

1. Introduction

Meeting the greenhouse gas emission reduction commitments, spelled out by the United Nations Framework Convention on Climate Change (UNFCCC) in 1992, is a major challenge for most countries, including Sweden. (IEA 1997 p.12) The Framework Convention states that emissions of greenhouse gases shall be stabilised at a level that prevents dangerous anthropogenic influence on the climate. According to the Kyoto Protocol the EU member countries have to reduce their emissions of greenhouse gases with eight per cent¹ between the years 2008-2012. Even though scientists declare that the CO₂ emissions have to be reduced by 60 per cent in order to limit further climate change. (Naturvårdsverket 1999 p.7) Even though Sweden has not ratified the Kyoto protocol yet, a decision was taken on emission stabilisation in 1993 in correlation to the Framework Convention. (ibid.) The parliamentary decision states that the emissions of CO₂ from fossil fuel sources should be stabilised on 1990s emission level by the year 2000. (Naturvårdsverket 1999 p.14)

To address the concerns for the climate, the energy system has to develop and change in a sustainable manner. A commonly used definition, also employed in this thesis, of *sustainable development* is the meaning used in the Brundtland report (The Commission of Environment and Development): *...to ensure the needs of the present generations without compromising the abilities of future generations to meet their needs.* (WCED 1997 p.282) To be able to meet the needs of the future generations and the emission reduction goals of greenhouse gases, the energy use in the world has to change from a reliance on fossil fuels to renewable resources, such as wind power, solar power and biomass. Still this is not enough, as stated in the quotation from the Agenda 21 document below; the energy system must also be much more efficient:

“Energy is essential to economic and social development and improved quality of life. Much of the world's energy, however, is currently produced and consumed in ways that could not be sustained if technology were to remain constant and if overall quantities were to increase substantially. The need to control atmospheric emissions of greenhouse and other gases and substances will increasingly need to be based on efficiency in energy production, transmission, distribution and consumption, and on growing reliance on environmentally sound energy systems, particularly new and renewable sources of energy.” (UN, 1992 ch.28)

This thesis is a study of a policy program with the long-term goal of reducing greenhouse gas emissions through addressing energy efficiency in industry.

¹ Within EU, the emissions reduction percentages have been distributed among the member states. For Sweden this resulted in a possibility to increase the emissions of greenhouse gases with four per cent until 2010, based on 1990s levels. Swedish policy makers do not take the possibility into consideration. (Naturvårdsverket 1999 p.12 & STEM 1999 p.31)

1.1 The Settings of the Study

The challenge has now turned from negotiating each country's greenhouse gas emission reductions to how the means for achieving the goals should be conducted. In Sweden the issue is complicated as the timing coincides with the phase out of nuclear power production. In line with the 1993 decision to stabilise CO₂ emissions on 1990s level and the energy political decision from 1991 to create a sustainable national energy system, NUTEK (Swedish National Board for Industrial and Technical Development) developed a program aiming at energy efficiency in the industry sector, named the *Eko-energi program*². (NUTEK 1997 p.38) The program was designed as a voluntary agreement. A voluntary agreement can be described as a kind of environmental policy instrument, that can be used as either a substitute for environmental legislation or as a complement to existing environmental policy. No clear definition exists of the term. (ELNI 1998 p.28) A voluntary agreement can be anything from a voluntary environmental certificate, such as different environmental management systems and eco-labelling schemes to more structured regulations with a binding contract. (Krarup 1999 p.5) Voluntary agreements are considered by its supporters to be more flexible and easier to balance with other economic, social and environmental policy objectives compared to traditional steering instruments as tax and regulations. (IEA 1997 p.11) Critics argue that voluntary agreements are nothing but make-up, established in order for the industry to avoid tough environmental legislation and for policy makers to avoid demands from the public opinion. (Elliot 1998 p.127 & Helby 1999 p.2)

The aim of the *Eko-energi* program is to stimulate energy efficiency in Swedish industries, through supportive actions, such as initiating energy efficiency projects at firm level. (SOU 1995:140 p.208) The program promotes environmental improvement through target companies interested in environmental management. The program has not resulted in clearly identified energy efficiency activities in all industries, but it has spurred increased awareness of energy issues, in terms of understanding energy as an environmental concern.

