frameworks of environmental, energy and transport policies and central element of this strategy is Sweden's signing and ratification of the United Nations Framework Convention on Climate Change (UN-FCCC) and the Kyoto Protocol. A natural part of the strategy is to ensure, together with EU, that the climate agenda is handled on an international level. The Swedish Government is of the opinion that it is possible to combine a policy for reduction of greenhouse gas emissions with continued successful economic development. (Energy in Sweden 2008)

Today Sweden has no minimum/medium target of emissions on national level, but as a member state, Sweden is included under EU minimum/medium target. Regarding New Energy Policy package, requirement for Sweden's proportion of renewable energy will increase from 39.8% in 2005 to 49% in 2020 and for the emissions Sweden's reduction should be 17%. (Energy in Sweden 2008)

Swedish environmental targets cover sixteen areas and they describe the quality and conditions for the country's environmental, nature and cultural resources that are regarded as ecologically sustainable in the long term. The energy sector affects all environmental targets in one way or another; however six objectives have been pointed out as the most important; reduced climate impact, clean air, natural acidification only, a good built environment quality, living lakes and waterways and maintenance of the grandeur of uplands and mountains. (Energy in Sweden 2008)

Although energy is a key factor in achieving many of the environmental targets that have been set, the sector's environmental impact has not been consistently and comprehensively treated within the environmental objectives structure. The Swedish Energy Agency believes that it is important that energy matters should be considered as an integral part of the development of society in general. (Energy in Sweden 2008)

Above reports give us opinion on why energy sector is so much dynamic and new energy policies should take action immediately. We can draw departing points for our thesis.

Departing points:

- The Swedish energy market is primarily affected by national and EU decisions.
- Political decisions should be taken immediately.
- Private actors make the investments but public authorities are ultimately responsible for a market design that fosters energy security and encourages investments.
- The Swedish Government believes that environmental target and economic development can be achieved by combined policies.

As we mentioned before, the energy sector is a chess board where every actor has to play by the rules of the game. EU and the Government play important roles by putting demands and regulations on the sector. Regarding our concern on SD, the sector needs radical change and this change has to be taken immediately. However all actors have different interests at this point and they try to influence each other on the change. Our departing points lead us to a discussion that how actors and interest organizations interact with each other in order to achieve environmental goals yet at the same time how they fulfill their interests and how environmental goals and economic development can be achieved by combined policies.

1.3. Aim of the Study

By doing this research we aim at describing actors, roles, interests and interactions in the energy sector and analyze the interactions focusing on growth and environment with the help of our theoretical framework. In a broader view, this is a research in sustainable development field. Sustainable development in this thesis will be studied with focus on the concepts "environment" and "growth", and complementary and contradictory aspects of those concepts are discussed. We first conduct a literature study on historical background of discussion on growth and environment as well as theoretical framework by using organizational and institutional theories. Through our empirical findings from Mälarenergi, we aim at explaining how a local energy company is influenced by national and international level environmental policies.

1.4. Research Question

- How national and international policy decisions affect a local energy company and its environmental strategies?
- How do organizations promote sustainable development through collaborations in the Swedish energy sector?

1.5. Target Group

This research targets both academicians and practitioners. It targets academic group because it is a master's thesis project that should be delivered and presented to teachers and fellow students. It also targets practitioners from mentioned sector for that research findings could be presented to organizations that have been studied. The authors believe this paper would represent a recent source for those who are interested in sustainable development and environmental issues.

As dissemination we present our findings to practitioners and to students. Practitioners could be from research partner companies as well as from other interested companies. Another significant target group is energy companies in developing countries, for example the authors' home countries Mongolia and Iran. Our motivation is that since this study presents an example of a local energy company in a developed country it might as well present a learning case study for other countries. We also present our findings to students who study in the areas of sustainable development, environmental studies, ecological economics and energy studies as well. In this way we would like to share our project with candidate graduates of the sustainability studies.

1.6. Delimitation

This research is limited to the concept of sustainable development, especially to the environmental concern. The case study is limited to Swedish energy sector and to a local energy company Mälarenergi AB. Actors in the institutional field of Mälarenergi was identified upon the information gathered from the company and not all the actors for interviewed for the research. Thus stakeholders in the Swedish energy sector in this study are limited to the organizations that are identified. Other limitations can be mentioned as time and language limitations. The research was conducted in a limited time period in order to fit the schedule frame for the master program. Language barrier exists due to the fact that we are non-native English speakers and interview Swedish people, interpret the interviews and write the thesis in English.

1.7. Disposition

The Method chapter presents the development of the thesis, research design and data collection methods as well as method critique. The Theory chapter presents the theoretical and analytical framework for the research based on the literature survey. Historical background of SD is presented in order to give the readers comprehensive overview of the development within the SD field. In the Empirical Findings chapter, we present the information regarding the case study that is collected through interviews and archival records. The Analysis chapter presents analysis of the empirical findings by using the analytical framework. Finally the Conclusions chapter presents the result of the research and recommendations for further studies.

1.8. Key Concepts

Sustainable development: "is development that meets the needs of the present without compromising the ability of future generations to meet their own needs." (WCED, 1987; p.43)

The essence of this form of development is a stable relationship between human activities and the natural world, which does not diminish the prospects for future generations to enjoy a quality of life at least as good as our own.

There has been recognition of three aspects of sustainable development (Harris, 2000):

- ***Economic:*** An economically sustainable system must be able to produce goods and services on a continuing basis, to maintain manageable levels of government and external debt, and to avoid extreme sectoral imbalances which damage agricultural or industrial production.

- ***Environmental:*** An environmentally sustainable system must maintain a stable resource base, avoiding over-exploitation of renewable resource systems or environmental sink functions, and depleting non-renewable resources only to the extent that investment is made in adequate substitutes. This includes maintenance of biodiversity, atmospheric stability, and other ecosystem functions not ordinarily classed as economic resources.
- ***Social:*** A socially sustainable system must achieve distributional equity, adequate provision of social services including health and education, gender equity, and political accountability and participation.

Environmental stress has often been seen as the result of the growing demand on scarce resources and the pollution generated by the rising living standards of the relatively affluent. We will focus on environmental aspect of sustainable development in this paper. Different interpretations and definitions of SD will be provided in the Theory chapter.

***Growth*:** Increase in a country's productive capacity, as measured by comparing gross national product (GNP) in a year with the GNP in the previous year. In recent years, the idea of 'sustainable development' has brought in additional factors such as environmentally sound processes that must be taken into account in growing an economy (Business Dictionary)

Energy sector: The energy sector is defined in this report to include both energy production and final energy consumption in the end-use sectors. Energy production includes public electricity and heat (power) production, oil refining and the production of solid fuels. The end-use sectors are households, industry and services and transport.

Stakeholders: actors/stakeholders in a given industrial sector. Söderbaum (2000) defined stakeholders as "those who have something to stake in relation to the policies and activities of the company". Those consist of companies, suppliers, customer, media, non-governmental organizations (NGO), governmental agencies, as well as financial, commercial, legal, academic or health organizations.

Organization: is a consciously coordinated social entity, with a relatively identifiable boundary, that functions on a relatively continuous basis to achieve a common goal or set of goals (Robbins, 1990:p4).

2. METHOD

In this chapter the research design and the methods of data collection will be described. The method critic will be shown, pointing out the advantages and disadvantages of the methods used. The test of the chosen methods in the area of validity and reliability will also be discussed in order to justify the approach used.

2.1. Choosing a Topic

Fisher (2004: p25) stresses that choosing the topic is a very important step almost to get the project started and it should be interesting and exciting because it might be hard to keep the motivation and commitment when completing the master paper. In the beginning, choosing a specific topic for this thesis was not clear to the authors. What was clear and what we both were interested in was that we would like to write our thesis on an on-going debate in the field of sustainable development. Sustainable development was an attractive theme for the authors due to personal interest and engagement and the authors knew that it would be also interesting for our potential target group. During the proposal stage, the authors discussed with tutors and professors, conducted preliminary literature study and surveyed for the potential thesis partners – companies – in order to decide on a specific topic.

Although the direction of the topic changed few times the authors decided to focus on the energy sector because of the sector's increasing debates and issues regarding sustainable development. Once we were decided on a certain sector, our focus of study naturally fell on Mälarenegi AB because it was the biggest local energy company and focusing on local company would provide easier access to data we would need. The authors believe that local company and actors in its institutional field will give an in-depth study of the topic.

2.2. Research Design

This thesis project is conducted as holistic, single case study because the subject is a case about a chosen company. Mainly the thesis is based on qualitative research methodology. Semi-structured and open ended questions are used as interviews for the purpose of getting in-depth understanding of the topic. Fisher (2004) states that case studies enable us to give a holistic account of the subject of the research. In particular, they help the researcher to focus on the interrelationships between all the factors, such as people, groups, policies and technology that make up case studies.

According to Yin's classification, this thesis would fall into exploratory type of case study because the area of the study (SD) is rather new and less studied.

An ***exploratory*** research design aims to develop understanding in an area that is little understood (Yin, 1994). Even though its popularity in recent years we believe that sustainable development research is limited and little understood. A research about sustainability, – especially within energy field, is not widely done as it is widely spoken and written. We have come across very few numbers of previous studies that are conducted in the field during our preliminary literature study which made us more curious about conducting a research on the topic. Yin (1994) suggests that it is appropriate to use qualitative methods while carrying out an exploratory research since 'exploratory research' implies there is less of a basis from which to conduct research, and that a given area is not well understood. Therefore, we used qualitative research methods such as semi-structured and open end interviews.

Moreover, this research could be seen as an ***interpretive*** study. According to Fisher, people who take an interpretive approach to research see the link between understanding and action as an indirect one. Obviously understanding sustainable development and acting upon the concept is not a direct link. Knowledge about the concept cannot provide clear prescriptions for how to act. Sustainable development only tells us what's wrong or what should be done in order to prevent unsustainable future. However, in practice it is hard to implement those theories and suggestions. Fisher (2004) argues that understanding a situation should help us to use our judgment to arrive at a better choice of action. According to the author, interpretive approach is about meanings and interpretations of all those different thoughts, ideas, opinions and expressions, thus it is a dialogic process which means the meaning is developed through human interactions.

Hermeneutics is a general term for the process of interpreting human actions, utterances, products and institutions (Fisher, 2004). According to Alvesson and Sköldberg (2000), there are two types of hermeneutics; objectivist and alethic. Objectivist hermeneutics results in the understanding of underlying meaning, not the explanation of causal connections, whereas alethic hermeneutics focus on truth as an act of disclosure, in which polarity between understanding and explanation is dissolved (Alvesson&Sköldberg, 2000).

Hermeneutics has a theme that the meaning of a part can only be understood if it is related to the whole. This "part – whole" circle is representing objectivistic hermeneutics. Alethic hermeneutics is represented by a circle that consists of pre-understanding and understanding parts because in this way an element of scientific theory is inserted over and above humanist interpretation. (Alvesson&Sköldberg, 2000)

Alvesson&Sköldberg (2000) design four aspects of hermeneutic interpretation:

1. *Pattern of interpretation:* refers to the overarching set of interpretations of a certain text, that is, the coherent whole of partial interpretations. It corresponds to the 'theory' of various extra-hermeneutic discourses. In our case, it involves interpretation of theories about conflicting discourses of growth and environment and interpretations of interviews with different actors.

2. *Text:* can be literal, consisting of written or spoken words. The important thing here is to see texts as something – meaningful signs. Texts in this research consist of literature, documents, archival records, as well as interview records.

3. *Dialogue:* hermeneuticians use the procedure of asking questions to the text, and listening to it, in a dialogic form. In this way we go back and forth between old aspect of pre-understandings and new understandings. Dialogue process is experienced in this research as pre-understanding of theoretical literature and pre-understanding of interviews and going back to the theories and gaining new understanding of the theory and going forth to the interviews and gaining new understanding of the interviews.

4. *Sub-interpretation*: is continually formulated in the course of the process of interpretation. Sub-interpretation was formulated continually under the process of literature study and interview transcription processes.

Hermeneutic interpretation approach is fit for our thesis project due to the complex nature of the topic. It requires deep understanding both theoretical and practical sides of the topic. In general, sustainability is written in the texts that how it should be but the problem is how it is delivered in the action. Every actor approaches to the issue in from different points of views and interests. It involves not only technical and practical knowledge but also emancipation which means inclusion of feelings, attitudes etc. Biggest challenge here is to understand different parts of the 'whole' sustainability thing and explain it so that we could find better ways to realize it.

2.3. Data Collection

In order to carry out a satisfactory result, both primary and secondary data was collected from different sources. Data is categorized primary or secondary according to their contribution and relatedness to the research topic.

2.3.1. Primary Data

Primary data for this research was mostly obtained through interviews but some official publications were also used as primarily data. The authors believe that publications and/or reports issued by government offices are reliable source for data. However we have to bear it in mind that the government offices are interest organizations at the same time.

2.3.2. Interview Approach

There is much greater interest in the interviewee's point of view in qualitative interview, but in quantitative research the interview reflects the researcher's concerns and the approach is structured to maximize the reliability and validity of measurement of the concepts. Qualitative interviewing tends to be flexible, responding to the direction in which interviewees take the interview and perhaps adjusting the emphases in the research as a result of significant issues that emerge in the course of interviews. (Bryman, 2004: p319-320)

The first interview was planned with Erik Dahlqvist, energy engineering professor at Mälardalen University. This first interview could be seen as guidance for our next interviews and an important input to the paper since the respondent is both academic person and has deep experience in the energy field. The interview was scheduled for one to one and half hour and the questions were prepared in semi-structured form. Semi-structured interview method was chosen due its possibility to provide interviewees and interviewers chance to elaborate on the answers and add questions to take advantage of new information.

Following interviews were planned to include key respondents from the company upon suggestion by Erik Dahlqvist. We realized it was great opportunity to ask Erik Dahlqvist for suggestion for potential interviewees in Mälarenergi based on his experience with the company. He could direct us to related persons who could provide us the right information. With his suggestion and on the information gained during interview Erik we have planned interviews with key managers from Mälarenergi and individuals from county authority and municipal environment issues.

2.3.3. Choice of Respondents

Erik Dahlqvist is professor in energy engineering at School of Sustainable Development of Society and Technology at Mälardalen University since 2000. He is also research director for the profile that is called process and resource organization. The interview with Erik Dahlqvist was held on 8 April 2009 at his office at Mälardalen University.

Katarina Hogfeldt Forsberg is manager of the Environment, Quality and Safety division at Mälarenergi AB. Her role is to keep together the company's environmental system and work with different business divisions and different projects. The interview with Mrs. Forsberg was held on 28 April 2009 at Kraftvärmeverket Building.

Jonas Persson works at Mälarenergi Elnät AB which is partly (65%) owned by Mälarenergi AB. He is manager at the Marketing Department and responsible for customer relations both business customers and private consumers. The interview with Jonas Persson was held on 27 April 2009 at Mälarhuset.

Jan Berglund is distribution manager at Heat business area of Mälarenergi. He was suggested by Jonas Persson. He is responsible customers of district heating which consist

96% of all household in Västerås. The interview with Jan Berglund was held on 6 May 2009 at Mälarhuset.

Mats Lindberg is manager at Hydro- Wind Power business area of Mälarenergi. He was suggested by Jan Berglund because he could give us more information on alternative resources for energy that Mälarenergi trying to develop. The interview was held on 18 May 2009 at Mälardalen University.

Thomas Forsberg is director of the Environment Health Office (EHO) at Västerås City. He works with environment, health and food issues in the city and the EHO is an authority office. The interview was held on 8 May 2009 at his office.

Theresa d'Errico and **Johanna Olsson** work at the Environment Planning Office at Västerås City Municipality. They are responsible for sustainable development issues and Ms. Olsson is specialized in energy sector. They were suggested by Thomas Forsberg and the interview was held on 12 May 2009 at the City Hall.

2.3.4. Secondary Data

The gathering of information took place at the University Library in Västerås. When using the search engines ABI/Inform, ELIN, BOOK-IT, Libris, and Emerald at University of Mälardalen, the keywords "sustainable development", "sustainability", "growth and environment", "inter-organizational relations", "energy and growth", "energy and environment", "stakeholder", "environmental cooperation", "environmental conflict", "green energy", "renewable energy" were used.

Bryman (1989) describes that secondary data includes letters, reports to shareholders, memorandums and chief executives' speeches, and statistical materials refer to various company records. Thus, web pages of different organizations were visited in order to get basic information and if needed request for additional information was sent by emails.

Here are the list of publications and reports that are used as secondary data:

Energy in Sweden 2008 report is published by Swedish Energy Agency. The report summarizes Sweden's energy outlook in 2008. This report is a primary source for the research because it provides reliable information about Sweden's energy sector today.

Europe's Energy Position: Present & Future is a market observatory for energy report and published by European Commission. The main point in the report is the proposed New Energy Policy.

Towards Solutions – Sustainable Development in the Energy Sector is published by International Energy Agency and it covers problems and solutions regarding sustainable development in the energy sector.

Energy and Environment report 2008 is published by European Environment Agency and it assesses the key drivers, environmental pressures and some impacts from the production and consumption of energy, taking into account the main objectives of the European policy on energy and environment including: security of supply, competitiveness, increased energy efficiency and renewable energy, and environmental sustainability.

2.4. Reliability

Bryman (2004: p71) states that reliability refers to the consistency of a measure of a concept. The three factors involved in reliability of a measure are:

- ***Stability:*** considers whether a measure is stable over time, so that we can be confident that the results relating to that measure do not fluctuate.
- ***Internal reliability:*** considers whether respondents' scores on any one indicator tend to be related to their scores on the other indicators.
- ***Inter-observer consistency*****:** when a great deal of subjective judgment is involved in such activities as the recording of observations or translation of data into categories and where more than one observer is involved in such activities, there is possibility that there is lack of consistency in their decisions.

In this thesis work much attention was put into obtaining the right data and information for a reliable and valid measure. Data was collected from a number of scientific researchers and major references within the research field. The interviews were done with the key people who are responsible for the related departments and who have experience with the related topic. Moreover, interviews were recorded which enabled us to go back and listen to the responses over and over to understand the whole meaning. Therefore we believe that the information obtained is stable and internally reliable. Regarding the third factor, inter-observer consistency, the authors spent lot of time discussing their opinions and judgments in order to conclude with consistent decisions.

2.5. Validity

The validity shows whether the study was a success at measuring what the researchers set out to measure (Bryman, 1989). The validity refers to the degree of the research findings exactly represent what is really happening in the situation i.e. to make sure that the research measures what it is supposed to measure. The validity of a study can be lacking if the procedure of the research has poor samples that are incorrect or has misleading measurement. There are several

ways of establishing validity however we will focus on some of the validities that are taken into consideration in our paper.

- ***Face validity.*** The measure apparently reflects the content of the concept in question. Bryman (2004: p73) states that people who have experience or expertise in a field might be asked to act as judges to determine whether on the face of it the measure seems to reflect the concept concerned. We have asked Professor Erik Dahlqvist in the field of sustainable development who has also experience and researches in the energy sector about his opinion on our research topic. His response was that the topic was relevant and interesting regarding actors and people involved.

- ***Construct validity.*** The researcher is encouraged to deduce hypotheses from a theory that is relevant to the concept (Bryman, 2004: p73). We could say that this thesis is mostly a deductive study where we conducted theoretical study and then the research is guided by the theoretical frameworks.

- ***Internal validity.*** This refers to the issue of causality. (Bryman, 2004: p29).

- ***External validity.*** This issue is concerned with the question of whether the results of a study can be generalized beyond the specific research context (Bryman, 2004: p29). We believe that the results of this study on 'Organizational interactions in the energy sector regarding growth and environment' can be generalized beyond the context of the energy sector because SD issues are applicable to any sector.

2.6. Method Critique

Bryman (2004: p284) argues that qualitative research can be too subjective. The author states that qualitative findings rely too much on the researcher's unsystematic views about what is significant and important, and also upon the close personal relationships that the researcher strikes up with the people studied. Moreover, he argues that the scope of the findings of qualitative investigations is restricted. When participant observation is used or when unstructured interviews are conducted with a small number of individuals in a certain organization or locality, it is argued that it is impossible to know how the findings can be generalized to other settings.

This thesis is carried out within the range of a certain region – Swedish energy sector – and involves a local company. Thus the results cannot be generalized for other companies in Sweden though it can be used as moderatum generalization which means those generalizations will always be limited.

3. THEORY

This chapter will present theoretical references SD with more specific focus on growth and environment. Then institutional and organizational theories that will be used for analysis will be presented and discussed. Finally analytical framework will be drawn based on our theoretical study.

3.1. Nature and Society

"There was always someplace else to go when things got too difficult, either by reason of the deterioration of the natural environment or a deterioration of the social structure in places where people happened to live."
- Boulding (1966)

As it would be discussed in any SD research, we first discuss the fundamentals of the SD emergence. SD is a controversial concept and there exist many different views on the topic. We take the 'nature and society' view which discuss the problems of development of the society and sustainability of the nature. Ropke (2003) argues that human society is always nature; social processes are integrated with metabolic processes and the enormous increase in human population and economic activities imply that nature's basic support of human life can be threatened. As it is suggested, society is a part of nature and nature is supposed to support society. Society as human being is also a natural being because human has to rely on nature for its survival. Early 'naturalists' like Charles Darwin show that the existence and sustainability of the natural system was dependent upon the inter-relationships between its parts (Gancher cited in Sweet, 2000). During long history, nature and society lived in harmony. So what was the problem that threatened this harmony? McDonagh and Prothero (1997:p8) stress on the doctrine of *human exceptionalism*: that humans are fundamentally different from and superior to all other species; that people can determine their own destinies and learn whatever is necessary to achieve them; that the world is vast and presents unlimited opportunities; and that the history of human society is one of unending progress.

When we talk about nature and society, Ecological Economics is important because it addresses the relationships between ecosystems and economic systems in the broadest sense (Costanza, 1989). Several social changes and related discourses were instrumental in preparing ground for ecological economics (Ropke, 2003). Firstly, the new conceptualization of pollution and environment that became part of the public awareness from the beginning of the 1960s (i.e. Boulding, 1966). Secondly, the dramatic increase in the world population and the question of food and other resources that characterized in the beginning of the 1970s (i.e. Meadows et al). Finally, the discourse on energy especially after the oil price shock in 1973 become central to the development of ecological economics (Ropke, 2003).

In 1980s and 1990s, issues of conservation and use of genetic resources and biological diversity, global warming, the fate of indigenous people, equity in international trade, and climate change were hotly debated and discussed (Sweet, 2003). Managing or finding

solutions to some of the environmental threats are critical to sustaining life on earth while other environmental problems are important but less of an immediate threat (Sweet, 2003). Most of time rapid economical and radical technological developments are held responsible for environmental problems. For example, industrial revolution, which enabled human-being to take a further step in its history (Stearns, 2007), had caused huge environmental pollutions as a result of growing factories.

In 1987, the World Commission on Environment and Development (WCED) was held and a report called 'Our Common Future' was submitted.

According to the 'Our Common Future', much of the improvement in the past has been based on the use of increasing amounts of raw materials, energy, chemicals, and synthetics and on the creation of pollution that is not adequately accounted for in figuring the costs of production processes. Newly industrializing economies have shown the way to high growth and rapid poverty reduction, but at the expense of severe environmental losses. This experience shows that the challenges of growth and the environment must be addressed simultaneously. (WCED, 1987)

Discussing SD from the 'nature and society' perspective provides basic understanding of the significance of the topic. Once we accept to look at the nature and society as a whole then the concept of SD is unavoidable. As we mentioned earlier there are many different interpretations and definitions of SD, however we will not discuss the issue from SD itself but from rather specific concepts such as growth and environment.

3.2. Growth and Environment

We argue that growth and environment are contradictory but complementary concepts because growth cannot occur limitless, for example 'spaceman economy' metaphor of Boulding, at the same time growth and the environment are so natural components of the nature and society. Following these assumptions we provide different researchers' discussions in this section. While presenting the different perspectives on the discourse of growth and environment we follow timeline in order to develop the discussions. SD is perceived as a newly developed concept in many cases; however the discussions around the topic date back to 1960s.

In 1966, Kenneth Boulding produced his article 'The economics of the coming spaceship Earth', in which he highlighted the danger of steadily increasing production levels, both in terms of reducing finite resource stocks and in terms of environmental pollution. Boulding (1966) describes the current economy as the "cowboy economy", the cowboy being symbolic of the illimitable plains and also associated with reckless, exploitative, romantic and violent behavior, which is characteristic of open societies. Similarly the closed economy of the future might be called the "spaceman economy", in which the earth has become a single spaceship, without unlimited reservoirs of anything, either for extraction or for pollution.

Some research groups such as the Rome Club[2] consider that we have already exceeded the population and (average) consumption levels which the planet can bear. However, other researchers are extremely critical of this analysis and are of the opinion that the "Malthusians"[3] misunderstand the difference between growth in the physical and the economic sense and that there is a great potential for further economic growth through substitution and technical development.

In 1972, the campaigning of the group of like-minded individuals gained a new worldwide reputation with the first report to the Club of Rome: "The Limits to Growth", commissioned by the Club from a group of systems scientists at the Massachusetts Institute of Technology. The Report explored a number of scenarios and stressed the choices open to society to reconcile sustainable progress within environmental constraints (Club of Rome homepage).

In "Limits to Growth", a world model was constructed to estimate the future impact of continuous exponential growth under a number of different assumptions. The model assumed that population and industrial capital would continue to grow exponentially, leading to a similar growth in pollution and in demand for food and non-renewable resources. The physical, economic or social relationships were assumed to remain unchanged as well as the supply of both food and non-renewable resources which led to a prediction of collapse due to non-renewable resource depletion. (Cole, 1999)

Consequently the book attracted much attention in not only academic but also in society. Cole (1999) argues that the debate on the book continues throughout the 1970s and major critiques were addressed questioning the model's assumptions, particularly the assumption of finite limits to non-renewable resources. However, the authors of 'Limits to Growth' argue that 'limits to growth' is misunderstood as fossil fuels or some other resources will soon be exhausted. However, the concept is more subtle; it reflects auhtors' worry that current policies will produce global overshoot and collapse through ineffective efforts to anticipate and cope with ecological limits (Meadows et al, 2004).

Meadows et al (2004) emphasize that humanity is in overshoot and that the resulting damage and suffering can be greatly reduced through wise policy. To overshoot means to go too far, to go beyond limits accidentally – without intention. The three causes of overshoot are always the same, at any scale from personal to planetary. *First,* there is growth, acceleration, rapid change. *Second,* there is some form of limit or barrier, beyond which the moving system may not safely go. *Third,* there is a delay or mistake in the perceptions and the responses that strive to keep the system within its limits.

[2] The Club of Rome is a not-for-profit organization, founded in 1968, independent of any political, ideological or religious interests. Its essential mission is "to act as a global catalyst for change through the identification and analysis of the crucial problems facing humanity and the communication of such problems to the most important public and private decision makers as well as to the general public." Its members come from the scientific, political, business, financial, academic, religious, cultural and civil society communities.

[3] Named after English economist the Reverend THOMAS ROBERT MALTHUS (1766-1834), who believed that population would increase at a geometric rate and the food supply at an arithmetic rate. Malthusians are referred as 'growth pessimists'.

On the other hand, Sterner (2003) argues that there does not need to be a conflict between growth and environment but there can be: growth does not automatically lead to improvement from the environment point of view. The composition of goods produced in the economy is determined by demand on the market. When people's incomes increase they will eat more meat and drive more cars. These kinds of preferences or consumer habits can result in severe strains on the environment.

In recent years, industrial countries have been able to achieve economic growth using less energy and raw materials per unit of output. This, along with the efforts to reduce the emission of pollutants, will help to contain the pressure on the biosphere. But with the increase in population and the rise in incomes, per capita consumption of energy and materials will go up in the developing countries, as it has to if essential needs are to be met. Greater attention to resource efficiency can moderate the increase, but, on balance, environmental problems linked to resource use will intensify in global terms. (WCED, 1987)

One fundamental question is whether growth can continue indefinitely. Ecologists feel instinctively that nothing can grow forever in a limited space, for example the globe. Man has already taken over half of the planet's biomass production for his own needs. This shows that the limits are not just hypothetical future limits and that we are already using a large part of our "living space". (Sterner, 2003)

In 1992, United Nations Conference on Environment and Development was held in Rio de Janiero (known as Rio Summit or Earth Summit) which produced number of documents including Rio Declaration on Environment and Development and Agenda 21. Some main points from the Rio Declaration are:

- Human beings are at the centre of concerns for sustainable development. They are entitled to a healthy and productive life in harmony with nature.
- The right to development must be fulfilled so as to equitably meet developmental and environmental needs of present and future generations.
- In order to achieve sustainable development, environmental protection shall constitute an integral part of the development process and cannot be considered in isolation from it.
- States shall cooperate in a spirit of global partnership to conserve, protect and restore the health and integrity of the Earth's ecosystem.

These principles stress on the importance of human and nature interdependence, environmental protection on the development process and importance of cooperation in achieving global SD goals.

Last but not least, the Stern Review on the Economics of Climate Change (2006) brings hot debate to the topic. The report concludes that climate change could have very serious impacts on growth and development. If no action is taken to reduce emissions, the concentration of greenhouse gases in the atmosphere could reach double its pre-industrial level as early as 2035. This rise would be very dangerous indeed; it is equivalent to the change in average temperatures from the last ice age to today. Such a radical change in the physical geography of the world must lead to major changes in the human geography – where people live and

how they live their lives. Even at more moderate levels of warming, all the evidence – from detailed studies of regional and sectoral impacts of changing weather patterns through to economic models of the global effects – shows that climate change will have serious impacts on world output, on human life and on the environment. (Stern Review, 2006)

The report also concludes that the risks of the worst impacts of climate change can be substantially reduced if greenhouse gas levels in the atmosphere can be stabilized. Stabilization – at whatever level – requires that annual emissions be brought down to more than 80% below current levels. This is a major challenge, but sustained long-term action can achieve it at costs that are low in comparison to the risks of inaction.

The costs of stabilizing the climate are significant but manageable; delay would be dangerous and much more costly.

Emissions can be cut through increased energy efficiency, changes in demand, and through adoption of clean power, heat and transport technologies. Even with very strong expansion of the use of renewable energy and other low carbon energy sources, fossil fuels could still make up over half of global energy supply in 2050. Coal will continue to be important in the energy mix around the world, including in fast-growing economies. Extensive carbon capture and storage will be necessary to allow the continued use of fossil fuels without damage to the atmosphere. With strong, deliberate policy choices, it is possible to reduce emissions in both developed and developing economies on the scale necessary for stabilization in the required range while continuing to grow. (Stern Review, 2006)

Wrapping up, the debate on growth and environment continued to gain attention and importance as years passed by. In the beginning, researchers and NGOs (e.g. Club of Rome) were trying to attract the public attention and sometimes they were facing severe criticisms because it was hard to see the consequences that time. In recent years, the course of the debate changed and it took more political approach involving nations and governments. It shows that the discourse of growth and environment is unavoidable. In the following sections we present institutional and organizational theories which are more central to our research. Now that we presented historical and theoretical background, the next step is to look into organizational field to see how organizations interact regarding growth and environment.

3.3. Institutional Theory

Institutional theory is a framework for our thesis because the research is about organizational field of a local energy company and we want to study roles of actors involved in the energy sector. In this thesis, politicians, authorities, environmental organizations, investors, suppliers, customers, branch organizations and associations are important actors in the Mälarenergi organizational field. The study of organizational field provides an in-depth understanding of the organizational interactions. Keeping in mind the theoretical and historical background of the growth and environment, there is much to study about how organizational interactions are

influenced by the pressures and policy decisions taken on for example Rio Summit and/or WCED.

Environmentalism and Stakeholder

We take an insight into organizational environmentalism and stakeholders which provides a theoretical reference for Mälarenergi's organizational field. DiMaggio and Powell (1991) argue that organizations in an organization field create institutions when they interact with each other and then influenced by these institutions. Once an organization is viewed as an institution, it takes on the sociological level which means that it is not simply black boxes that produce goods and services but human organizations driven by emotion and tradition (Jaffee, 2001:p227). The institutional environment is "characterized by the elaboration of rules and requirements to which individual organizations must conform if they are to receive support and legitimacy from the environment" (Scott and Meyer cited in Jaffee, 2001:p228).

Robbins (1990:p205) describes organizations as open systems and argues that the key to understanding organizations as open systems is the recognition that organizations interact with their environment. The author differentiates between organization's general environment and specific environment. General environment may have an impact on the organization, but its relevance is not clear. On the other hand the specific environment is that part of the environment that is directly relevant to the organization in achieving its goals.

We should underline that the environment Robbins and Jaffee are referring to is the organizational environment not the natural environment. Organizational environment is important to understand organizations' interactions outside their boundaries. Growther and Green (2004:p163) defines this external environment as that it includes both the business environment in which the firm is operating, the local societal environment in which the organization is located and the wider global environment.

Environmentalism provides an explicit recognition that stakeholders other than the legal owners of the organization have power and influence over that organization and also have a right to extend their influence into affecting the organizations activities (Growther and Green, 2004:167). Söderbaum (2000:p46) stresses that a move from neo-classical theory of firm to a stakeholder model is a significant step. Stake can be based on ownership, contractual relationships or on non-contractual relationships as well as those who will be affected by specific decision situations. An important issue Söderbaum argues about is the limits to the stakeholder model. He argues that we should take into consideration that there are differences in power between actors and also interested parties related to an organization may have conflicting interests.

Organizational actors respond to various pressures for change, such as new economic conditions, new technological developments, shifts in the state policies or laws, and attempts by actors to alter the balance of power within the sector (Campbell published in Magnusson and Ottosson, 1997). The author argues that already existing inter-organizational relations embody a degree of rigidity out of which it is difficult for actors to break as well as the

existing balance of power limits the ability of less powerful actors to pursue institutional changes that would increase their power.

Svendsen (1998:p38) stresses that the sustainability literature and the 'environmental revolution" help us to understand the movement toward more collaborative approaches to stakeholder relations. First, experience shows that the environmental sustainability affects companies' business in a good way. Second, business has a major role to play in ensuring society's sustainability. Third, the individual business leaders must undergo a profound transformation in their personal values away from the techno-centric views of past years toward a future-oriented view of the world.

Many business leaders and managers, despite wanting to 'do the right thing', are unsure where to start. They might agree that building strong, mutually beneficial stakeholder relationships is important, but few understand how to establish and maintain win-win associations (Svendsen, 1998:p14).

Welford (2000:p101) emphasizes that talking of sustainable company is not easy however it may be possible to talk of business acting in a way which is consistent with sustainable development. The author states that firms engaging in a sustainable development dialogue would be conceived of as lying at the centre of a network of social relationships which are articulated by a stakeholder model.

Isomorphism

According to Sevón (1996), "to imitate is to act like someone else with the more or less conscious intent to achieve the same, or similar, consequences. It is a way of learning from others' experience of having done and achieved something. (…) One does not have to use a trial–and–error strategy". DiMaggio and Powell (1991) categorized three types of isomorphism:

1. **Coercive isomorphism:** results from pressures from the legal, political, cultural, and organizational environments on which an organization is dependent. This is a direct and explicit imposition of organizational models, however, not all institutional isomorphism derives from coercive authority.

2. **Mimetic isomorphism:** this type of isomorphism is due to uncertainty, for instance, when goal is ambiguous or when the environment creates uncertainty. New organizations are modeled upon old ones throughout the economy and tend to model themselves after similar organizations in their field that they perceive to be more successful.

3. **Normative isomorphism:** this source of changes stems from professionalization. Professionalization is understood as the efforts to control the production and to establish a legitimating for the organizational field.

The similarities amongst organizations can make it easier for them to transact with other organizations and to fit into administrative categories that define eligibility for public and

private grants and contracts (DiMaggio and Powell, 1991). There are many hypotheses, which try to predict isomorphic changes.

Following these hypothesis we can draw that there is one main reason to think so, it is that the more success of an organization, the greater the extent to which other organization will model itself on this successful organizations. It is clear what a company looks for is benefits and success. Another reason could be the uncertainties or ambiguous goals of new companies and these companies adopt the model of bigger and older companies. It is suggested that pressures from outside and/or inside the organization shape the structure of the organization through a process of institutionalization. Examples of the pressures are laws, regulations, and societal norms, as well as the influence of internal groups or professionals.

Sweet (2000) argues that even though individual firms do not directly participate in development towards sustainable practices, those who imitate environmental solutions in industrial field still indirectly contribute to the environmental compliance. Sterner (2003) argues that there can be companies which are attracted by the possibility of plundering natural resources, of bribing that in power and of employing a fairly destitute labor force which does not make demands.

When to study three companies' environmental strategies, Schwartz (2004) states that the companies undergo a complex process when they must adapt to the surrounding world's growing environmental consciousness and demands. At the same time the companies try to achieve legitimacy through their actions, which means that they strive for consistency between themselves, their actions and their surrounding worlds.

Institutional theory and stakeholder theory provide that how organizations imitate each other when they try to cope with their environment. In the energy sector and in the case of growth and environment it is important to understand how the pressures on higher level impact on lower level such as EU decisions impact on local company. While studying organizational field it suggests that stakeholders in one company's organizational field impact on the company's relationships. As Söderbaum argues, there might exist interest conflict and power inequality however in order to achieve SD organizations have to co-operate (win-win situation). In the following section we elaborate on this.

3.4. Inter-organizational Collaborations

Previous sections on growth and environment and institutional theory draw lines that intersect in the point that is 'collaboration'. There could possible many different relationships be formed in the organizational field such as partnership, alliance, joint ventures, or even conflict. Why we take co-operation and collaboration then? Our motivation here is that SD, specifically growth and environment, can be achieved through collaboration and co-operation. Although co-operation and collaboration sound similar concepts they are different and we will present different interpretations and definitions in this section.

Characteristics of successful inter-organizational relationships include agreed goals and common purpose, high motivation for success, having the right people and the right leadership, maintaining balanced relationships, trust and respect, good communication and formalization of the status of the relationship as essential for partnership success (Casey, 2008). The growth of inter-organizational relationships is fostered by frequent communications to formalize the relationship and build consensus about the terms of the relationship among the parties involved (Van De Ven & Walker cited in Casey, 2008).

Cooperation is defined as coordinated actions taken by parties to achieve mutual outcomes. Advocates of inter-firm cooperation argue that alliances, joint ventures, and other forms of collaboration are largely precompetitive, because they help firms to reduce risk and lower costs. The interaction of cooperation results in cooperative behavior, allowing the partnership to work by ensuring that both parties receive the benefits of the relationship. (Hardy et al, 2003)

Moxen and Strachan (1998:p16) talks about a different form of co-operation that is the environmental network, the function of which is to co-ordinate the actions and environmental programs of those organizations who elect to join. The authors argue that networks are the key delivery mechanism for local, regional, national and international environmental policies. Ekbia and Kling (2005) states that the cooperation among firms in different forms and capacities – asset, technology, expertise, information, etc. – is the cornerstone of the network enterprise and what motivates a networking strategy in the first place.