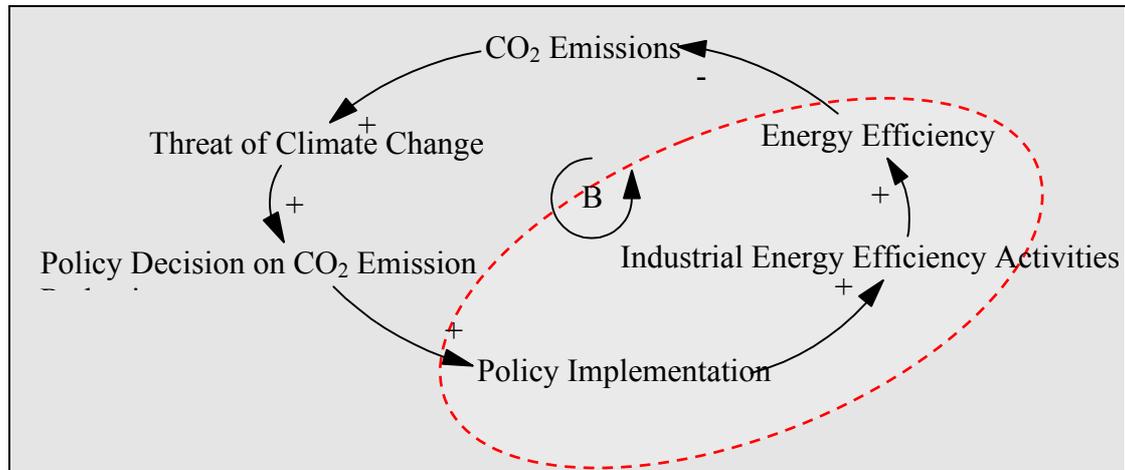
The thesis is based on a case study of the forestry co-operative *Södra*, which processes forestry products, and its participation in the *Eko-energi* program. The relation between the political intentions and its outcome in a private organisation is the theme of the study. The empirical study has been conducted within the framework of the VAIE-project (Voluntary Agreement Implementation and Efficiency), an EU-financed research project, at the Department of Technology and Society/Energy and Environmental Systems System, Lund Institute of Technology at Lund University.

1.2 Purpose of the Study

The overall aim of the thesis is to discuss, illustrate and understand the implementation of an energy efficiency program on firm level. The assumption of the study lies in the notion, suggesting that the *Eko-energi* program can move the industry forward, in a direction towards a more sustainable energy system.

² The program is called *Eko-energi* in Swedish, meaning "Eco-energy". The Swedish name is used throughout the thesis.

The theme of the thesis can be summarised in the conceptual model below. The figure in the box illustrates a possible interpretation of the relation between the concepts of the study.



Box 1. The causal loop diagram illustrates, in a very simplified manner, how the addressed issues could be linked to each other: The international community has acknowledged that CO₂ emissions can lead to increased global warming and climate change. (Government Communication 1997/98:13 p.2) As a consequence a Swedish policy decision to stabilise the CO₂ emissions to the atmosphere on 1990s levels was taken. (Naturvårdsverket 1999 p.14) It is possible to argue that both the threat of climate change and the actual levels of CO₂ emissions have reinforced a political decision addressing the issue. The decision has then increased implementation activity on the issue. One implementation instrument that was developed was the Eko-energi program, aiming at energy efficiency in industries. Hence, the implementation process can bring about activities in the industries pointing at energy efficiency such as new technology, increased awareness among employees, energy management and so on. This would in turn lead to increased energy efficiency in the industry and reduced CO₂ emissions in the very long run. There is obviously nothing that says that energy efficiency alone would lead to reduction of CO₂ emissions. The pluses in the model imply that a one element reinforces the other. However the loop is controlled by reverse feedback (the minus in the model) that disrupts the reinforced development of CO₂ and climate change. The interruption of a destructive pattern indicates that the model is balanced. Applied to a society, the simplified model indicates that the society could be maintained sustainable, in equilibrium with the environment. (de Rosnay 1979 p.7) The thesis focuses primary on the variables within the dashed boarder.