In his book 'The Formations of Inter-Organizational Networks', Ebers (1997) focuses on the contingencies and processes that lead to the emergence of inter-organizational networking relationships. The author stresses that the motives for forming an inter-organizational networking vary from revenue increase to cost and risk reduction. However he also argues that motives alone cannot provide guidance for explaining these relationships or their organizational form. Ebers (1997:p8) states that at the institutional level, certain political, legal, cultural, industry, and/or regional environmental conditions impact on the likelihood of network formation.

Kumar and van Dissel (1996) states that many authors outline benefits and advantages of inter-organizational relationships while some author recognizes the potential for conflict in these relationships. When forming relationships organizations have to depend on each other and Kumar and van Dissel (1996) suggests that the level and nature of interdependence are likely to influence the potential and source for conflict. Moreover the authors stress that if a resource is to be shared by a number of independent parties, the resource will need to be clearly identified, defined, and standardized otherwise there would be no agreement about the object of sharing.

Conflict is defined as "a situation in which one channel member perceives another channel member(s) to be engaged in behavior that is preventing or impeding it from achieving its

goals" (Stern and El-Ansary cited in Rose and Shoham, 2004). Conflict is the process that begins when a person or group feels negatively affected by external entities. The reasons for conflict occurrences are varied, ranging from incompatible personalities to offensive behavior, and to a perceived divergence of interests. Closer to the corporate context, comprehensive studies of organizational conflicts point to the undermining of task-related values as the main culprits behind team disorders (Tan et al, 2005:3)

Longoria (2005) stresses that unfortunately, the meaning of inter-organizational collaboration is unclear and the outcomes of the application of this concept are not well understood. The author argues that an urgent need exists for all human service stakeholders to engage in critical thinking, dialogue, and generating a knowledge base concerning the outcomes of inter-organizational collaboration in the specific context of the lives of individuals who received services from organizations that practice inter-organizational collaboration.

Inter-organizational Collaborations

While a range of different definitions of collaboration exists in the literature, we use definition by Hardy et al (2003) that is collaboration as a cooperative, inter-organizational relationship that is negotiated in an ongoing communicative process, and which relies on neither market nor hierarchical mechanisms of control. This definition of collaboration is inclusive enough to encompass a wide range of collaborative arrangements (e.g., consortium, alliances, joint ventures, roundtables, networks, associations), and yet provides a set of critical characteristics that distinguishes it from other forms of inter-organizational activity. Most importantly, it distinguishes collaboration from those inter-organizational relationships that are cooperative, but where cooperation is either purchased, as in a firm's supplier relationships, or based on some form of legitimate authority, as in a relationship that might occur between a state regulatory agency and a firm operating within its jurisdiction.

Effects of Collaboration

Inter-organizational collaboration has been linked to a range of important outcomes for collaborating organizations. The strategy literature emphasizes the way in which collaboration between organizations results in the sharing of critical resources and facilitates knowledge transfer. The learning literature argues that collaboration not only transfers existing knowledge among organizations, but also facilitates the creation of new knowledge and produce synergistic solutions. Finally, research on networks and inter-organizational politics suggests that collaboration can help organizations achieve a more central and influential position in relation to other organizations. (Hardy et al, 2003)

Strategic effects refer to the way in which collaboration helps organizations to improve their strategic performance by developing an enhanced competitive advantage as a result of a variety of activities, including sharing resources, developing technological knowhow, sharing knowledge, acquiring new distribution outlets, building a greater understanding of new

markets, and securing access to scarce assets. According to this view, collaboration is about working with partners to leverage existing resources of all kinds to provide maximum strategic benefit. Thus the strategic effects of collaboration are primarily about the pooling and transfer of resources of all kinds. (Hardy et al, 2003)

The reasons for collaborating are clear: organizations should collaborate to gain access to combinations of resources that produce new or improved capabilities that allow organizations to do things they could not do alone. While these organizations do not face market pressures, they still compete for funding, clients and government endorsement, and the acquisition of distinctive resources still has a 'competitive' advantage. In sum, the development of capacities within organizations is an important potential effect of inter-organizational collaboration. The key to these strategic effects is the extent to which the new capacities are distinctive and consequently provide a competitive advantage to the organization. (Hardy et al, 2003)

Collaborations necessarily change the network of interactions between organizations for the duration of the collaborative relationship. However, the effects of the collaboration may be much broader than the single collaborative relationship and may endure beyond the life of the collaboration. For instance, collaboration may generate ties between organizations that are not directly involved in the collaboration or change the broad pattern of resource and information flows across the network. Therefore the network transformation effects of collaboration may be much greater than the addition of a single link between two or more collaborating organizations for a finite period. Consequently the effects of collaboration on the network position of an organization may vary significantly. (Hardy, 2003)

Trust and Inter-Organizational Cooperation (IOC)

Located in the space between total knowledge and total ignorance, trust reflects confidence or predictability in one's expectations and faith in the goodwill of others not to harm your interests when you are vulnerable to them (Harriss cited in Rose and Shoham, 2008). Lane and Bachmann (1998:p35) defines inter-organizational trust as "the confidence of an organization in the reliability of other organizations regarding a given set of outcomes or events.

Institutional-based trust is defined by Zucker (cited in Lane and Bachmann, 1998:p15) as a type of trust which is not dependent on interpersonal familiarity and common history but where reliance is on formal, socially produced and legitimized structures which guarantee trust. Vlaar et al (2007) distinguish trust from distrust and formal coordination from formal control. The authors argue that trust, distrust, and formal coordination and control affect inter-organizational performance. Although trust and distrust involve the expectations of managers concerning their partners, formalization involves actual interference in collaborative endeavors.

Cousins (2002) suggest that the need of organizations is to protect their interests. The author stresses that although collaboration should be a win-win situation, life in an organization teaches workers – for both themselves and as organizational representatives – to watch their back, assuming that the others' gain could be their loss.

The network structure of inter-organizational relationships implies different points of view which undermine common understanding. This tension creates a paradox whereby the more unconnected the partners are, the greater the chance of bridging structural gaps and establishing effective collaboration, but these different positions in the social structure are precisely the reasons for different points of view, low trust, and low chances of a successful partnership. (Rose and Shoham, 2008)

3.5. Analytical Framework

Analytical framework for our research could be produced by discussing differences and complementarities of institutional theory and inter-organizational collaboration. This framework will provide understanding that how we can analyze the organizational field of Mälarenergi.

First of all, we argue that SD can be achieved through collaboration and co-operation. It is a mutual commitment that everyone should take responsibility for the issue like we discussed nature and society as inseparable parts. There are different motivations for collaboration such as increase in revenue and cost reduction etc, however when we put the collaboration into SD context the motivation could be different than the traditional ones. Moreover, when we put together collaboration and institutional theory then we can obtain some interesting framework for our analysis. To start with, stakeholders in the institutional field interact with each other. The purpose of the study is to investigate how they interact when the case is about growth and environment.

Growther and Green (2004:p89) argues a stakeholder-managed organization attempts to consider the diverse and conflicting interests of its stakeholders and balance these interests equitably. However from the collaborative view, Svendsen (1998:p3) suggest that a collaborative model assumes that stakeholder relationships can be source of opportunity and competitive advantage. Relationships can increase an organization's stability in a turbulent environment, enhance its control over changing circumstances, and expand its capacity.

According to Moxen and Strachan (1998:p16), solutions to local or regional environmental problems are only possible when all of the relevant actors, including central and local arms of government, industry-led bodies and organizations, co-ordinate their individual efforts to deliver improved environmental standards. Thus, the relationships in the institutional field could also analyzed by using cooperation and collaboration theories and when we apply those

theories we also have to bear in mind the characteristics and outcomes of the cooperation and collaborations such as conflict and/or trust.

In order to understand the pressures caused by environmental issues and their impact on the organizational field we take Costanza's technological optimism vs. pessimism theory.

3.5.1. Technological Optimism vs. Pessimism

Technological optimism vs. pessimism theory is useful to understand the technical perspectives of the environmental issues. For example why we have to take action and change current policies, what would be the outcome of not taking action, what kind of options we have in case of different actions etc. In this thesis, technological optimism vs. pessimism theory will be relevant in order to understand why it is important to pursue a New Energy Policy in the energy sector.

According to Costanza (1989), the line of thinking that is called "technological optimism" believes energy and resource limits to growth will be eliminated as they arise by development and deployment of new technology. An opposing line of thought – "technological pessimism" – assumes that technology will not be able to circumvent fundamental energy and resource constraints and that eventually economic growth will stop.

The optimists argue that unless we believe that the optimistic future is possible and behave accordingly it will never come to pass. The pessimists argue that the optimists will bring on the inevitable leveling and decline sooner by consuming resources faster and that to sustain our system we should begin conserve resources immediately. (Costanza, 1989)

Table 2: Payoff matrix for technological optimism vs. pessimism

	Optimists Right	**Pessimists Right**
Technological Optimism Policy	High	Disaster
Technological Pessimism Policy	Moderate	Tolerate

Source: Costanza (1989)

If we pursue the optimistic policy and the optimists are right then the payoffs would be high (Costanza, 1989). On the other hand, if we pursue optimistic policy and the truth is to conform pessimistic assumptions then the result is, as Costanza calls, disaster. When we pursue pessimism policy though optimists are right then the result will be moderate. If we pursue pessimism policy and pessimists are right then the result will be tolerate.

As game theory, Costanza suggests, we should choose the maximum of the minimum outcomes. Therefore we should choose pessimism policy because it looks better to prevent possible environmental problems rather than dealing with them after getting them.

Ecological damage is often irreversible. Cleaning up later is not an option when terrestrial and aquatic biodiversity has been lost because of habitat destruction. For example, pollution and destructive fishing techniques have damaged a large proportion of coral reefs in some areas. Complete reversal of this damage is unlikely; therefore, efforts need to focus on preserving global biological resources before they are damaged. (Thomas and Belt, 1997)

Optimist can be consisted of governments, companies and other interest organizations that believe in technology. Pessimists can be NGOs such as Club of Rome, Malthusians etc. Optimistic policy in the energy sector could be current policies and pessimistic policy is the New Energy Policy. According to Costanza, as a game theory we have to choose the pessimism policy which means we have to choose New Energy Policy. As we presented in the Introduction chapter[4], the New Energy Policy is a proposed policy that should be taken decision if we want to achieve sustainable energy sector. It constitutes coercive isomorphic change for the organizations in the energy sector. Stakeholder model would suggest that it is essential to form 'win-win' relationships and collaborative theories suggest that 'win-win' relationships can be achieved by forming inter-organizational collaborations that aims for the mutual benefits of the organizations.

The analytical framework will be used in analysis chapter.

[4] Read more about New Energy Policy in section 1.2. Problem Discussion.

4. EMPIRICAL FINDINGS

In this chapter presented are empirical findings as a result of data collection through interviews, archival records, documentation, publication, internet search, and library databases.

4.1. Energy Sector

The energy sector is defined to include both energy production and final energy consumption in the end-use sectors. Energy production includes public electricity and heat (power) production, oil refining and the production of solid fuels. The end-use sectors are households, industry and services and transport.

History[5]

Until the industrial revolution, the main sources of heat and power were firewood and coal. Oil was avoided as it created disagreeable-smelling fumes. It was in the 1850s, when the process for refining oil was developed that petroleum became an essential part of the energy industry.

Since then, it has had a large impact on other industries dependent on energy, necessitating the establishment of some structure and regulations in the industry. OPEC, the Organization of Petroleum Exporting Countries, was formed in 1960 and is now comprised of 11 countries that control more than three-fourths of the world's crude oil supplies. Together they decide the total output of petroleum for each year, and thus affect the per barrel price of oil.

There have been two crises in oil pricing: 1973 as a result of an Arab oil embargo and 1979 after the outbreak of the Iranian revolution. In both cases, oil prices rose sharply. After a peak in oil prices in the early 80s, the market saw a sharp decline followed by a collapse in 1986.

Due to excess supply, the industry hit a low in the late 1990s, when the price of oil dropped to ten dollars a barrel as the industry witnessed major shifting. Several mega-mergers among international oil companies took place, including the well-known Exxon-Mobile and Chevron-Texaco merge and the Amoco and Arco to form BP merge, followed by another collapse occurred in 1998 following economic instability in Asia. However production recovered, reaching a high of 70 dollars a barrel in 2005.

Trends

Despite the current boom of this industry, it has created many problems, most of which are **environmental** in nature. One major issue is the pollution created by burning fossil fuels, as

[5] Source: http://globaledge.msu.edu/industries/background.asp?industryID=29

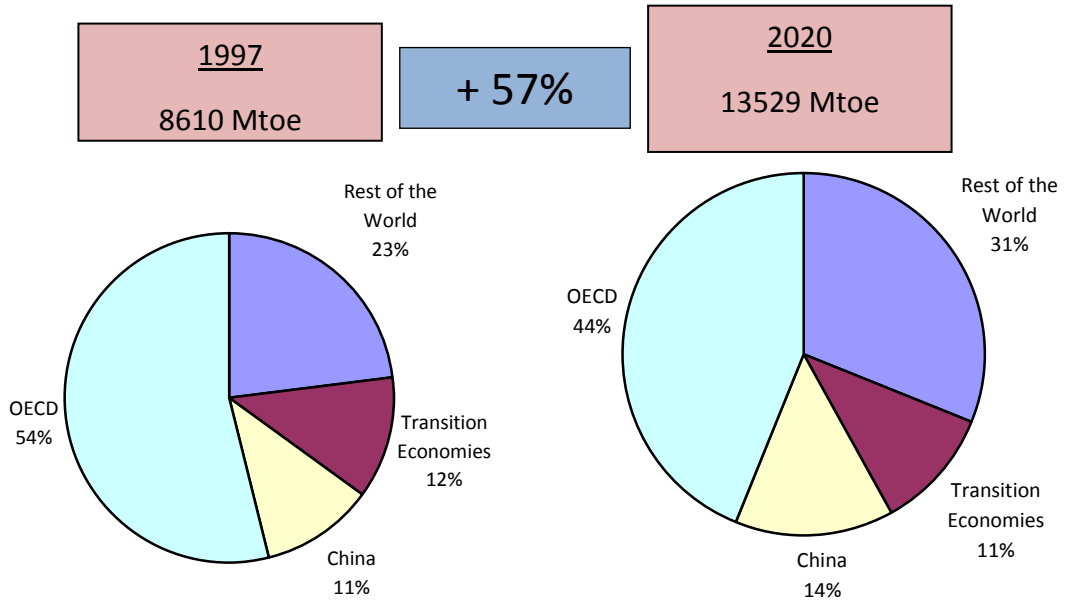
well as the global warming effect said to be caused by increased greenhouse gas emissions. In an effort to combat this, nearly the entire industrialized world signed the Kyoto Treaty, which limits greenhouse gas emissions on a country-by-country basis. Government subsidies and tax incentives offered have also contributed to making environmental conservation a large part of the industry. (Global Edge)

The other big issue with petroleum as a principal energy source is the fact that it is a **nonrenewable resource**. Sixty-five percent of the known oil reserves in the U.S. have already been burned, and according to the Alternative Energy Institute, the world's supply of oil will reach peak production around 2010, which will also mark the halfway point of its depletion. Already, the Ghawar oil field in Saudi Arabia, which is the largest in the world and considered one of only five super-elephant sized oil fields, is declining in production. (Global Edge)

Future Outlook

These dilemmas illustrate how the energy industry is in great need of some innovation and risk taking, whether to better develop alternate energy sources or to locate more oil reserves. Alternative energy sources are already given subsidies and tax breaks from the United States in order to make them competitive. However, in the short run the future of the energy industry looks bright. There is new demand from Asia as the consumer products industry in China demands more energy; reports from the International Energy Agency (IEA) state that by 2030 China will import as much oil as the U.S. Recent troubles in the Middle East also promise higher prices and higher profits. (Global Edge)

Figure 1: Composition of World Energy Demand by Region



Source: 1997: IEA data; 2020: IEA Projections from World Energy Outlook 2000, reference case, OECD/IEA, Paris.

The IEA World Energy Outlook 2000 projects that, over the next twenty years, countries outside the OECD (Organization for Economic Co-operation and Development) will need investment of some $2 trillion to install 1900 GW of new electricity generating capacity. (IEA, Toward Solutions)

It estimates that by year 2020, energy demand of OECD countries will decrease by some 10%, on the other hand, China and the rest of the world will increase their demand while transition economies' demand stays unchanged. This figure also shows the importance of the energy – environment issues because if the developing countries follow the same pattern as developed countries did years ago then the world will be in irreversible danger. That's why energy policies need to be dealt in international level.

Pressures on the global environment which will come from a projected 57 per cent increase in mainly fossil-fuel based energy demand over the next 20 years must be acceptably managed. Sustainability requires that we alter present and projected trends, for example in greenhouse gas emissions. All Member countries of the International Energy Agency are committed to the objective of combating climate change. Many of them have announced their intention to ratify the Kyoto Protocol before the Johannesburg Summit, thereby taking on board the legal commitments stemming from this protocol. (IEA, Toward Solutions)

4.1.1. Debate on Energy and Environment[6]

Energy plays an important role in each dimension of sustainable development: economic, social and environmental. Energy services underpin economic activity. They enable basic needs, such as food and shelter, to be met, and they contribute to social development by improving education and public health. Access to modern energy services can also be environmentally beneficial, for example, by reducing deforestation and decreasing pollution caused by inefficient appliances and processes. But there can be conflicts: growing energy use can increase absolute levels of pollution and involves swifter resource depletion. Sustainable development is about finding the right trade-offs. (IEA, Toward Solutions)

Growth is sustainable only if there is a reliable, uninterrupted supply of energy in a form that does not threaten the environment…

Managing the interaction between energy and the environment remains one of the major sustainability challenges for policy-makers today. Energy production, transport, use and consumption affect the environment from the extraction of primary geological resources to end-use services. The severity of the impact varies greatly, as does the degree to which the environmental risks have been recognized and captured, either by regulatory action or by

[6] The information is obtained from IEA publication Toward Solutions: Sustainable Development in the Energy Sector 2002 and EEA report Energy and Environment 2008.

pricing structures. Fossil fuel combustion creates roughly four-fifths of total man-made greenhouse gas emissions in the form of carbon dioxide. The energy sector also contributes to methane emissions through coal, oil and gas extraction and transport, and emits nitrous oxide. Actions to curb emissions will shape the global energy and climate future. In addition, there are growing problems with the disposal of wastes, ranging from those generated in pollution-control operations, such as thermal discharges in thermal power plants, to those associated with high level radioactive waste.

Ambient air quality levels in several large cities outside the OECD show emissions well above World Health Organization air-quality guidelines. Energy-efficiency improvements, fuel switching from biomass, dung and coal to natural gas and electricity, and basic emissions controls could achieve meaningful reductions at limited costs. However, overall costs of remedial or preventive actions could dissuade many of the least-developed countries from taking actions already adopted by OECD countries.

In light of these considerations, Member governments of the IEA affirm:

- that countries should act to reduce long-term trends in greenhouse gas emissions;
- the importance of controlling local pollutants and disposing of waste from energy production and use in order to promote a cleaner environment and protect human health;
- the need to ensure high safety standards in the operation and maintenance of energy equipment, plants and infrastructures and the need to put in place appropriate mechanisms to respond to potential accident or failure, including further international co-operation to improve prevention and defense against acts of sabotage and terrorism of the energy infrastructure.

The concept of energy security in Europe encompasses a wide range of issues including energy efficiency, diversification of energy supply, increased transparency of energy demand and supply offers, solidarity among the EU Member States, infrastructure and external relations. Together with the energy efficiency, the energy import dependency aspect of security of supply has direct environmental consequences. Some of the links between the environment and the energy import dependency are determined by the fuel mix used to deliver energy services, the level of demand for those services and the speed with which these services have to be delivered. (EEA, Energy and Environment 2008)

Building on the EU's three principal goals for energy policy (security of supply, competitiveness and environmental sustainability) on 10 January 2007 the Commission proposed an integrated climate change and energy package. On 9 March 2007, the Council endorsed the package and agreed on a target to reduce greenhouse gas emissions (GHG) by 20 % by 2020. The package also includes mandatory targets to increase the EU contribution from renewable energy to 20 % of the total final energy consumption with a 10 % binding target for renewable energy in transport (provided this target is achieved sustainably). It also

introduces a target to increase energy efficiency by 20 % against a baseline/reference scenario with existing policies and measures with 2005 as a base year.

Increased energy efficiency is key for achieving simultaneously environmental and energy security as well as competitiveness objectives. One of the key areas with the highest economic potential for reductions is the consumption of energy in buildings. Enhancing renewable energy is another key factor for reaching the dual goals of security of supply and reduction in GHG and air pollution emissions.

The report underlines that end-use energy efficiency measures should be implemented in the residential sector to ensure that energy services (i.e. heating, cooling, and lighting) remain affordable. At the same time, improved energy efficiency will also deliver environmental and social benefits. Two key factors influence the overall household energy consumption: fewer people living in larger homes and the increasing number of electrical appliances.

Implemented separately, the three main targets (GHG emissions reduction, renewable energy and energy efficiency) will not be sufficient for ushering in necessary changes and shifting the European energy system towards using cleaner and more sustainable energy technologies, whilst ensuring that the energy supply is competitive and secure. However, if addressed simultaneously, Renewable Energy Systems (RES) and GHG emissions reduction measures are likely to bring about significant technological changes.

4.1.2. The Swedish Energy System[7]

In Sweden, environmental issues related to energy deployment and use gained particular importance after the 1960s. Electricity production in Sweden is basically fossil-free. Approximately half of the electricity production comes from hydropower and the remainder is provided by nuclear power. Despite rising industrial output, the use of oil has fallen from more than 70 % of the total energy supply in 1970 to around 30 % today. This is mainly due to diversification of fuels and more efficient use of energy. The share of renewable energy sources in the Swedish energy system has increased rapidly during the past decade, from 22 % of the total energy supply in 1994 to 28 % today. Biomass accounts for the greater part of the increase. Wind energy has increased from negligible in 1994 to almost 1 TW/h today.

Sweden has an extensive district heating sector. District heating accounts for about 40 % of the heating market in Sweden. The change in the fuel mix has been dramatic. Compared to 1970, when oil was the main fuel, oil accounts for only a few percent today. More than 62 % of district heating fuel today is biomass.

[7] The information is obtained from Government Offices of Sweden web page www.regeringen.se

A dramatic drop in emissions of sulphur and a steady decrease of emissions of nitrogen oxides have occurred. Swedish scientists were among the first to discover the effects of acid rain; this was a focal point in the first UN Environmental Conference in Stockholm in 1972, twenty years before the following conference in Rio de Janeiro in 1992. Swedish industry was also among early world pioneers in demonstrating the first technological solutions for flue gas desulphurization.

Sweden and the other Nordic countries liberalized their electricity sectors relatively early. To further integrate the Nordic energy market, a great deal of effort is now going into improving the transmission system and using modern technology to increase the international interconnections.

How does the system work?[8]

In Sweden, there are 10 or 15 regional net owners, having all the connections to Vattenfall net and above regional net there is 'stamnätet', by SVK.

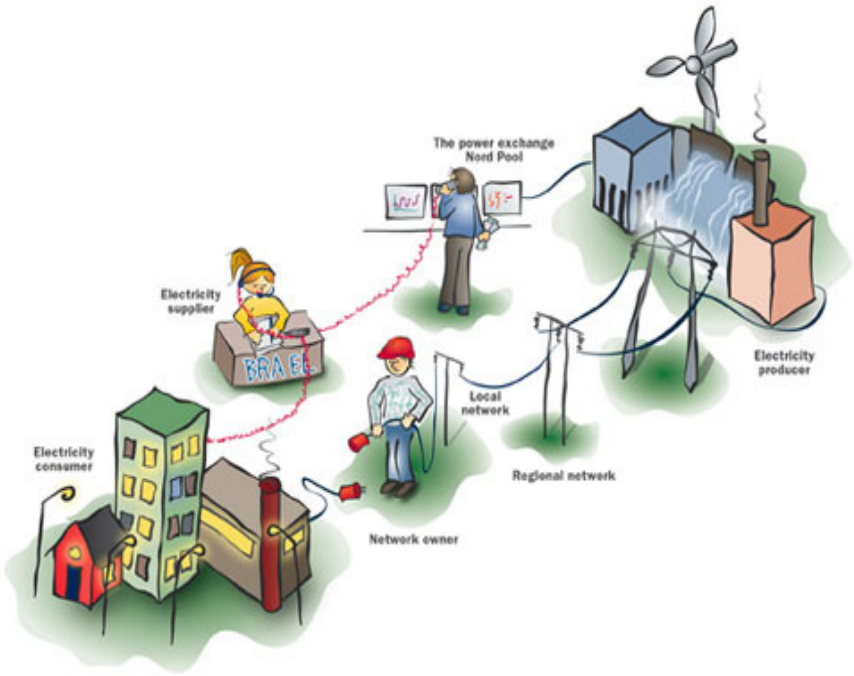


Figure 2: The electricity system in Sweden (Source: SVK hompage)

Final **electricity consumers**, everything from industries to households, must have an agreement with an electricity supplier in order to be able to buy electricity. The picture above shows the entire chain. The bottom part illustrates the physical transfer of power and the upper part the financial transfer, where power is purchased and then sold on.

The **power trading company** can have several roles; electricity supplier as well as balance provider. The electricity supplier has the supply agreement with the final customer. A power

[8] From SVK illustration and explanation

trading company can either have the balance responsibility itself or purchase this service from another company. The power trading company can purchase power on Nord Pool - the Nordic power exchange - or directly from an electricity producer or another trading company.

The **production plants** are owned by the electricity producers. In Sweden, about half the power produced are hydropower and the other half nuclear power.

The **grid owners** are responsible for transmitting the electrical energy from the production plants to the consumers. This is achieved via the national grid, the regional networks and the local networks, which are all owned by different network companies. The regional networks transmit power from the grid to the local networks and sometimes to major consumers, for instance industries. The local networks distribute power to the final customers within a certain area. All network owners report their consumption and production measurements to Svenska Kraftnät's settlement system.

Svenska Kraftnät owns the national grid and has the role of **system operator**. This means that SVK ensures that production/imports correspond to consumption/exports and that the Swedish electricity system's plants work together in an operationally-reliable way.

Green certificates for promoting renewable electricity

On May 1, 2003, a new support system for renewable electricity production, based on trading in electricity certificates for renewable electricity, was introduced to bring a greater proportion of electricity from renewable sources into the country's energy system. All electricity users, with the exception of manufacturing processes in energy-intensive industries, are required to buy certificates corresponding to a certain percentage of their electricity use.

Bio energy and wind for a sustainable future

The proportion of bio energy used in the Swedish energy system has steadily increased from a little over 10 % of the total energy supply in the 1980's to about 16 % or 100 TW/h in 2004. Most of the increase has been attributable to industry and district heating plants. The bio fuels used in the Swedish energy system consist mainly of wood fuels, black liquors and tall oil pitches, and ethanol.

To a large extent, the expansion of bio fuels has come about through an ambitious policy on renewable energy, and the Swedish Government is determined to continue pursuing this policy. Investment in bio energy will contribute to a secure and sustainable energy supply as well as growth and job creation.

Wind energy today accounts for less than one percent of the electricity production. The potential for wind energy is substantially larger. The expansion rate for wind energy has increased rapidly during the past few years. A national target has been set for creating the conditions for annual wind power production of 10 TW/h by 2015.

4.1.3. Swedish Energy Policy[9]

"Swedish energy policy strives to create a sustainable energy system with a long term vision for Sweden to obtain all energy supply from renewable energy sources. Sweden has decided that an energy policy should create conditions for efficient and sustainable energy use, as well as a cost-effective Swedish energy supply with minimum negative impact on health, the environment and the climate. It should also facilitate the transition to an ecologically sustainable society." (Regeringskansliet, Energy Policy)

The guidelines for the country's energy policy were set out in the 1997 Energy Policy Agreement, together with a strategy for continued restructuring of the country's energy system. This restructuring looks to assurance of the country's electricity supply by basing the energy system on permanent – and preferably indigenous and renewable – energy sources, coupled with efficient use of energy. (Energy in Sweden 2008)

The Government intends to present a climate policy bill in the autumn of 2008. In order to formulate its climate policy and to obtain and prepare material for the bill, the Government has initiated a dialogue with a number of organizations from industry, research and politics. This dialogue is based on the climate and energy package published by the European Commission on 23rd January 2008, as well as on the final report of the Climate Commission, published on 4th March 2008.

The Government has also appointed a Sustainable Development Commission, under the chairmanship of Prime Minister Fredrik Reinfeldt, with Minister of the Environment Andreas Carlgren as vice chairman. The Commission draws its membership from a wide field, with members from industry, independent organizations, research organizations, public authorities and political parties. Its work is concentrated on reviewing how improvements in the effectiveness, and modernization, of organizations, regulatory structures and policy measures can assist the work of moving towards sustainable development and environmentally responsible growth. Sweden is due to take the Presidency of the EU in autumn 2009, and the Commission sees its work as particularly relevant to this. As far as energy is concerned, the Government intends to invite all parties in Parliament to reach a wide ranging and strategic energy consensus, based on Alliance for Sweden's energy agreement.

In January 2007, responsibility for energy matters was transferred from the previous Ministry of Sustainable Development to the Ministry of Industry and Commerce. However, climate policy and environmental aspects of the energy sector fall within the remit of the Ministry of the Environment.

At the beginning of 2005, the Government established the Energy Markets Inspectorate (EI) as part of the Swedish Energy Agency (SEA) in order to create an efficient market for

[9] The information is obtained from SEA publication Energy in Sweden 2008

electricity with effective competition. The Inspectorate exercises surveillance of the electricity distribution companies, monitoring developments on the electricity market.

On 1st January 2008, the Inspectorate was broken out of the Agency and became a public authority in its own right, with Yvonne Fredriksson as Director General. The reason for creating a new public authority was that it was felt to be essentially inappropriate for one and the same public authority to have both surveillance duties and support duties.

The Program for Energy Efficiency Improvement in Energy-Intensive Industries (PFE) was started at the beginning of 2005, which year also saw introduction of the EU emission trading scheme.

The planning objective for wind power production includes a requirement that local authorities must have agreed plans for 10 TW/h of wind power production by 2015. The SEA was instructed by the Government in 2007 to prepare a proposal for a new planning target for 2020. The Agency suggests a target of 30 TW/h, of which 20 TW/h should be onshore and 10 TW/h offshore. The Government's Wind Power Bill includes proposals for measures to assist achievement of the planning objective, including support for local authority land use planning for 2007 and 2008. The planning process was simplified in the autumn of 2006, so that plans for wind farms with aggregated capacities not exceeding 25 MW now need only to be notified to the local authority.

In addition, the 2002 Energy Policy Decision also includes measures to improve the efficiency of energy use, such as energy advisory services, technology procurement projects and the market introduction of energy efficient technology.

A special conversion grant, available from 2006 until 2010, was introduced at the beginning of 2006 in order to reduce the use of oil and electricity for heating purposes in residential buildings and certain commercial premises. The grant is available for conversions to district heating; bio-fuel fired heating systems, heat pumps or solar heating. However, grants were withdrawn from the beginning of 2007, because all funding had been used up. Until the end of 2008, owners of public premises can apply for grants for conversion and energy efficiency improvement measures.

Grants for installation of solar cells for use by public premises have also been available from 2005, and will remain available until the end of 2008. The previous tax reduction concession for the installation of biofuel fired heating systems and higher performance windows in new detached houses has been replaced by a corresponding grant, which will be available until the end of 2008. A grant for solar heating in commercial premises and detached houses is also available until the end of 2010.

An investigation into electricity network tariffs is due for completion on 22nd December 2008, setting out proposals for legislation and regulations as needed to enable the surveillance

authority to require the network operators to submit their tariffs and connection fees/methods for approval prior to their introduction. The report will also include proposals for how power supplies from other countries connected to the Swedish regional networks shall be dealt with in order to ensure that they are treated in the same way as when they are connected to the national grid.

4.2. Mälarenergi AB

4.2.1. Organization

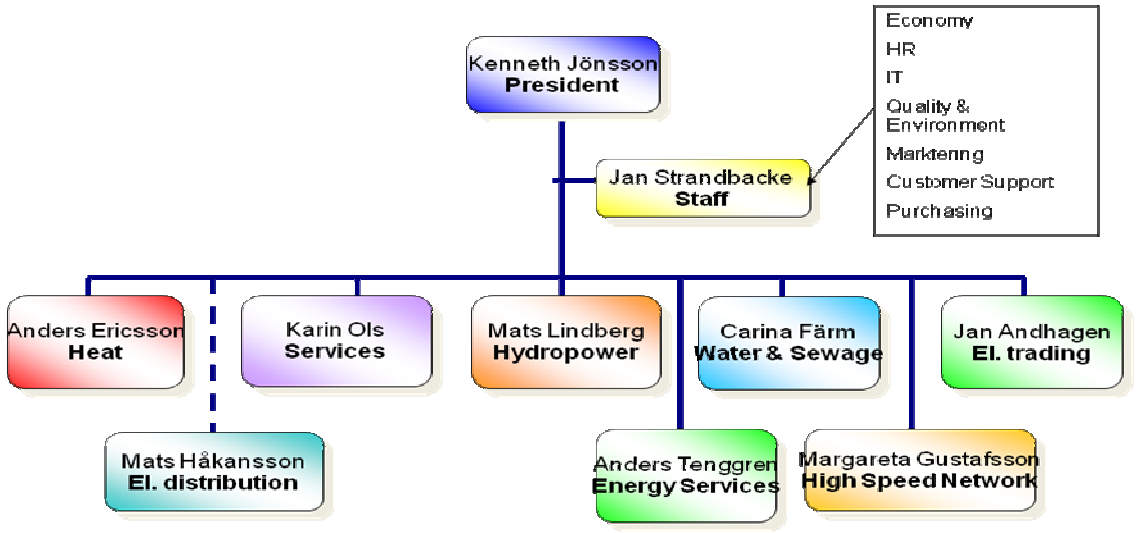


Figure 3: Mälarenergi Organizational Chart (Source: Mälarenergi AB homepage)

Heat (AO Värme) is the biggest business area in the whole group and they are responsible for district heating, district cooling and network for distribution. **Services** (AO Service) provide service for the group and they have projectors, engineers and constructors. **Hydropower** (AO Kraft) is the business area that produces energy from water power and wind power. **Water & Sewage** (AO Vatten) is for delivering drinking water and as well as the treatment of waste water. **El.Trading** (AO Elhandel) sells electricity to the customers. **Energy Service** (AO Energitjänster) started to sell energy services to the customers two years ago. AO Energy Service deals with district heating and the water net only.

El.Distribution (Elnät AB) is a subsidiary that is owned jointly by Mälarenergi (65%) and other communities. It is a grid owner company. **High Speed Network** (Stadsnät AB) is another subsidiary and they provide broadband service for Västerås. **Support** is a department under VD and it provides supporting services such as Economy, Human Resource, IT, Quality and Environment, Marketing, Purchasing and Customer Relations.

Mälarenergi Elnät AB[10]

Mälarenergi Elnät is owned by Mälarenergi (65%) and the other owners are Hallstahammer, Arboga, Köping.

The organization is divided into two separate groups:

1. Grid Owners
    1) Drift
    2) Technical
    3) Net Market
2. Entrepreneurs

Grid owners are responsible for managing the grid, and Entrepreneurs are responsible for building all the cables, power stations and power lines and handling of all the meters.

The first group is Grid owners. Under the Grid owners, there are three divisions.

Drift:

Drift is responsible for managing the grid and they own all the sites, all the cables, power stations and connections, all equipment that Elnät has put out in the field. They monitor the grid 24/7. If there occurs a power failure somewhere, causing by storm or anything else, they have to find out it and report to people (fixers from Entrepreneurs) to get it fixed because they are responsible for delivering electricity 24/7 during all year. One of the things that Elnät has to do within legislation is that *it has to deliver electricity all the time and every time*. If failure happens and if it gets longer than a certain time to get fixed then they have to pay refund to customers because of this electricity failure. The government decided that the electricity owners must take the responsibility to fix the electricity failures as shortest as possible. Now there are hard demands on the delivery of electricity all the time. In drift, there are 12 people working as monitories.

Technical:

The technical division is responsible for all the technical questions, calculating on the grid to see if it is possible to have more customers and such.

They do all the calculations like investments, projects and such. If there is going to be a new area where with lot of households, they calculate that how big the cables should be and the net should be there. They calculate all the investments, when should the company build new stations, all the projects for building and re-building etc. There are 15 people working and they are the common engineers. Within the new projects they might also use some external companies like ABB or Ariva or some others. Most of the buildings such as putting down cables are done by Elnät themselves. However, if there is a large central net station then the construction is usually bought from some other suppliers.

[10] Interview with Jonas Persson, 2009-04-27

Net Market:

Net market is responsible for all customer activities, measurement, building, and all the things that have to do with the customers. They have 100.700 customers and 98.000 are small consumers.

No marketing is required because of the monopoly. However, what they do is try to get out good and accurate information toward the customers. The main channel for communicating is the invoice because everyone gets it. Then some other ways of communicating are through homepage and newspaper that goes to all end-users which is called Non-Stop. They try to have a good communication with their customers because even if you are monopoly you should always give information so the customers should know what to expect and how they should behave when they have problems or questions. It is the most important communication. Elnät has also common customer center with Mälarenergi and it is one of the things that they buy services from is that they should answer all the questions the Elnät arise. So they do something like marketing or information! In their view it is more like information. It is important to find different channels to reach to the customers because the main goal is to get more customers and give them enough information at the right time and in the right way.

Entrepreneurs:

The second group is Entrepreneurs and there are 80 persons who are working with building and so on. They are the part in the organization that actually does more than this legal monopoly part because they actually sell services to other companies. Entrepreneurs are supplier for the internal use but they also sell their skills and services to other companies. That is the part that why it is divided into two because they can go out and sell their services to who need it.

The division is divided in three areas. First, there are people who do all the problem management which is reported from drifting part and they are 'fixers'. The second part is 1/3 of them who are project workers and their responsibilities are building different things like city net connections, help customers building large electricity plants and all other technical things. And the third is the ones that are managing the meters, all the meters for the customers and collection of meter values. There is a project going on in Sweden that all the meter values must be automatically collected. From 1 July 2008 they have replaced all the meters within the area so they can communicate with them and collect data each month. They are responsible for gathering data from meters and deliver them to marketing.

Grid owners as monopoly

Grid owners are monopoly because within the grid owners' area Elnät is the only one who is obliged to build electrical grid so no one else can put a cable and connect to customers. It is not possible for Vattenfall for instance to build a grid in Västerås.