The thesis aims at exploring the implementation process of the Eko-energi program as it reaches one of its targets: Södra. The objective is to provide insights in mechanisms that have affected the implementation process and the outcome of the voluntary program in an industrial corporation. Different factors, which either strengthen or obstruct the implementation process, are identified. These factors will be approached, discussed and analysed through primarily an implementation theoretical perspective. More specifically; the purpose is to discuss driving forces and barriers in the implementation process of the Eko-energi program, which have affected the outcome of the program in Södra.

The following empirical questions will be specifically addressed in relation to the analysis of the case:

- Is the implementation process of the Eko-energi program in Södra lacking top-management support?
- What are the motives behind Södra's involvement in the Eko-energi program?
- To what extent are the objectives of the Eko-energy program achieved in Södra?
- Which are the principal driving forces and barriers affecting the outcome of the program?

1.3 Theoretical Approaches

Implementation of environmental policies is influenced by factors that determine the outcome of the policy in different respects. Such factors can be a mix of social, legal, economic and political factors, for instance management, knowledge, energy regulations and costs. (Gillberg 1999 p.92) In order to investigate the impact of such factors on the implementation of the Eko-energi program, an interdisciplinary approach is applied to the study. Different academic disciplines such as political science, sociology, economics and environmental science are represented in the thesis.

The theoretical framework of the analysis departs from policy analysis research. (See section 3.1) Policy analysis is an interdisciplinary research field, consisting of political science, economics, psychology and sociology. (Premfors 1989 p.12) Within policy research implementation theory is often applied along with evaluation and steering analysis. Here, the framework consists of elements from implementation theory and evaluation analysis. The framework also includes components acquired from organisation and economic theory. Together these theoretical approaches enable an understanding of the mechanisms that has affected the implementation of the Eko-energi program in Södra. The theoretical framework can be understood as a conceptual model that sets the boundaries for the study and links the theoretical issues to each other. (See chapter 3.) For example, the organisational perspective helps to define the boundaries of the industrial firm, Södra, in its specific context.

1.4 Method and Material

The thesis is a case study of the implementation of the Eko-energi program in Södra. The focus of the analysis is set to the last stage of the implementation process, where the program reaches the target Södra and the *target group*, within Södra. The target group consists of actors in Södra, who are participating in the implementation of the Eko-energi program. The case study has been conducted from a *bottom-up* approach (see section 2.2.2.). Through approaching the actors interacting in the policy area, an *implementation structure* – a kind of network of actors, where found. The target group was asked about their motives, goals, activities and contacts among other things. The findings have been used to establish the structures and factors that have affected the implementation process of the Eko-energi program in Södra.

Södra is an energy intensive industry, which was one of the reasons for choosing Södra as a research object. The other reason for choosing the company Södra is its early entry into the Eko-energi program, which is something that has affected the outcome of the program in Södra. The program started between 1993 and 1994, and Södra signed an agreement in November 1994. (Interview with employees at Mörrum pulp mill 990909) The case study was conducted at the Södra pulp mills in Värö and Mörrum and at the sawmills in Lenhovda and Kinda. The choice of the pulp- and sawmills for the case study is consequence of Södra's own selection of the divisions to be the primary target group for the Eko-energi program. The choice was motivated by the divisions' high-energy consumption, compared to the other units and divisions within Södra. Investigating how and when a certain event occurred is typical for case study methodology and especially useful when the subject is contemporary and complex, as the case of energy efficiency policies. (Yin 1984 p.23) Case studies are focused on

processes, how they work and develop. An entire process is not addressed in a case study, instead the study concerns one or a few units. Moreover, a case study often applies qualitative methods, as interviews and observations. (Halvorsen 1989 p.67) A case study enables learning from a specific case, rather than acquiring general knowledge. The objective of the thesis is not to examine all aspects of policy implementation. Instead some aspects will be highlighted, as they are believed to have an important impact on the implementation process. It might be considered a limitation that no general conclusions can be drawn from a case study. However, a case study is not of interest if the context is not addressed, as a part can not be understood without its entity, according to hermeneutic research standards. Therefore the context of the implementation process will be addressed in the study. This implies that the study contains descriptive elements that will not be analysed but serve as a guide to the subject. (Lundquist 1993 p.49) The context that will be described here, consists of the elements of the policy process concerning the Eko-energi program that lead to the implementation stage of the program. Different employees in Södra have been approached and interviewed. They have been selected because of their involvement in the implementation process in the company. The actors have been interviewed about the implementation process of the Eko-energi program; their role, priorities, energy conservation, and relation to the environment, resulting in an inventory of Södra's participation in the Eko-energi program, which has served as a base for an interpretation of the implementation process.

1.4.1 Material

The material sources can be divided into two main categories; theoretical and empirical case study material. The theoretical material consists of theoretical literature, articles and information published on Internet. The validity of internet sources is not questioned, as it consists of official governmental material published on-line. The theoretical literature is retrieved from secondary sources and concerns primarily policy analysis, implementation theory, organisation theory and economics. As the implementation literature is of an older date it can be worthwhile to mention it more specifically. The implementation literature is based on a selection of some of the leading researchers in the field, primary referring to the work of Daniel Mazmanian and Paul Sabatier, whom are considered to be among the most prominent advocates for the top-down approach while Benny Hjern is considered to be a forerunner of the *bottom-up* approach. (See section 3.1) The works of Jeffery Pressman and Aaron Wildavsky are also considered, whose classic work *Implementation* from 1973, constitutes the origin of implementation research. (Premfors 1989 p.122 & Sabatier 1986 p.22)

The empirical material for the case study has been collected through interviews and reading of official documents and other written materials produced by Södra. In-depth interviews with key-persons, (both from Södra and the energy authorities) involved in the policy-making and implementation process of the Eko-energy program in Södra, have been conducted. Eight representatives from Södra have been encountered at their working places for in-depth interviews. The interviews have been semi-structured: An interview manual was prepared with open questions. The study has benefited from the working method that gave the interviewed persons an opportunity to talk freely. The interviews have been conducted partly with a tape recorder and partly by taking notes. One in-depth interview was made over the telephone. The interviewees have been

identified through the snowball method: One informer gives the names of other possible informers. (Halvorsen 1992, p.102) In addition to the interviews, information has been retrieved through e-mail and telephone contacts with employees in Södra.

1.5 Limitations and Thesis Outline

The scope of the study is limited to an understanding of the mechanisms behind an implementation process of a voluntary program in a private company. There is no intention to draw any general conclusions of the effectiveness of voluntary agreements per se. However, it is believed that the study can throw light on specific issues that can contribute to an assessment of voluntary programs if addressed in a wider context.

Even though the thesis in many aspects is an implementation study, the intention is not to carry out a straight implementation analysis. Instead implementation theory serves as a source of inspiration and as a cornerstone in the analytical framework applied in the thesis. Moreover, the study takes on evaluation-like criteria; addressing the outcome of the Eko-energi program in relation to the initial intentions. The main difference between evaluation research and implementation research is that the former deals with goal and result analysis, while the latter includes the institutional settings as well. (Lewin et al 1986 p.302).

Naturally there is range of factors that affects the outcome of the program in the company. In this thesis the factors discussed are limited to elements in the organisation structure (motives and capacity to implement the program), the actors participating in the implementation and economic considerations such as costs. The economic terms are addressed very briefly. The idea is not to make a thorough economic analysis, but to provide a picture of Södra's reasoning concerning costs and investments, as Södra's management of the Eko-energi program has been affected by these factors. Thus important economic aspects, such as cost-benefit, sales and turnover, are only addressed indirectly.

Energy efficiency is discussed as one aspect that can contribute to a shift towards a sustainable energy system. There are other aspects to consider for a sustainable energy system, of which a change towards renewable energy resources from fossil fuel is an important subject. Such considerations will not be covered here. Lastly, key concepts are defined as they appear in the thesis.