As a monopoly, Elnät's responsibilities are for all their customers they should do the measurement of their consumption as every house hold, every industry, and then they have to

report their consumption to the electrical supplier that has the delivery of the electricity. Actually every customer can choose which electricity supplier they want to have. There are companies like Mälarenergi Elnät, Telia, Vattenfall and E-ON as the electricity suppliers who have the possibility to sell electricity within this area.

However, Elnät is monopoly as the meaning of to meter the customer's consumption and then report the measurements to the actual energy supplier. So every flat owner in Västerås has a meter installed and Elnät is responsible for the meter and for the consumption registration as well as responsible to collect the metered data, responsible to report the metered data both to customers and the company that has contract with.

The reason for grid owners' monopoly is infrastructural because the city does not want ten companies digging in the city and putting cables in the streets and that's why it is called natural monopoly.

Interactions within Mälarenergi group

1. **Board.** As 65% owner, Mälarenergi sits in Elnät's board.
2. **Supplier**. Elnät buys many services from Mälarenergi internally such as customer center, marketing, environmental issues etc.
3. **Group activities.** Elnät participates in Mälarenergi's group activities such as leadership, common tools for reporting time, and business system etc.

Elnät, as a grid owner, does not produce any electricity and they only transport/distribute what is produced. A part of legislation on this field is that grid owners are not allowed to produce and distribute energy at the same time. It is divided by legislation, that the grid owners must be in a different company apart from the electricity producers because they are obliged to give the same information or same support to Mälarenergi Elhandel as well as Telia or GodEl or any other suppliers. So it is their role to be transparent because if the grid owners produce energy then they might also benefit from something that should be equivalent for every other producer.

Mälarenergi Heat[11]

Heat division at Mälarenergi has 160 employees and it is divided into two parts; Production and Distribution.

Most of employees work in the production part. Jan Berglund is responsible for the Distribution part. It is the distribution division that is responsible for all the customers of the company. The company has about 13.600 customers including small households, shops and industrial buildings. Jan Berglund is also responsible for the net of the district heating. The company has about 660 kilometers of the net, from dimension of 1000 millimeters in diameter down to the villa diameters about 22 millimeters.

[11] Interview with Jan Berglund, 2009-05-06

The company has CHP (Combined Heat and Power) plant for combined production of electricity and heat and it is one of the biggest CHPs in Sweden. The company has about 96% of all the customers in Västerås that are connected to the district heating system. This is a very large percentage of customers and it is not very common in Sweden. Jan Berglund believes that Västerås is one of the few cities in Sweden that has this big share of the whole market of district heating.

District heating as natural monopoly

District heating division does not see itself as monopoly because they are working on the heat market. There is only one producer and only one trader of district heating in Västerås, that is Mälarenergi. However, district heating is one form of heating system and heat pump is another form of heating system and customers are able to choose freely either of them. The other types of heating systems include such as heat pumps, biomass energy and district heating. Using of biomass for heating is even possible in small houses but not very common in houses that are located in center of the city. It might be more used for the houses on the country side.

The heat pumps are the biggest concurrent for the district heating and for the company. Customers are free to choose heat pumps or district heating or some other type of heating system so in that sense district heating is not a monopoly, but district heating is very dominate in the city. The household owners or customers in general can choose any of these heating systems. Oil as resource is not a matter anymore in heating area but customers might also want to have wood pallets as their resource for heating system although it is not so common to use them as fuel in Västerås.

Interactions within Mälarenergi group

Heating division also interacts with other business areas at Mälarenergi group such as Service from whom they buy services, Hydropower which produces energy from water power and wind power, Water that is for delivering water and the treatment of waste water.

Since two years ago, Energy Service started to sell energy services to the customers. District heating division is delivering the district heat and they only deal with services regarding this delivery. Although Mälarenergi's heating division is the owner of district heating net, Energy Service is dealing with district heating and the water net only. When there are new customers that are required to get connected to the net with putting new pipes for district heating, the water or the waste water net, then Energy Service deals with that matter for instance.

The Service has projectors and constructors, so heating buy their services internally and also it happens that they buy services from other companies. Mälarenergi has to buy some energy services regarding the substations in the customer's area that is necessary for district heating system. Mälarenergi heating division delivers the heat to one point inside the customer's building only. But energy service companies are able to widen their business and also sell services inside the whole customer's building for the secondary systems and so on.

For instance, they are capable of helping and guiding their customers to a better and more efficient way of using energy. This way of relation between energy service companies and customers is much more common in Sweden than a direct relation between heating companies selling services to the customers. But selling directly to the customers would have positive effect on the relationship between the customer and the company.

Mälarenergi Hydropower[12]

Mats Lindberg is division chef at Malarenergi's Hydropower and the division currently has only hydro electric power. They have 41 hydro plants in Västmanland and county of Värmland and the total production is about 200 GW/h per year. They want to invest in wind power so they are negotiating with a company who delivers wind power plants at site. The company wants to buy one hydro plant in Orebro but there is no hydropower plant for sale. In Hydropower division, 11 people work, out of them six people work at the 24 hydro plants that are in Västmanland. And the 10 hydro plants in Kopparberg they outsource a company, VB Energy, for the managing and running of the plants. In the county of Värmland, there is Fortum service that runs the plants. Mälarenergi pays for those outsourcing yearly.

Mats Lindberg does not see hydropower as a monopoly like district heating although it is a sort of monopoly. They are able to sell the electricity in a fixed price during the future years as well. The electricity produced in the hydro plants is sold to Nord Poole which is a free market.

4.2.2. Productions and Resources

In this part information about the productions of Mälarenergi that was gathered from different resources would be presented. This information is mostly achieved by the interviews and also some information was taken from the web page of the company as well. As an introduction to this part some general information about Mälarenergi's services would give the reader an overall view of the company's services.

Production:

- Electricity and district heating in the co-generation plant in Västerås
- Electricity power in 41 water power plants in Västmanland and Värmland
- District cooling.

Distribution:

- District heating in Västerås and Hallstahammar
- Fresh water and waste water supply and handling in Västerås
- District cooling in Västerås.

[12] Interview with Mats Lindberg, 2009-05-18

Total customers:

- Electricity: approximate 156 000 (including business partners)
- Water: 13 949
- District heating: 12 860
- Broadband: 32 600 household customers and
- 2000 business customers with 31 000 employees
- All municipal schools, administrations and companies with a total of 6000 employees,
- All of Västmanlands Läns health centers.

District heating and CHP definitions

District heating is an intelligent, environmentally friendly way to heat homes, schools, other premises, etc. As the name implies, district heating comes from somewhere within the district. Instead of every building having its own boiler, district heating is supplied by a central plant which can use advanced methods to run on many different fuels, so benefiting both households and the environment. (DHA homepage)

Combined heat and power (CHP) is what's produced when both electricity and heat are produced at the same time. In other words, the heat that's always produced when electricity is generated is utilised. CHP is both more energy-efficient and more environmentally friendly than other forms of generation. Only 6 percent of the electricity used in Sweden comes from combined heat and power, which is less than elsewhere in the EU. (DHA homepage)

Mälarenergi Heat[13]

On heat division we achieved some interesting information from the interview with Jan Berglund at Mälarenergi Heat. He mentions that district heating is something common for households, almost like electricity but it is different in the sense that every household has electricity but not all of them have district heating. District heating market is different with the electricity market as all the electricity nets are connected in the whole Sweden and the whole Europe almost. So it is easily possible to have one electricity producer in the north of Sweden and they are able to have their customers in south of Sweden. But that is not possible with district heating system as each town or each city have their own district heating net of their own.

But the Swedish government has put an investigation on the matter recently to open the district heating nets. So other producers would be able to connect to the district heating net and transport the heat to their own customer to the other end of the net. This system is called "third part access" and this new net system would be ready by April of the year 2010. The reason is because big customers and also producers of the waste heat system would want to come in to heat market and use the existing nets. They want to be able to sell their production to their own customers and nobody is really aware of the possible results yet.

[13] Interview with Jan Berglund, 2009-05-06

CHP production plant

Mälarenergi has five boilers and four CHP blocks and each one of them is capable of producing electricity and district heating. The oldest one is working from the year 1963 and Mälarenergi has a plan to make a big boiler for industrial waste. Today Mälarenergi uses peat as its main fuel. It is called condensation system if the company produces electricity only. In that process they need to cool down "panna" with sea water and that is a waste obviously. So by utilizing CHP process Mälarenergi is able to use more than 90% of the energy value of the fuel.

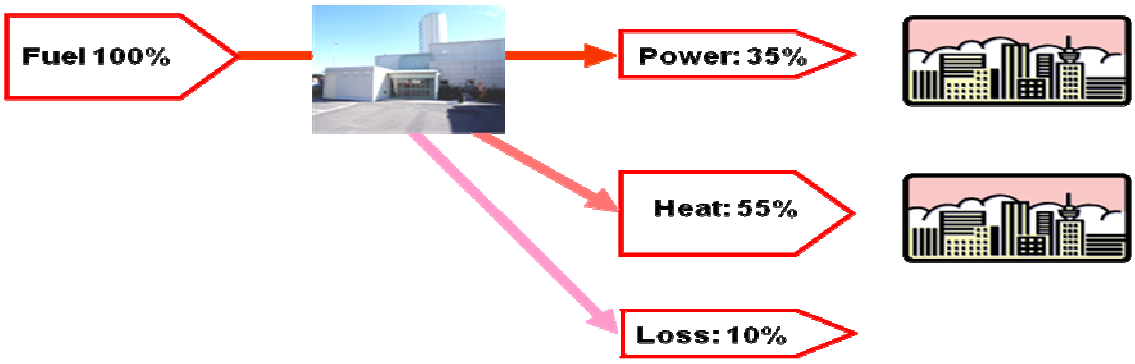


Figure 4: CHP production (Source: Mälarenergi AB)

There is the possibility to combine the electricity and the district heating in the CHP process. It is also possible to produce either of district heating or electricity. The company's strategy on producing is dependent on the prices of heat and electricity, electricity and heat market and the also amount of demand on these two.

About 40% of the energy value of the fuel would go to electricity production and about 50% would go to the district heating production. So when company decides to produce the electricity only, 50% of the energy value of the fuel would be wasted in the form of heat that has to get cooled with sea water. This is the main reason that CHP, Combined Heat and Power, production is very efficient.

It is very common in Europe to waste that 50% of the fuel and cool down the "panna" with sea water after producing electricity. Obviously the companies' strategies are dependent on the prices and market of heating in Europe. According to this, apparently it is more about the benefits for the company and not being environmental friendly or being a more efficient producer in the sense of using the potential energy within the fuel. In Denmark and Germany energy producers still use coal as their fuel and they also waste 50% of the energy value within the fuel. Mälarenergi believes that CHP production system is the best solution that exists in Europe.

District heating system in all around Sweden has about 50% of the whole heat market. Single family houses have about 12% of the whole heat market in Sweden. The reason is that the principle of district heating is efficient when the customers have industrial buildings or big houses because it is very expensive to put pipes and connect them to the net for single family

houses. However, the loss within the net is about 12% of the energy per year although the net is very well isolated.

Mälarenergi has two big heat pumps in the district heating system as well. Heat pumps give this opportunity to the company to use waste water from the buildings all around the city and the energy within this waste water, before it goes out to the lake. The company has a cleaning process before using the waste water. The process is that the cleaned warm waste water goes in to those two heat pumps and that raises the temperature. The energy that is obtained from this process would also be added into the district heating system. Having rather cold waste water after this process confirms the efficiency of the process and best possible way of using the potential energy usage of warm waste water.

Wind, water and solar power[14]

Mälarenergi does not have any wind power plants yet as it is not windy enough in the middle of the country but the company would be able to buy shares of the wind powers by the coasts. Today, water power plant has more shares within Mälarenergi.

When the company has wind power then they should have other power to back up because the wind plant might stop (for example if wind stops blowing). So when building many wind power plants it is important to have as many as other power resources to compensate the power. Compared to water, wind is harder to achieve. Solar energy might be good for Oland and Gotland and on the other areas it is only possible to have them on small scales on the roofs of the buildings.

There is a possibility for customers to buy hydro power electricity but then they would not have electricity when the water plant does not work. Lots of hydro power plants do not work now and the reason would be lack of water especially during the summer time as there is no storage for water. In the north of Sweden there are big dams to storage the water. They are able to store water for production of two years of electricity. But the company produces with the water which is available to them, if there is more water available then they are able to produce more and vice versa. So the company has its more production during spring, autumn and winter.

The problem is having too much water behind the dams. During the winter when there is some much ice then it is hard to take the intake and then we need to use steam to melt the ice. As the amount of production is dependent on the amount of water available so it is impossible to predict the amount of production. The company is able to measure an average amount of production and it is about 200 GW/h.

[14] Interview with Mats Lindberg, 2009-05-18

Mälarenergi resources

Using different kinds of resources and allowance regarding possible resources is a subject that is more decided on the political level. Politicians in Sweden do not agree on every decision that is made by EU about the level of emission allowance and they put some further rules and regulations on this matter. For instance, Västerås city decided that power plants should not use any fossil fuels among their resources and the politicians decided to eliminate that by the year 2015. This is an example of a political decision made by the owners of the power plant that is much tougher comparing to the demands from the Swedish Government or even EU level. It is typical that politician put demands on their companies.[15]

Mälarenergi's resources consist of 30 % Coal, 30 % bio fuel and 30-40 % peat. But the company is trying to replace their coal usage with peat and wood waste as well as a lot of renewable energy resources, so in the year 2008 the company had only 10% of coal left among its fuels which was a record for the company. The company has 41 small water power plants which produce electricity that in total provides 20% of the whole electricity production of Mälarenergi.

Peat is made up from organic material and it is neither considered as fossil fuel nor as renewable resource. It has a place in between and that is very much dependent on political decisions. Peat could be considered as biomass resource if it is taken out at this time, but if it stays in the ground for a long time it will form into coal eventually that is a fossil fuel. So it is not decided by the politicians yet that if peat is renewable energy resource, biomass or fossil fuel as it has potential for becoming fossil fuel.

In 2007, ICPP, international climate planet panel, made a decision that peat can be considered as being renewable energy resource. In Sweden about 20 TW/h of energy is produced from peat every year. From this point of view peat is a renewable energy and power plants do not pay CO2 tax on it. On the other hand they do not get green certificate which means they have made a compromise on not paying any CO2 tax and not holding a green certificate either.

One of the interesting and important points in the interview with Katarina Hogfeldt Forsberg about different types of fuels that are used in Mälarenergi is about the main reason that does not allow the company to use peat for instance as its main fuel. It is impossible for Mälarenergi to be dependent on only one type of fuel because of the size of the company. The company has modern 'panna' that is built for bio fuel and they have to invest more on this matter and try to distinguish if they would be able to use other bio fuels or not. Peat could be used as main source in smaller companies like the company in Sala for instance that uses peat as their total production fuel.

Companies are not allowed to take peat without permission from government. There are city municipalities and region authorities and national authorities like Swedish environmental agency for instance. So the company has to go through three different levels in order to get

[15] Interview with Erik Dahlqvist, 2009-04-08

permission for using peat. Also there are courts that company has to ask for permission from them as well. There are five different courts in whole Sweden named as Miljodomstolen (Environment Court) and in this case Mälardalen belongs to Stockholm Miljodomstolen. They have environmental divisions as well and they respond to all kind of environmental questions and concerns.

On the other hand Erik Dahlqvist mentioned that Mälarenergi has invested in a lot of hydropower plants as 20% of electricity production is from hydropower plants. The company is trying to replace the coal totally with renewable resources. They will be still using peat but at the same time they aim to replace some of the peat and some of the coal by waste, which is primarily wood waste from the building materials and so on. Approximately 10% of the renewable resources would be organic resources. This is the current strategy for Mälarenergi and they also have plans for bio energy, wind power and solar power in their future plans.

From the point of view of Jonas Persson from Elnät it really does not matter that what kind of electricity customers are interested in or what kind of electricity producer is selling as they only distribute the energy in their grid. That issue is something between customers and producers. It is impossible to recognize the different types of incoming energy into the grid as all types of power such as nuclear power or water power or other sources are put together. It is also not possible to track that what type of power production goes to which customer.

4.3. Actors and Interest Organizations

Following actors and interest organizations are active in the institutional field of the local energy company Mälarenergi AB:

- Mälarenergi AB
- Västmanland County
- Västerås City
- Swedish Energy Agency (SEA)
- Swedish Environmental Protection Agency (SEPA)
- Energy Market Inspectorate (EI)
- Svensk Kraftnät (SVK)
- Swed Energy (SE)
- Elforsk
- Nord Pool
- Swedish District Heating Association (DHA)
- Mälardalen University (MDH)
- Housing (MIMER)

It is important to bear in mind that those are not all and complete list of actors and interest organizations that are involved in the local energy sector. Those are the actors that are

mentioned during interviews with respondents. The authors believe that it is relevant to focus on those actors when they study the institutional field of Mälarenergi AB.

4.3.1. Västmanland County

Västmanland has an area of 8,363 km2 - 2% of Sweden's total area and consist of 11 municipalities. A total of 262 050 people live in the county of Västmanland and most live in the city of Västerås. Today, progress in business activities in Västmanland is headed by export-oriented high-tech companies. They are characterized by advanced technological know-how, production capacity and superior quality and present an interesting opportunity for international investment. The administrative centre of the Västmanland County is the city of Västerås. Significant public actors in the county are Västmanland County Association of Local Authorities, The County Council of Västmanland, The County Administration Board of Västmanland, ALMI Västmanland and the Mälardalen University.

4.3.2. Västerås City

Västerås is the sixth largest city in Sweden with a population of 134,000 people. Sweden is divided in 25 counties and Västerås belongs to Västmanland County. The City of Västerås owns Mälarenergi AB thus the city plays an important role in analyzing the institutional field of the company. Two environmental offices are interviewed: Environment and Health Office (EHO) and Environment Planning Office (EPO).

EPO works with energy plan/strategy that how they want to develop the energy in Västerås. It is a big plan that involves many actors. EPO's role is to keep this group together and to make sure that they work according to the plans. EPO is holding together all the actors when Västerås city decides how they should work with energy plan. They prepare proposals and give it to the City Board. EPO plans city energy and reports it to the politicians on the City Board and the board takes decision on how to take actions regarding climate strategy etc. EPO works with the plans until the politicians decide. Regarding planning, EPO can work with EHO and other city EHOs.[16]

EHO is an executive office taking care of environment, health and food and has 29 well educated specialists working. EHO has main purpose of preventing problems in the early stages. In order to do so, EHO works together with other environmental offices around the region and as an authority office EHO works with policy. As soon as EHO suspects an environmental violation it reports to the police and the police take care of the problem. One of the main areas is information that the office has to give information to citizens.[17]

EHO assignments include supervision, prevent problems, and give information, take legal actions.

[16] Interview with Theresa D'Errico and Johanna Olsson, 2009-05-12
[17] Interview with Thomas Forsberg, 2009-05-08

The law EHO bounds to be 'Miljöbalken' (Environment Code) which was enacted in 1999. Before that there were 59 laws and now all they are put together to a common law.

EHO has to report to central authorities like Swedish EPA, Chemical Institute, Central Food Administration etc. There are different levels, companies report to EHO and EHO report to central authorities and they report to EU level etc. EHO plays an intermediate role. County Administration Board also checks on EHO's works. EHO and the County Administration Board work together; divide responsibilities. But sometimes county authorities come and check EHO activities.

4.3.3. Swedish Energy Agency

The Swedish Energy Agency is the national authority for energy policy issues. The Agency's headquarters are in Eskilstuna and it has around 250 employees. The Agency's mission is to promote the development of Sweden's energy system so that it will become ecologically and economically sustainable. This means that energy must be available at competitive prices and that energy generation must make the least possible impact on people and the environment. Within the agency's area of activity the Energy R & D Board task is to: - work towards closer collaboration with trade and industry regarding research, development and demonstration, - decide on support to research development and demonstration according to regulations about state support to energy research, about state support to energy technology, about energy technology contributions and about state subsidy toward the purchasing of technology, of energy-effective technology and new energy technology, and to decide in different cases according to regulations about state support to some investments within the area of energy. (SEA homepage)

4.3.4. Swedish Environmental Protection Agency

The Swedish Environmental Protection Agency (SEPA), created in 1967, is the national agency for environmental protection and nature conservation as well as outdoor recreation and hunting issues. Its key tasks are to present proposals for environmental policy and legislation to the Swedish Government and ensure that environmental policy decisions are implemented. The Agency complies with the ISO 14001 environmental management standard and EMAS for both direct and indirect environmental impact. The Swedish EPA supplies expert knowledge and proposals to central government in its national, EU and international work on environmental issues. Nationally the Agency regulates, sets standards and acts as a guide, coordinator and evaluator. Some 100 Swedish EPA employees are involved as experts and Swedish representatives in EU-related work and in international multilateral or bilateral cooperation. Funded by central government, the Swedish EPA is independent authority acting on the basis of a government ordinance that defines its terms of reference. (SEPA homepage)

4.3.5. Energy Market Inspectorate

At the beginning of 2005, the Government established the Energy Markets Inspectorate (EI) as part of the Swedish Energy Agency in order to create an efficient market for electricity with effective competition. The Inspectorate exercises surveillance of the electricity distribution companies, monitoring developments on the electricity market and their operations are regulated by the Government through the Agency's instructions. The aim of the Government's energy market policy is to promote efficient markets with well-functioning competition that ensure a reliable supply of energy at internationally competitive prices. This means that efforts have to be made to establish markets where the utilization of resources and price formation are efficient.

The task for the Inspectorate is to work for an improvement of the functioning and efficiency of the Swedish electricity, natural gas and district heating markets. This includes to draw up regulations and to decide on matters that concern the duties of the Agency under the Electricity Act, the Natural Gas Act and the Pipelines Act. The network companies are of considerable significance to the competitive market as they own and manage the networks and are therefore responsible for the functioning of the essential infrastructure. In addition the network companies are important players in the chain of communications when there is a change of electricity or natural gas supplier. On 1st January 2008, the Inspectorate was broken out of the Agency and became a public authority in its own right, with Yvonne Fredriksson as Director General. The reason for creating a new public authority was that it was felt to be essentially inappropriate for one and the same public authority to have both surveillance duties and support duties. (EI homepage)

4.3.6. Svenska Kraftnät

Svenska Kraftnät (SVK) is a state utility which was established on 1 January 1992. The company administers and runs the national electrical grid which in total consists of approximately 15,000 kilometers of 200 kV and 400 kV lines plus installations, interconnectors to neighboring countries and IT systems. The duties of the system operator include the responsibility for the electricity system being in a short-term state of balance and its installations working together in an operationally reliable way. Operations are primarily financed by the fees that power producers and network owners pay to transmit power across the grid. Svenska Kraftnät is responsible for maintaining the balance between the production and consumption of electricity in Sweden. This task is performed by the Operating Balance Service, which monitors the electricity balance in the short-term and keeps the frequency of the networks at 50 Hz. Deviations in frequency occur when the planned production of electricity does not correspond with the actual consumption. (SVK homepage)

SVK's main activities are (SVK homepage):

- *Contingency planning:* Svenska Kraftnät is the authority responsible for Sweden´s power supply contingency planning. This means that they have to plan, supervise and

co-ordinate the electricity supply's resources in order to meet society's power requirements during times of crisis and war.

- *Data transfer:* Svenska Kraftnät has a uniquely complete IT environment, with its own country-wide data network and advanced computer systems. These link the Swedish power system together and enable, among other things, the monitoring and control of the network, power trading, operational planning and development.
- *Energy Certificates:* In order to increase the proportion of renewable electricity, a system is in use from May 1, 2003, for trading in energy certificates.
- *National electrical grid*: Svenska Kraftnät administers and runs the national electrical grid of 220 kV and 400 kV lines plus installations, interconnectors to neighboring countries and IT systems.
- *System responsibility for the supply of electricity:* The duties of the system operator include the responsibility for the electricity system being in a short-term state of balance and its installations working together in an operationally reliable way.
- *System responsibility for the supply of natural gas:* Since July 2005, Svenska Kraftnät also has the system responsibility for the national supply of natural gas.

4.3.7. Swed Energy

Swed Energy (SE) is a non-profit industry organization representing companies involved in the production, distribution and trading of electricity in Sweden – with a total of 171 member groups. Including subsidiaries within these groups, the organization is made up of 355 individual member companies. These include state-owned, municipal and private sector companies as well as associations of different types. (Swed Energy homepage)

SE's mission is to serve as a centre for knowledge building and information sharing. SE strives to effectively and successfully monitor and promote the common interests of its member companies. In Sweden, SE works through a number of channels and plays an important role in shaping opinion. The organization is a body to which proposed measures are referred for consideration and serves as the industry's voice in dealing with regulatory authorities, public agencies and government ministries. Throughout the country, SE conducts regional activities. The division into four regions with local staff in Kristianstad, Skövde, Umeå and Västerås ensures good access and better service for the member companies. The regional focus also facilitates greater impact in the industry's opinion-building activities. (Swed Energy homepage)

4.3.8. Elforsk

Elforsk is one branch which conducts joint R&D operations for the Swedish power industry. Its overall aim is to coordinate the industry's joint research and development. Operations are organized in five program areas – Hydropower, Electricity and Heat Production, Transmission and Distribution, Electricity End-Use, and Strategies and Systems. Issues touching on several program areas are handled primarily by Strategies and Systems. It is not

only R&D within technique but also it could be also how new laws should and legislation look tomorrow and how should they as electricity branch react in different, it is also how can they get the politicians to make the right decisions. Different companies come together and make this organization. Elforsk is owned by SwedEnergy (75%) and Svenska Kraftnät (25%). (Elforsk homepage)

4.3.9. Nord Pool

Nord Pool (the Nordic Power Exchange) is the single power market for Norway, Denmark, Sweden and Finland. Nord Pool was established in 1996, and was then owned by the two national grid companies, Statnett in Norway (50%) and Svenska Kraftnät in Sweden (50%) and it is the world's first multinational exchange for trading electric power. The Nord Pool group has more than 420 members in total, including exchange members, clearing clients, members and representatives in 20 countries. The customer base for Nord Pool ASA now includes 400 members. The membership includes energy producers, energy intensive industries, large consumers, distributors, funds, investment companies, banks, brokers, utility companies and financial institutions. The common Nordic market primarily involves electricity generation from such resources as water, nuclear energy and coal. Since the generating modes differ and are distributed differently in the various countries, the need for additional power will vary from country to country and at different times. (Nord Pool homepage)

4.3.10. Swedish District Heating Association

Svensk Fjärrvärme (Swedish District Heating Association) is a trade organisation for companies in Sweden which generate district heating, combined heat and power and district cooling. The association has more than 130 member companies at locations all over Sweden. In addition to the district heating companies, a further 60 related companies such as suppliers and consultants are affiliated to the association. DHA's members are responsible for 98% of the district heating supplied throughout Sweden, and district heating has become the single most common form of heating in the country. (DHA homepage)

DHA activities include:

- Provision of information to politicians and other decision-makers in Sweden and within the EU.
- Dealing with research and development in the industry in cooperation with the Swedish Energy Agency.
- Production of industry requirements through technical regulations adapted to tally with current tried and tested technology, plus standards and directives.
- Working with testing, standardization and quality assurance of products.
- Working with issues related to climate and the environment. The superb environmental qualities of district heating are worth working within the best way possible.

- Working with information in the form of conferences, trade fairs, reports, newspapers, printed matter, websites and lots more besides, with a view to passing on news and knowledge of the industry. (DHA home page)

There are fourteen people working at DHA and they all have their specialist fields for which they bear responsibility, maintaining cutting edge knowledge as well. DHA is working to make the district heating industry an obvious, growing part of an energy future which is ecologically sound, and financially and socially sustainable. DHA is expert in different laws, technology, markets in this CHP. They are lobby organization against the politicians who are deciding upon these rules. (DHA homepage)

4.3.11. Mälardalen University

Mälardalen University is a relatively young university with its 31 year long history. In the late 1970s there was an increasing demand in the region of Mälardalen for technically trained personnel. The result of this demand was the start of Mälardalen University, which was at the time named the University in Eskilstuna/Västerås. Throughout the start up phase the university mainly offered educations in the field of technology. However, some educations in the pedagogical field were also offered. As the years progressed other educational fields have been introduced. One of the major additions was the inclusion of the former county council managed education of nurses. During its 31 years Mälardalen University's student population has grown dramatically from the original 1 500 to around 15 000 students today. (MDH homepage)

4.3.12. Housing (MIMER)

Bostads AB Mimer, which is the official name of the company, is owned 100% by Västerås City Council. The board is composed of solely politicians. Mimer is organized in two principal districts, west and east each containing its own Customer Centre named Customer Centre West and Customer Centre East. In the city centre there is one further Customer Centre named Customer Centre City which shares location with Mimer´s Headquarters. Each District is responsible for its own result regarding operations and is fully responsible for all services to tenants in the district. The rental of apartments is handled by all 3 of the Customer Centers.

4.4. Environmental Issues in the Energy Sector

Government of Sweden aims to identify the things that have very negative effects on health such as DDT, PCB and aromatic hydrocarbons that might cause cancer. They are almost prohibited totally. Mercury and cadmium are also considered as poisonous material and they are very restricted. They are obliged to have measurements in power plant in a certain way that is controlled and then they have to report the amount of any of these materials in their

production. The report goes to different levels such as county, authorities, government and environment protection agencies.[18]

Environmental agencies make and put the overall rules and very often they start on a United Nations (UN) level, then they go on to the European Union(EU) level, then down to Swedish level, then downer to the county level and then to the municipal level. Then there are principles that are making demands and on the other hand we have the power plants that have to fulfill all these requirements and demands. They are regulations that power plants have to make reports on the amount of emission that they release. If they release lower amount of NO2 as emissions in to the air then they earn money for instance and if they are polluting with more amount of NO2 then they have to pay some money in forms of taxes or different types of fees. This happens on a national neutral level as the government does not take any taxes on NO2 emissions.

Government takes taxes on SO2 emissions and the amount of the tax that the company has to pay depends on the amount of SO2 that they release during their production process. The government is both helpful and not helpful in these kinds of situations. They would receive less tax from pollutions if the power plants strive to reduce their emissions. On the other hand, from the point of view of the power plant, reducing the amount of released SO2, means using fewer amounts of coal and that leads to less amount of production that reduces the amount of income for the company accordingly. This is an example of driving force, tax controls and limitations on the amount of emissions that is given by Erik Dahlqvist.

In Sweden, power plants are allowed to have CO2 emissions. Some politicians think that this is not a good decision and some others tend to disagree. The good thing about this is that power plants in Sweden are trying to reduce the amount of CO2 emissions and they are shifting more into the wind power and so on. But the bad side of the story is that, this would reduce the level of competition for Swedish industries. On the other hand, as most part of the electricity is producing from nuclear and hydro power, so it really does not matter so much from that perspective. But when it comes to heat it matters because the company still uses fossil fuels.

From the point of view of the politicians, they would tend to drive all actors of the system in a certain direction, but from the point of view of the financial department they have the interest of receiving the taxes. So there is conflicting interest between the financial department and environment ministry department internally within Mälarenergi that would tend to drive the whole system into a sustainable society.

When it comes to power plants, they have permits that allow them to emit as much as they already do. As an overall look, power plants should try to reduce their amount of emissions every year. As long as the level of emissions allowance is very high, then it is not so difficult

[18] Interview with Erik Dahlqvist, 2009-04-08

for the power plants to keep their amount of emission below the allowance levels. It is achievable by doing their process in a more efficient way or it is possible with reducing the amount of fuel used, in many power plants. These kinds of driving forces for power plants could be used in order to make them reduce their amount of emissions down to a certain level and then it would be very difficult to come further in their capacity. In most power plants in Europe there are no difficulties because they have put so high levels of emissions allowance that it is not a real driving force for them.

Katarina Hogfeldt Forsberg also mentioned that there are limitations on the amount and different kinds of emissions. Companies will be able to run their process if only they do not exceed the limitations on emission. However, Mälarenergi has the strategy to have lower level of emission limitations because the company wants to be effective in the process.

Environmental protection agency (EPA) is the one organization, introduced by Erik Dahlqvist to us, that agglomerates all these data about emission levels and would send them to national level, EU level and UN World Bank. The authorities are supposed to take actions and have the role to drive them in to the right direction by taking actions or tougher demands. On the other hand the demands tell that they are not allowed to have higher level of emission that is accepted by EU level. On the amount of CO2 emissions there are some exceptions, as mentioned before, that allow power plants to have them. On the other hand taxes on fossil carbon are 10 times higher than taxes on fossil carbon in the rest of Europe.

Green electricity certificate is a certificate that the holder would get some support if they introduce any new environmental friendly technologies. The certificate is valid for ten to fifteen years and when the duration of validity of the certificate has passed then the holder of the certificate would not receive any subsidy anymore because the technology is not useful anymore. This is one way to drive producers into inventing or using new environmental friendly technologies. When time passes then the power plants is not that efficient anymore regarding new technologies available so the amount of income would reduce and then at one point the owner decides to close down the power plant.

Mälarenergi has “Bra Miljöval” product which means “Good Environmental Choice” and this is kind of ‘green’ electricity that is produced from hydro power plants.

The Swedish Nature Club (Naturskyddsförening) is another organization introduced by Katarina Hogfeldt Forsberg to us. It is the organization that has a system for environmental friendly products and they put their sign on different types of productions that show the product is produced in environmental friendly ways. Electricity is also one of the products that can be classified into environmental product if it is produced in environmental friendly ways. So ‘Bra Miljöval’ is the environmental electricity that customers can buy by paying little bit more than normal price. Nowadays, numbers of people who buy those kinds of products increase a lot because people became conscious about environmental issues. It is

also good for other companies or municipalities that want to have an environmental friendly profile because the kind of energy that they use might also influence their profile.

Theresa D'Errico and Johanna Olsson mentioned that moreover, EPO's role is to see the best for Västerås city. Companies have their own interests sometimes that might not be in line with the goals of city as a whole. So EPO has to make sure that the development is going in the right direction. There are also different projects with other organizations like regional health organization, regional authority and some others. Cooperation within the Västerås city and with other regional organizations is important for achieving the goals.

As Mälarenergi is owned by Västerås city then EPO can put demands on them. However, there are companies like Fortum for instance, located in Stockholm but not owned by the Stockholm city and they are still very good at working with climate or environmental issues. When customers want to buy energy they would prefer to buy it from good company. So it is not only competition for selling the products but also to be a "good" company because customers in Västerås are able to buy electricity from another company in other part of Sweden. People care about price at first choice but a lot of people are aware of climate issues and they want to buy "green" energy.

Katarina Hogfeldt Forsberg also mentioned that Mälarenergi is a very big company in the region and it has a very big effect on environment. Of course it would be worst if all households would have had their own heating system or electricity generators but still the company has its affects on environment. The first concern for Mälarenergi heating is to have effective delivery system with lowest possible costs to the customers. But also having the lowest effect on environment that is possible is a great concern for the company too. Mälarenergi has very superior technical solution for filtering the smokes and emissions that comes out of the boilers. There are two full-time employees working on environmental issues in the heating division.

Some business areas within Mälarenergi have their own environmental responsible personnel that work quite close together with quality and environment office and they have the same routines and the same instructions for the company as a whole, even if they are in different business areas. Some other business areas do not have their environmental responsible personnel then the quality and environment office has to assist them. Heat and water are the divisions that have their own personnel that work with environmental issues. There are two people working with environmental issues in the heat division now and there is one full time person working on physical environmental issues recently.

There are a lot of different problems but also there are a lot of similar questions or common areas. Talking about chemicals or garbage waste is similar; the company has to have the similar system for all business divisions to take care of waste. They have to have similar routines and instructions for chemical emissions too. That's why they have a common chemical database; they have to control the chemical usage for whole company, the amount that is used and what kind is used.

Besides controlling the usage, the common database is good for common purchase of the chemicals too then they can prevent buying chemicals from different sources. If the chemical is bad for health or for the environment, then they have to get rid of that and find a new one to replace. They have about 1.000 different chemicals that they use at current time but Mrs. Forsberg thinks that they are able to reduce the number. Mälarenergi have water treatment as well and what they release into Mälaren Lake is also a big question for quality and environment office.

4.4.1. Environmental Goals

Theresa D'Errico and Johanna Olsson, environmental officers at the Environmental and Planning Office (EPO) at the Västerås City Administration Office, informed us that there are 16 national environmental objectives that the Swedish government decided many years ago. Those objectives are ground for EPO's own environmental program and they have adjusted them according to the situation in Västerås and use it as guideline for their activities. There are four areas they work with and there are some objectives in each one.

1) Climate change
2) Natural and Cultural Resources
3) Chemicals
4) Planning and Infrastructure

During this interview we realized that EPO gets missions from politicians most of the time. Then it is up to them to work with the mission. Then they need to bring different people from different divisions together and organize meetings with them. During the discussions with politicians and Mälarenergi or any other involved organizations they create documents and they prepare proposals. They examine the feasibility of the proposal all together. It is a process that EPO is in the middle of it and they are the link between companies and politicians. EPO works with national level in many ways because Swedish EPA can give money to local level and EPO has received money to run some projects. Right now they are running four climate projects and 50% of the cost is paid by Swedish EPA, but there are also projects that can only receive 10 or 15% funding.

EPO does not require companies to do anything because they do not have an authority role. The Environment Health Office (EHO) at Västerås city municipality could require the companies on their activities that are affecting environment. EPO has energy plans together with companies. For example, EPO has energy plan for reducing fossil fuel and introducing more renewable energies, Mälarenergi is also willing to participate this plan. So it is more like cooperation than requirement for Mälarenergi to follow the city's energy plans. Mälarenergi lives in a world that there are other energy companies which provide "green" energy but consumers want to use their energy with low cost so it is in their favor for Mälarenergi to change.

One of the four areas is climate change and to achieve what is stated in the goal is in the program that should be achieved in couple of years. The environmental goals are the

'umbrella' documents that show the direction and mission, the energy plan is more concrete plan that shows what are going to be done in the energy sector and who are going to do it or when it should be done with how much money and so on. This plan involves many other actors and EPO is part of it. EPO actually plays the role of 'binder' because they need Mälarenergi and MIMER and all the other important sectors to be part of it, EPO cannot sit in the office and come up with the goals. They have to cooperate with Mälarenergi and MIMER. EPO can have an idea that they should go this direction, but the companies have to say even it is possible or not because they are the experts. Then at the end, it is the politicians who make the decisions. If they want better or tougher goals then it is the politicians who have to pay out more money on the issue.[19]

There are seven goals or objectives in energy sector that has be to achieve by 2015. Mälarenergi, MIMER (housing) and Fastighetskontoret (FK) are three important and biggest actors in the local energy sector that play important roles at achieving those seven objectives. They set a concept for "low energy" houses and they want to achieve this objective by working together with those three actors mentioned above. There are also objectives about how Mälarenergi wants to develop the district heating. There are many houses that do not have district heating in Västerås and Mälarenergi wants to connect them to the system.