1.5.1 Outline

The following chapter is a presentation of Södra. Chapter three discusses the theoretical approaches applied in the study. The theoretical concepts are set in a context and a theoretical framework is developed. In relation to the theoretical components discussed in chapter three, the case is analysed in chapter four. Firstly, structural conditions in the program formulation are addressed. The discussion is however preceded by a description of political problems and political decision that lead to the formulation of the Eko-energi program. Secondly, structural settings posed by Södra, both the organisation structure and economic constraints, in terms of costs, are analysed. Thirdly, actors and especially the target group in Södra, are analysed (see Box 2). Lastly, the outcome of the implementation process is analysed in chapter five, as defined by the empirical questions posed in the introduction chapter.

2. An Introduction to Södra³

Södra, which was established in 1938, is a *co-operative* that processes forestry products, whose members are 32 000 forest owners in the South of Sweden. The co-operative manages timber trading and owns several industries where logs are processed into paper pulp, sawn timber and bio fuels. The productive forestland amounts to 1.7 million hectares and Södra employs approximately 2 600 persons.

Södra differs from ordinary companies as it is a co-operative, owned by its members. A co-operative can be defined as group of people with common objectives that shares the co-operatives profit. (Parkin et al 1995 p.223) The common interest of Södra's owners is to operate forestry practice and to process the forest products (logs, bark, chips etc.) into profitable products as paper pulp, sawn timber and bio fuel. Those operations are divided into different operational organisations. Södra Skog is the operation organisation for forest practices. Operations are carried out in 51 forestry districts, which form five regions. (See figure one, below.)

Södra's industrial operations are carried out by, Södra Timber, producing sawn timber; Södra Cell that produces pulp and Södra Skogsenergi that produces bio fuel. These industrial operational organisations are the target for the case study.

The operational divisions are wholly-owned subsidiaries and run like private companies and act under their own profitability-responsibility in their defined sector. Södra's activities are managed and co-ordinated by Södra's executive management, which is situated in the headquarters in Växjö.

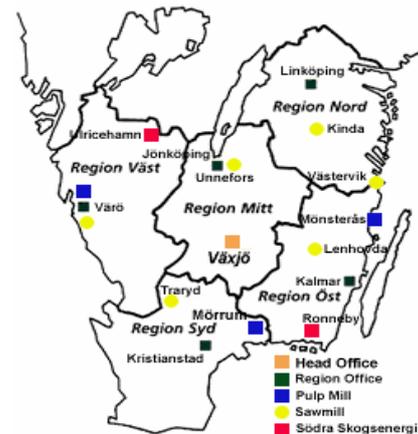


Fig. 1 The map shows the geographical setting of Södra in the South of Sweden. (Source: <http://www.sodra.se> 990901)

2.1 The Industrial Operation Divisions

Södra's industrial operations are carried out at 12 plants, which belongs to three different divisions: Södra Timber, Södra Wood Fuel and Södra Cell. Södra Wood Fuel is a bio energy company, producing bio fuel in form of wood chips, pellets and wood powder. In 1998 the division delivered bio fuel equivalent to 1.7 TWh. However the division was not selected to be a part of the Eko-energi program (see

³ The facts in the chapter refers to *1998 Annual Report* and *1998 Environmental Report*, published by Södra.

section 3.1.4) and will therefore not be in the focus of the study. The two divisions that did take part in the Eko-energi program were Södra Timber and Södra Cell.

Södra Timber produces sawn timber in six sawmills and employs about 520 persons. (For location see fig. 1) The units produce totally 600 000 m³ of sawn wood products per year, which is four per cent of Sweden's total production. The mill in Västervik will be closed down, but a new saw mill is built in connection to the pulp mill in Mönsterås. When it is opened during 1999, Timber's production capacity will increase to 1 million m³ sawn timber. 75 per cent of the production is whitewood, used mainly as building material. Södra Timber invested for 242M SEK (28 MEuro) during 1998, of which 181 MSEK (21 MEuro) was invested in the Mönsterås sawmill. 80 per cent of the production is exported. Södra Timber has been in the red for some years due to low sales prices, especially on whitewood.