Thomas Forsberg is director of the Environment Health Office (EHO) at Västerås city municipality. He mentioned that big companies like ABB; they know themselves about sustainable development so they do not need regulations but small companies need to be regulated. Small companies are more interested in making profit and environmental way is not always cost-efficient however if the small companies understand the importance of SD then they would follow the regulations. That is the reason that EPO works in softer ways as they try to give information on SD and try to convince companies to take SD actions and they discuss those ways. On the other hand, EHO has to protect its authority role as well.

Challenges in changing energy sector towards SD require both economy and technology from the point of view of Theresa D'Errico and Johanna Olsson. For instance, there is project about "low energy" houses going on in Västerås. Special technologies are needed for developing these kinds of houses of course but on the other hand economy is important as using new technology is more costly and if because of that people might not have enough money to buy them then there is no point to build these kind of houses.

On the other hand, people at Mälarenergi claims that it is the company's choice to be environmental friendly however there are still many authorities that put regulations and taxes. But the company wants to create a profile to be caring for climate and environment by taking their responsibilities. Mrs. Forsberg says that it is natural since what they are doing is something good for environment from start so she believes that it is quite easy for the company to talk about environmental issues. They try to be good at this issue and that's why they compare themselves with other companies. When a company wants to be the best it is not only about their production, it is also that how they behave themselves. For instance, the

[19] Interview with Theresa D'Errico and Johanna Olsson, 2009-05-12

transportation system that they use or the different types of environmental friendly fuels they use for their vehicles could be important too.

Jonas Persson also mentioned that within the grid owner's field, there are not any regulations really. It is a mission that they get from the Board of Mälarenergi and other communities. The Board wants them to be environmental friendly although it is not regulated. However, there are all those EU regulations which influence national level and then the national level regulations are put down to communities. But it is more their concern to be environmental friendly and not any regulations. Moreover, Elnät handles its environmental issues with Mälarenergi's environmental group. Within Elnät, they buy some electricity to cover the losses within the net and they choose their supplier so they get energy that is produced as environmental friendly as possible for instance the ones that use fewer amounts of fossil fuels during the production process.

Another thing they do as environmental concern is that the company tries to use environmental vehicles. All the vehicles the company has are on biogas or electrical cars (hybrid). Moreover, they have a 5-year plan that they have to go through all their building and check if they are using as amount of energy as needed or more, so it is a big program and they look through everything like ventilation, lights and such. These could be small things compared to their productions site but Elnät cannot affect that happens in the production so their goal is to be neutral for CO2 in their daily life.

District heating system is the most sustainable system in Jan Berglund's opinion, and the reason is because Mälarenergi uses bio fuel as its main resource. It has a big production plant where they can put very high technical cleaning equipment as well as they can have very high level of efficiency in production of both district heating and electricity at the same time. Heat pumps might be more environmental friendly but when good efficient district heating is used then heat pumps and district heating are nearly comparable at the same level regarding environmental issues. Other example is that Mälarenergi should exceed the amount of renewable energy when they produce electricity; they are looking at solar, wind, water and waste for alternative renewable energy resources.

4.4.2. Challenges in the Sustainable Energy Sector

The biggest concern for quality and environment office is the climate change according to Mrs. Forsberg. Even if the process of producing heat and energy within the company is on a good and acceptable level of being environmental friendly but still, quality and environment office is working on possible ways to reduce amount of emissions and pollutions caused by the company.

The company's first priority is to get rid of the coal among its fuel resources. They are working and searching for a new technology that would allow them to use other fuel resources. Garbage might be a very good choice to use as fuel as mentioned before and Mälarenergi is working on the technology to be able to use sorted garbage as fuel resource. Mälarenergi also have water power, wind power and solar energy but combined power plant

is the biggest plant of Mälarenergi and at the same time it is the biggest combined power plants in whole Sweden.

Mälarenergi's biggest investment regarding environmental goals is to build a new boiler that works with the sorted waste from the garbage as its fuel resource. They also have to get permission from the politician and authorities in order to use wood waste and sorted out garbage as fuel. On the international level peat is considered something in between fossil and bio fuel although peat was considered as fossil fuel before in Sweden but now there is no tax on using peat as fuel resource.

Providing resources could also be mentioned as the most challenging concern for Mälarenergi. Biomass fuel is a very good choice of fuel but it is impossible to use bio mass fuel only as the company's fuel resource because of the size of the company and because the amount of biomass fuel that is available is not enough. Also a company on this size cannot be dependent on one kind of fuel only, so Mälarenergi is looking for new energy resources and new technologies in order to take the most possible energy value of the fuel resources.

Regarding water, wind and solar power plants, Mats Lindberg says that the biggest challenge is with authorities. In his opinion, the Swedish government is not informed or aware of the existing problems regarding energy sector. The government have announced that energy sector in Sweden would want to have a specific amount of wind power by the year 2020 but how the energy sector would reach that goal or are they able to reach that goal is a big question for energy sector that government does not know about. It takes years to take the permissions and it would need a huge amount of investigation that might not be so easy to achieve by the year 2020 in ten years.

Maybe it is easy to build up wind power plants everywhere where the wind is blowing however the problem is that how to distribute the electricity produced in those plants. It is hard to build grid to transfer the electricity, it will take time and investment and it is not possible to be achieved by year 2020. Government wants to increase wind and water power plants but they are not aware of these of small but significant problems we are facing.

One of the biggest problems for the company is that there is not a good network for distribution and they have to think about their investigation and also on the other hand what does the law or authorities say. When there are no guidelines it is so hard to do what the company thinks is the best.

Professor Erik Dahlqvist mentioned that Mälarenergi is very well prepared when it comes to challenges regarding production of electricity and heat. There is only a few percentage of usage of fossil fuel left in the companies' process. He also mentioned that the company is planning to have waste classification within the power plant and their goal is to replace the coal that they have left among their fuels with organic waste.

Talking about challenges regarding providing resources he mentioned that there is more amount of demands on biomass fuels than the amount that suppliers are able to provide today. Demanders are looking for new types of fuels and there is not enough amount of biomass to

cover all the demands. Then one solution that might be helpful for the power plant is to reduce the amount of electricity and heat production. An important issue here is to find a balance production point between the amount of electricity and the amount of heat. So if consumers are saving heat then they should also save electricity in different ways such as using light emitted or reduced energy lamps etc.

One difficulty that power plants are facing is to find an adequate amount of biomass fuel with an affordable price. Providing resources appear to be more important than environmental goals for the power plants. In Germany power plants has started to use more and more biomass resources and in Denmark they are building a big power that uses straw as their main fuel resource. As companies starts to use more biomass fuel as their resource for the power plants then it would take some time to provide resources. Then according to the higher level of demands on biomass fuel the prices would increase and then more suppliers would be interested in producing biomass fuel. As the amount of production of biomass fuel increases then its prices would decrease again until the market arrive at equilibrium between the amount of demand and supply. There is a very strong demand on getting rid of coal and oil in Europe.

Thomas Forsberg also thinks that providing resources could be challenge for the companies but he is positive about this matter because there could be alternative fuel sources for energy production. He believes that the companies need to put more effort on research and develop in order to find better solutions. For example, some years ago, getting rid of the waste and garbage was a big problem but now it could be used as fuel resource and it is even cheaper to use them as fuel comparing to the ways used before to take them away. He thinks that from 20-30 years from now, climate change still will be the biggest problem.

In his eyes also, the biggest environmental challenge is climate change. He believes that it is important to learn lessons from past and take actions now so that the next generation will not make the same mistakes again.

He studied environment in 1970's at Umeå University. He says that during thirty years of his experience in this field he sees the flow of the environmental concerns from big companies and factories that constituted problems till now that every single person contribute to the problem by their way of living. Now it is common Swedish people's ways of living; what they produce, how they use their big personal cars instead of using public transportation and such or two persons live in a big house with using a bid amount of energy that is not necessary. Everyone takes part in the problem and that is why it is a bigger problem now. It is important that average people get informed and educated about the problems. The government has to educate them about how serious the problem is, so that people start to change their ways of living. People have to understand that it is not sustainable for future to use their own cars for every purpose or use airplanes for short distances and so on.

Professor Erik Dahlqvist also believes that private consumers have a very important role regarding the amount of consumption of both electricity and heat. They would be able to have an active role and be helpful regarding their behavior on energy consumption and then as a result of their behavior the amount of energy consumption would decrease enormously.

As researchers, sustainable development is the main concern, he says. The company is also investigating on biomass production and household waste for transportation systems. One example is to decompose biomass in order to produce biogas for vehicles' fuel. They are also working on waste water treatment plant in order to optimize activated slash products.

The biggest challenge in the sustainable development is in the transportation from the point of view of Professor Erik Dahlqvist as an involved person in both academic and practice area. There are two directions regarding SD solution. One is to have more hybrid vehicles that would give the ability to reduce the amount of energy that is used within transportation section. Then the other is combination of electrical vehicle with production of new electricity at the same time as hybrid vehicles generate electricity. In the beginning of the project of waste classification, Mälarenergi is planning to produce electricity and heat only, but in the long term development they are planning to use the waste in order to produce fuel for vehicles as well.

Ms. D'Errico and Ms. Olsson also think that the biggest challenge is within transportation sector. They think that Mälarenergi is quite good at their production process as they also want to have more renewable energy and they try to get rid of fossil fuel and coal. So the big challenge is to change the way of travelling and transportation because there are still many people who prefer to travel by their own car instead of public transportations like train, bus and such.

They have to work more on to introduce different types of transportation or to introduce different types of fuel like bio gas, electricity or hybrid cars. Ms. D'Errico believes that it is more about being efficient in every way and every aspect of consuming energy whether it is used for traveling or for lighting and heating means. She also mentions that individual consumers are able to reduce the amount of energy consumption by using it more consciously and more careful.

They think that housing might be able to be considered as the one that consumes energy the most because companies are rather good in using energy in an efficient way. On the other hand there is no heavy industry in Västerås so the small households are the most important consumers of energy. That is the reason that EPO, together with other departments, has to give information and try to change people's behavior. It is a big challenge to change people's behavior on consumption because people buy more and more electrical appliance for their homes that leads to higher energy consumption.

4.5. Research and Development

Professor Erik Dahlqvist mentioned that in most divisions within Mälarenergi there is no research and development department and it is Mälardalen University that does the research for them. They mostly do researches on optimization of energy processes for instance power plants and waste recycling in different ways. They have thirty five researches working on the

researching area. On the education area, they have basic education in energy field, and one or two years master degrees and also sixty PhD students.

Theresa D'Errico and Johanna Olsson also mentioned that EPO works closely with Mälardalen University too. For example, they university helped them to define "low energy" houses and Professor Erik Dahlqvist was and is involved in many different projects such as bio gas fuel for vehicles and conferences as well. It also might happen when EPO could have questions about new technologies or questions regarding energy sector or transportation system that they need help with, and then they would try to contact university or Professor Erik Dahlqvist directly.

Jonas Persson says that Elnät does not have its own R&D department. However, they try to keep up to date with different branch organizations. There is an organization called Swed Energy and it is a society that Elnät owns together with lots of other grid owners, electricity producers and other energy actors. They have a lot of R&D projects going on in different areas with them. Elforsk is one branch which conducts joint R&D operations for the Swedish power industry. Its overall aim is to coordinate the industry's joint research and development. It is not only R&D within technique but also it could be also how new laws and legislation should look tomorrow and how they should react as electricity branch in different situation. It is also a matter that how they can get the politicians to make the right decisions.

According to Katarina Hogfeldt Forsberg Main research areas include fuel projects and alternative energy resources as the company does not want to be dependent on one type of resource only. It is the main thing that they concentrate their research to investigate other possible sources. For example, they are running a project currently with farmers in order to use corps as energy sources. Also they have water treatment project which aims at using waste water for farmlands.

Moreover, Mälarenergi works together with Mälardalen University on many projects; especially Professor Erik Dahlqvist is involved in many projects that Mälarenergi runs. There are also students, who do their thesis and research projects and/or students who do internships in the company. Another important research going on at the company is to take care of old industrial waste from 1950s.

At the moment Mälarenergi has a benchmarking program with other similar companies like Götebörg, Linköping and Lund's energy companies in order to compare different aspects to figure out if the company is running in a good condition or not or is there any steps that could be taken in order to improve regarding environmental issues. Quality and environmental office at Mälarenergi has some employees working in the Swedish Energy Branch Organization and the office co-operate with them. Swedish Energy Branch Organization up to date their information according to European environmental organizations and then they come back to the company with new demands or new regulations.

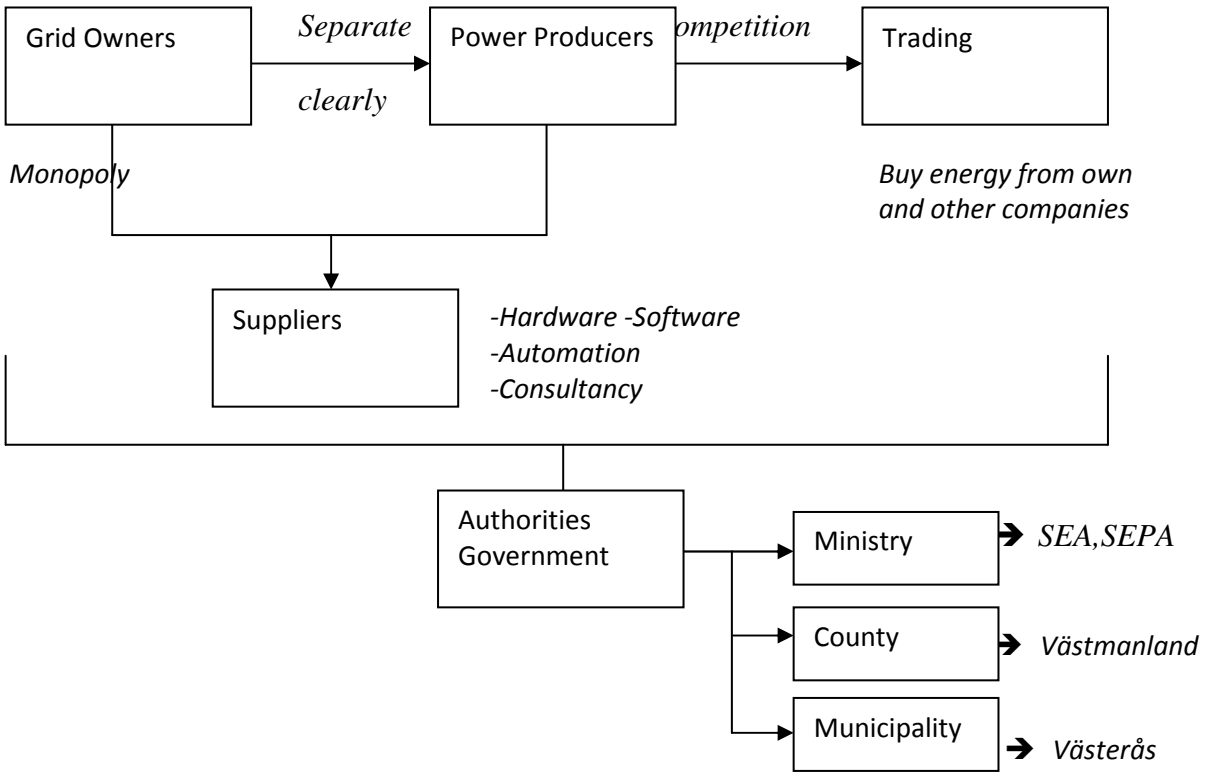
5. ANALYSIS

In this chapter the authors describe the interactions in the Swedish energy sector based on the empirical findings and analyze them in accordance to the analytical framework.

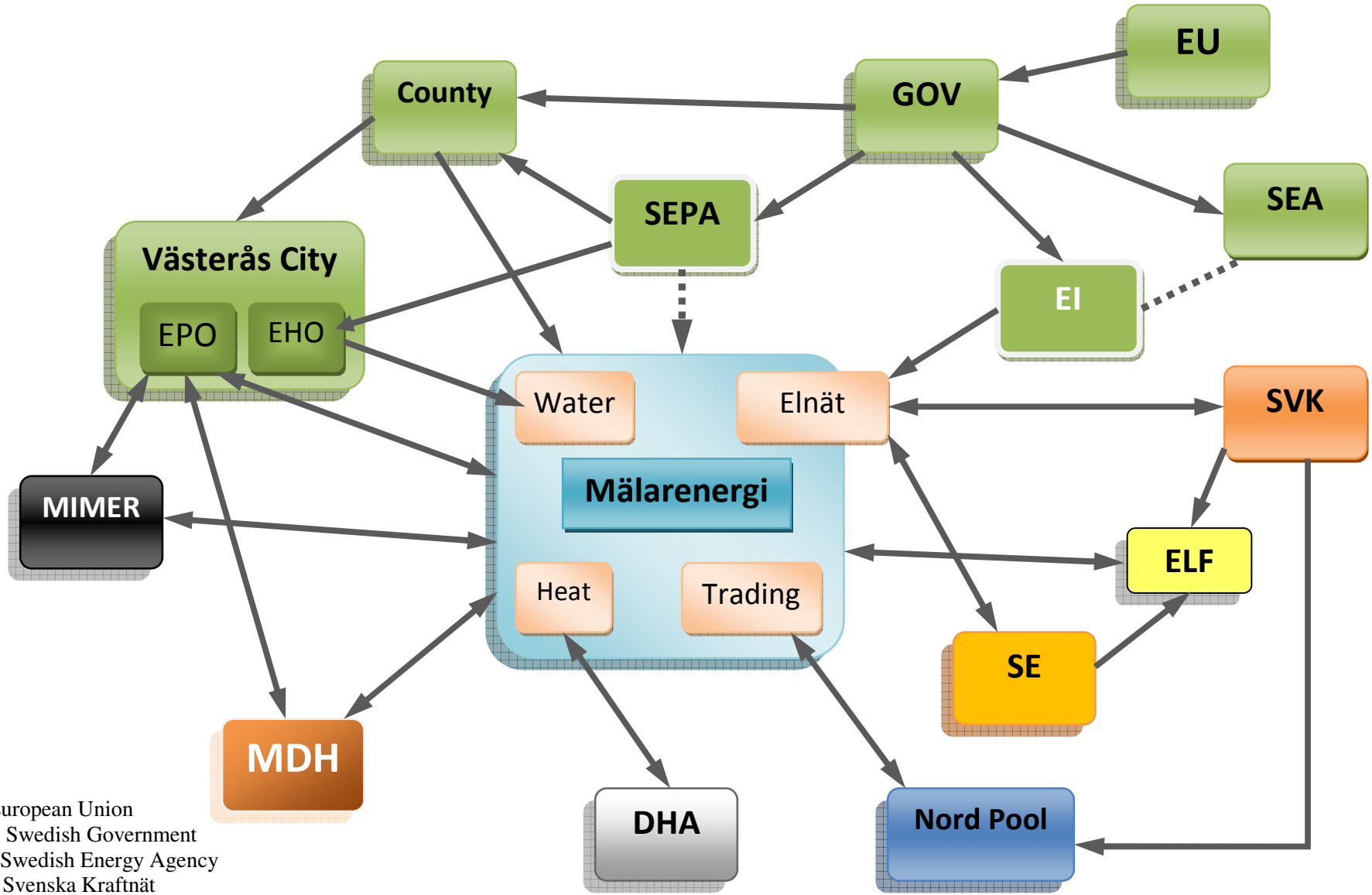
5.1. Describing the Interactions

In the energy sector it is important to distinguish the grid owners, power producers and trading companies because grid owners are pure monopoly whilst trading companies operate in the competitive market. The grid owners should produce or distribute electricity in a way that no one suffers from lack of energy. The producers and the trading companies are making contracts every day. They discuss about the price and the level of supply and demand exactly like stock market. There are suppliers that try to support the energy companies with different types of tools and equipments to fulfill all the demands. Then there are authorities on the other hand, that put regularities in to the system. Environmental agencies are making or putting the overall rules and very often they start on a UN (United Nations) level, then they go on to the EU (European Union) level, then down to Sweden level, then downer to the county level and then to the municipal level.

Figure 5: Illustration of the Swedish energy sector



Source: Based on the interview with Erik Dahlqvist.



EU: European Union
GOV: Swedish Government
SEA: Swedish Energy Agency
SVK: Svenska Kraftnät
Nord Pool: Nordic Power Exchange
EHO: Environment Health Office in Västerås
EPO: Environment Planning Office in Västerås

ELF: Elforsk
County: Västmanland County
MIMER: Housing Company

DHA: District Heating Association
EI: Energy Market Inspectorate
SEPA: Swedish Environmental Protection Agency

Cooperation towards common goal is fundamental in Mälarenergi's relationships with other organizations. We could look at the relationships in two different levels; local and national. At local level, the company's most important relationship is with the city of Västerås which is the owner at the same time. We interviewed environmental officers from both the Environmental and Health Office (EHO) and the Environmental Planning Office (EPO). EPO is in the middle of a relationship that involves major organizations in Västerås such as MIMER (housing), MDH (university), VL (regional bus traffic), VahabMiljö (garbage handling), Fastighetskontoret (real estate agency) and including Mälarenergi.

Regarding local energy sector EPO officers define three organizations as most important; Mälarenergi, MIMER and Fastighetskontoret (FK) because collaboration of these three actors is the key to successful energy development program in the city. [20] Local energy development program consists of seven goals that should be achieved by 2015. Collaboration is based on those common goals which benefit both organizations in the long run. Moreover collaboration is easier to realize in this relationship because both companies (Mälarenergi and MIMER) are owned by Västerås city which makes them part of one family. MIMER as housing company is one of the biggest customers of Mälarenergi because they own the most houses. In order to introduce a new energy efficient system such as 'low energy houses' two companies have to co-operate. They realize that in the long run the project will benefit both of them.

EPO plays key role in this relation because it is the organization that brings all others together as well as it is the link to the politicians who take the decisions. EPO's role is to make sure that Mälarenergi, MIMER and FK achieve their goals. Even though Mälarenergi and MIMER are companies on their own they belong to the city and they have to follow the city policy. In other words, they are parts of the 'family' which makes it easier to work with them regarding environmental objectives and plans. That's why they play big role in the city's development plans because the city needs them to be on the right way.

EPO's role is intermediate. They do not have authority role that they can tell others what to do. On the other hand, the Environmental and Health Office (EHO) is authority and they audit companies' activities regarding environmental issues.[21] However, EHO is not allowed to audit on Mälarenergi regarding its activities due to Västerås city's ownership issue. But they can check Water Treatment Department of the company because it is about health of the citizens.

Opposite to EPO, EHO has authority to audit and report the companies to the police if they violated the environmental laws. Västerås City Board (VCB) has less influence on EHO's work because EHO is more bend to the laws. However, there are 7 politicians who are on the Environmental Health Board (EHB) and this board does not need to follow the City Board. The City Board gives money to EHO for their use but EHB decides how to use this money.

EPO and EHO work together; mostly like EHO check on plants and report to authorities. EPO has softer role because EHO is an authority office they cannot tell the companies what they

[20] Interview with Theresa D'Errico and Johanna Olsson, 2009 – 05 – 12.
[21] Interview with Thomas Forsberg, 2009 – 05 – 08.

should do in order to prevent environmental pollution. However, EHO cannot check on Mälarenergi plants because Västerås city owns it and it is not appropriate to check on your own plants yourselves. So the regional authority checks on Mälarenergi plants. However, EHO checks some parts of Mälarenergi like drinking water, waste water when it is in the city as well as ashes and metals they use.

EHO, EPO or any other offices at Västerås City Administration are not allowed to audit Mälarenergi's activities because it is inappropriate for one authority to have both ownership role and regulatory role. Therefore the company is audited by regional authority which is Västmanland County Administration. However Mr. Forsberg says that there are different boards for ownership and environmental issues and same politician cannot take part in both boards. It is so to avoid that one person takes part in a decision that benefits his/her interests.

Above the County there are government agencies and ministries such as SEA, SEPA and EI. Regarding environmental issues SEPA is the authority but in most cases local energy company do not contact with them because they are far away to reach with every single question.[22] Therefore Mälarenergi's Environment, Safety and Quality department works more with regional level environmental authority. We could say there is an indirect relationship with SEPA and Mälarenergi but SEPA regulates the County environmental directives. From the interviews with people at Mälarenergi it shows that the company has less interaction with SEPA. When it comes to environmental questions it is the company's own effort to be 'good' company and to have a profile that shows their environment concerns. Thus we could say that it is their awareness and initiatives that influences their actions. Pressures regarding environmental issues on the company are big because its business nature contributes a big deal; however efforts they take covers different forms from big projects like biomass fuel power plant to small actions such as personals taking bike to work or using bio gas cars.

SEA was an authority office before EI broke from the agency. Now SEA plays more support role which means the agency works more with statistics and research and development (R&D). Since 2005 EI is the authority office in the Swedish energy sector. Mälarenergi Elnät AB has to report to some government authorities like EI and SEB about all its activities.[23] Elnät has to report to SEB because it deals with measurement and metering. Every year, the company has to make report on all their customers and how their consumption. However, the actual department that is monitoring grid owners as a monopoly is called Energy Markets Inspectorate (EI). As a grid owner Elnät is monopoly in the electricity market. It is important to clearly distinguish the grid owners from power producers and have to bear in mind that the market is strictly regulated. Grid owners do not have any legal contracts with each and every one of the customers and suppliers but they have legal directives that what should they do as a grid owner and they are also controlled by EI that if they do everything in the way that a grid owner has to do and if they do send the information to everyone or not.

[22] Interview with Katarina Hogfeldt Forsberg, 2009 – 04 – 28.
[23] Interview with Jonas Persson, 2009 – 04 – 27.

Another important actor in the grid owner's field is Svenska Kraftnät (SVK) which is a system operator. SVK is the organization that Swedish grid owners are member to. SVK's relationship depends common goal that is to achieve an effective electricity market in Sweden. SVK is a key organization in the Swedish electricity market. Elnät has to report to SVK as they are also a regulating actor for grid owners. So it is like they are responsible for the board everyone plays to report everything that happens and every customer also has a contract with a supplier and every supplier has to have a contract with a balance responsible so that for every customer that has received electricity there has to be a supplier who produces the equal amount. Grid owners are responsible for reporting measurements of the production and consumption of power, and the balance providers for reporting bilateral trade values. These must be reported with the right level of quality and at the right time.

SVK jointly owns Nord Pool with Norwegian Stattnet and Elforsk with Swed Energy. Swed Energy and Elforsk's main activity is to develop R&D in the energy sector. For example, Mälarenergi Elnät does not have its own R&D department but it works with Elforsk on researches and projects. In this point, collaboration is grounded on the common R&D objective. Mälarenergi Hydropower[24] also works with Swed Energy and mostly they have to follow the guidelines that say how to operate, monitor and repair the hydropower plants. One thing to mention here is that Hydropower is regulated by three different counties (Västmanland, Värmland, and Orebro) which also show that the counties can put different demands on the companies. For example while Västmanland County only wants a yearly report, Orebro County can demand the company to answer many questions and permissions besides the yearly report.

For district heating there is a DHA which is a branch organization for R&D and political lobbying. Mälarenergi heating department is associated with DHA and as the company has the biggest combined power and heat (CHP) plant in Sweden it is important for them to work on CHP researches with other organizations.[25] DHA is responsible for dealing with political matters and technical matters and that is why they are one of the most important actors for heating division of Mälarenergi. DHA is expert in different laws, technology, markets in this CHP. They are lobby organization against the politicians who are deciding upon these rules.

Mälarenergi's research activities at local level involve MDH and EPO. MDH co-operates with the company in many researches regarding renewable energy and for environmental activities EPO and EHO find MDH as good partner because the university is good at its environmental concerns.

[24] Interview with Mats Lindberg, 2009 – 05 – 18.
[25] Interview with Jan Berglund, 2009 – 05 – 06.

5.2. Institutional Theory Analysis

Analysis of the above described interactions could be done using our analytical framework that we have defined in the theory section. Now we will try to analyze the actors' influence on each other from the institutional theory. An important point here is that the institutional field also provides roles of stakeholders. Stakeholders includes different actors from owner, manager, employee to supplier, customer, competitor as well as someone who is going to be influenced by the decisions made in the organization. As the stakeholder model and institutional theory suggest the organizational network is an open system which means the organization and the other organizations around that organization have to interact with each other.

When interacting in an open system, organizational interactions also face limits and conflicts such as unbalanced relationships based on different power level. Especially in a sector like energy sector that is strictly regulated by not only national and regional level regulations but also influenced by international level policies the power relations are important to keep in mind. Therefore we reach in a conclusion that in institutional field of an energy company, coercive isomorphism is dominant. As DiMaggio and Powell (1991) argue coercive isomorphism may result in an organizational change that is direct response to government mandate: for example, manufacturers adopt new pollution control technologies to conform environmental regulations. From the interviews with Mälarenergi staff it is obvious that the company takes actions mostly depending on the regulations by the government authorities. For example when they want to build a new production plant that uses renewable energy resources[26]; it is because the government puts policies to increase the renewable energy production. Due to the nature of the business that impacts not only organizational and local level but also national and international level, there exist many pressures for the energy company.

An important thing the authors of the institutional theory talk about is that the companies could build strong, mutually beneficial stakeholder relationships with each other in order to cope with the demanding institutional field. We could see that the Mälarenergi and other actors such as EPO, EHO, MIMER, and MDH etc. understand the importance of 'win-win' relationship and promote this relationship in the energy sector. For example, Mälarenergi ad MIMER form a relationship that bases on the 'win-win' outcome.[27]

Finally the companies imitate the best practice that is already tried and/or the practice they think is the best in order to deal with the environmental problems. In dealing with environmental problems, we see that Mälarenergi is also influenced by normative isomorphism that results from professionalization because the company has to work and co-operate with different research and branch organizations that are only specialized in the related areas; for example Elforsk. Moreover Mälarenergi tries to legitimize itself through

[26] Interview with Katarina Hogfeldt Forsberg, 2009 – 04 – 28.

[27] Interview with Theresa D'Errico and Johanna Olsson, 2009 – 05 – 12.

actions such as 'BraMiljoval', investments in renewable energy resources and its engagement in local economic and community development.

5.3. Inter-organizational Collaborations Analysis

In the energy sector, we see that co-operations and collaborations are important for the sustainable development. Main driving force for inter-organizational collaboration is to conduct R&D to achieve common goals which is, for example, introducing a renewable energy technology. Renewable energy is the biggest research area because the government encourages renewable energy and introduces tax incentives such as 'green electricity certificate', and the companies want to be cost efficient too. Energy companies are aware of their environmental impacts and they face many regulations such as reducing greenhouse emissions or increasing renewable energy resources. Even though it might be costly for companies right now to adopt 'greening' policy, they realize that it is not today's business they are doing but tomorrow's. Environmental regulations are global which means no local energy company is acting alone. Usually these regulations start at UN level, then goes to EU level and then to national level and at the end to the local level. [28] When they come from those many levels they gain harder demands on the companies because it is not about just local but also international level that is affected by the actions.

Talking about regulations and authorities, those are the 'kings' and 'queens' of the energy sector chess board because they are the core and have authority over the other characters. The branch organizations, associations and non-profit organizations can be seen as rooks, knights and bishops. They have their own importance in the course of game and usually they move along with each other. If you play wise you with your knights and pawns you could take over kings and queens which in this context means that associations and other organizations can influence on the political decisions by lobbying.

Another aspect of the inter-organizational relation is knowledge creation and sharing the resources. R&D could be seen as mutual outcome that the partnering organizations want to achieve by this relationship. In the Swedish energy sector, R&D driven collaborations are fundamental to inter-organizational relationships. Some authors define motives for collaboration as revenue increase and cost and risk reduction. However, we think that in the energy sector collaborations are not really driven by these motives because usually an energy company is a state (city, county) owned which means revenue increase might not be the first case. That's why collaborations in the energy sector is motivated by achieving mutual goals such as decrease in emissions and increase in renewable resources.

Moreover, collaborations on the institutional level are influenced by policies, legal decisions and regulations. For example we can see that from the interaction between Mälarenergi and DHA because Mälarenergi, together with other companies, tries to influence political decisions. The Association is an expert organization that sees the benefit of the members

[28] Interview with Erik Dahlqvist, 2009 – 04 – 08.

which means companies cannot manipulate political decisions on their own but together they form association and become more influential.

During our theoretical study on collaborations and co-operations we mentioned about the limits too that is the suggestion that inter-organizational relationships may also cause conflicts. However, in the study of energy sector we did not identify any conflict between actors. That does not imply that there exist no organizational conflicts in the energy sector. Rather we have to keep in mind that the actors are not all the actors involved in the sector and not all the actors are interviewed. We could only expect to identify an obvious conflict situation, if there is any. However, interview results show that the actors in the energy sector underline the importance of cooperating is essential to achieve their goals.

Finally trust is an important topic when talk about inter-organizational collaborations. Institutional trust is defined as type of trust which is not dependent on interpersonal familiarity and common history… (Zucker cited in Lane and Bachmann, 1998) In our thesis we did not tackle much about trust issues in the institutional field of Mälarenergi. However we could say that some interpersonal trust and familiarity can be identified because the network is local and the people work at Mälarenergi have close contact with people work at Västerås city and/or at MDH.

6. CONCLUSION

There are many organizational co-operations and collaborations are formed in the energy sector. Mostly they aim at achieving common goals and conducting researches and lobbying to influence political decisions. Regarding environmental objectives a local energy company is bound to national and international regulations however they are also willing to change themselves and try to create a profile of 'environmental' organization. Therefore, besides requirements about low emissions or higher renewable, there are actions that are taken in the company that could influence their daily behavior on energy usage. We could talk about three levels of authorities in the Swedish energy sector; local, regional and national. Moreover, we could classify the relationships into authority relation and collaborative relation because it is important to distinguish one's authority role and support role. As climate and environmental issues gain importance regulations and demands on the energy sector become harder. It became fact that energy resource is declining and if we continue to use fossil fuels that will put irreversible damages on the earth. Since there is no one right solution for this global problem, the companies have to continue on R&D. That's why R&D is the main collaboration reason for the organizations in the energy sector.

Moreover, in the energy sector companies are mostly influenced by coercive isomorphism which results from political legal regulations and pressures from other actors. For achieving sustainable development, organizations form collaborations that are based on 'win-win' relationships. As a basic concept in sustainable development course, 'win-win' relationship suggests that the both (all participating) actors will benefit from the collaboration like our chess game metaphor, when we play our characters not only based on today's moves but also considering tomorrow's moves then we will be able to see what moves we should make in order to win the game. It might not seem easy and comfortable to win for sustainable development game however if we could only see few moves ahead then we will understand the importance of winning this game with the costs of sacrificing today's important characters.

6.1. Further Research

This research study gives good and motivating information regarding interactions, co-operations and collaborations within the energy sector. During the research in order to find empirical findings which were mostly achieved by interviews with different people from different actors within the whole network, we had the chance to interview with some people from some actors in the field and not all the including actors. Further study could be considered as more interviews with people from the "left out" actors. Having the chance to interview other different organizations or different departments from the company, which we

did not have the chance to interview because of different reasons or difficulties, would be a good opportunity to come up with more thorough and interesting information and results.

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APPENDIX

APPENDIX A: Interview questions for Erik Dahlqvist

1. **What kind of role you think you have in this field?**
2. **Can you identify important actors/stakeholders in the energy sector?**
3. **Can you define actors' relationships with each other?**
4. **What do you think, what could university (MDH) contribute to Mälarenergi?**

   Is there any cooperation between MDH and Mälarenergi?
5. **What are the biggest challenges in SD field for Mälarenergi?**
6. **Do you think they are well prepared for the challenges in terms of technology?**
7. **What are the standards or norms for energy companies regarding SD?**
8. **What are the requirements for the companies in terms of climate goals?**
9. **What is most challenging for an energy company? Climate change or providing resource?**
10. **What is the most difficult problems with using "peat"?**
11. **Why doesn't Vattenfall AB (or any other company) distribute electricity to Västerås?**
12. **Is Mälarenergi monopoly in this area in Västerås?**
13. **How it affects its relation with other actors?**
14. **What are the main suppliers? Do they have interaction/cooperation with the suppliers?**
15. **What can you tell about Research and Development (R&D) activities of Mälarenergi? Do they cooperate with others, for example MDH?**

APPENDIX B: Interview questions for Mälarenergi AB

1. **Can you introduce yourself and your division?**

2. **What kind of role does your division play within Mälarenergi and with other outside organizations?**

3. **Can you identify important actors/stakeholders in the energy sector? And define actors' relationships with each other?**

4. **What are the biggest challenges in SD field for Mälarenergi? Do you think you are well prepared for the challenges in terms of technology?**

5. **What is your systematic approach to environmental issues?**

6. **How do you maintain this approach? Or do you work/collaborate with other actors?**

7. **What are the requirements for your company in terms of climate goals?**

8. **What is most challenging for an energy company? Climate change or providing resources?**

9. **Can you tell us about your input resources?**

10. **Are your emissions high or low comparing similar companies?**

11. **What are the most difficult problems with using peat?**

12. **Is it regulation or corporate social responsibility that affects your company's choice on sustainability?**

13. **Can you tell us about 'Bra Miljöval'? How does it work and what are its impacts?**

14. **Where do you buy electricity? Can you explain about how this transaction works? Who are the biggest suppliers?**

15. **Is Malarenergi monopoly in this area in Västerås? How it affects its relation with other actors?**

16. **What can you tell about Research and Development (R&D) activities of Mälarenergi? Who do you cooperate with regarding R&D?**

APPENDIX C: Interview questions for Västerås city EPO and EHO

1. **Can you introduce yourself and your department?**

2. **What kind of role does your department play within regional energy sector?**

3. **Can you identify important actors/stakeholders in the energy sector? And define actors' relationships with each other?**

4. **What are the biggest challenges in the energy sector regarding SD?**

5. **What are the requirements for energy companies in terms of climate goals?**

6. **Is it regulation or corporate social responsibility that affects company's choice on sustainability?**

7. **What kind of problems, or questions do you face when working with energy companies?**

8. **What role does Västerås city play in the energy sector? And for the Mälarenergi?**

9. **How does Västerås city balance/manage its interest (tax interest and regulations) regarding energy matters?**

10. **What are the environmental goals that should be achieved in the regional energy sector?**

11. **What is the role of the energy sector in relation to S.D. in general?**

12. **What are biggest challenges in changing the energy sector (economic, technological, intuitional restraints)?**

13. **What kind of actors and stakeholders in and outside the organization is more important?**

14. **What are the biggest challenge in implementing sustainability in term of organization and management?**

15. **What are the most important channels for information, inside the organization/department? And with outsider?**

16. **What role do you think the university has?**

17. **What do you think will be biggest changes in the energy sector in the next 20-30 years?**