Södra Cell is the largest division, holding 58 per cent of Södra's total sales and 76 per cent of the employees, equivalent to 1 480 persons. Södra Cell manufactures market pulp at three pulp mills: Mönsterås, Mörrum and Värö, with a total capacity of 1.3 million tonnes per year. The pulp is mainly exported to paper mills in Western Europe, where the major part of the pulp is used for production of writing and printing paper. In 1998 1.2 million tonnes of pulp were produced, of which 78 per cent was so called chlorine free Z-pulp.

Mönsterås pulp mill is currently being reconstructed, in order to increase the production from 550 000 tonnes per year to 750 000 tonnes per year. In addition to the pulp mill a new saw mill is constructed (see above). Södra Cell invested totally 969 MSEK (110M Euro) in 1998. Most of the money was used at Mönsterås, where capital expenditure amounted to 701 MSEK (80 MEuro), of which 230 M (26 MEuro) was used for environmental investments such as rebuilding of the waste water treatment plant, a new system for malodorous gases and measures on the recovery boiler aimed at reducing nitrogen oxide discharges into the air. Both the pulp- and sawmill will start to operate during the autumn of 1999. Mörrum produced 393.000 tonnes in 1998, of which 66 per cent was Z-pulp and the Värö mill produced 312.000 tonnes.

2.2 Södra's Environmental and Energy Practice

Södra has committed itself to an environmental policy and a nature conservation policy. The environmental policy is based on the conviction that the forestry industry can be a sustainable business:

... the raw material is renewable and the products can be recycled.

(Source: *Environmental Policy*, published by Södra 1996)

In relation to the environmental policy a central decision exists that oblige every division and unit within Södra to implement EMAS. All pulp mills, sawmills and parts of the forestry division Södra Skog, are in the process of implementing EMAS. Seven units are EMAS registered; both operational divisions and the forestry region "Nord", which became the first forestry region to be EMAS-registered. The remaining plants and mills are about to be registered during 1999.

An annual environmental inventory is conducted. Södra themselves prioritise the following emissions: NO_x, SO₂ and CO₂ emission into the air and AOX, COD, N and P into water⁴. All emissions were decreased from 1997 to 1998, except for nitrogen levels, which were stable, and CO₂ emissions, which increased, due to increased oil consumption in the pulp mills in Värö and Mörrum. (See section 5.1) Södra Cell is the most polluting division, especially when it comes to emissions to water. In the area of air pollution Södra Cell and Södra's transport unit stand for the major part of the discharges into air.

Concerning final energy demand, thermal energy is the main energy form. The major part of the thermal energy is generated from bio fuels (about 94 per cent), mainly in form of felling residues and peat. The pulp mills' energy (heat and electricity) is generated from the wood substances precipitated in the digester plant and the oxygen-bleaching process, supplemented by other bio fuels or oil in the boilers. The major part of the energy is used in the pulp mills for cooking the wood, bleaching and drying the pulp, evaporation of return liquor from the digester plant and for producing electricity. In Södra Timber the thermal energy is needed for the drying process. It is generated from bark and shavings. The total input of energy for production of heat in Södra was 35 000 TJ, of which 78 per cent is derived from black liquors, 14 per cent from Södra's own bio fuel and two per cent purchased from bio fuel and six per cent is from fossil fuel.

The total electricity consumption was 990 GWh in 1998, of which 880 GWh was produced at Södra Cell's pulp mills. For example, the Mörrum pulp mill is self-supporting to 95 per cent. 11 per cent of the total electricity consumption, equivalent to 140 GWh, was purchased from local distributors in Mörrum. The fossil fuel consumption was in 1998 4 800 TJ, mainly consisting of fuel oil and diesel, purchased externally. Södra sells energy as well. From Södra's plants 6 400 TJ were sold, in form of bio fuel and district heating. This has replaced 150 000 m³ fuel oil in other industries and thermal power stations. In Mörrum the surplus steam from the recovery boiler and bark boiler is distributed as district heating to Karlshamn, a nearby town. However, around 70 per cent of the steam can not be recovered, partly due to a lower pressure. The low quality steam is cooled and discharged into the air.

It has to be noticed that Södra is quite unique in the sense that they only manufacture pulp and do not have their own paper industry. This affects the energy use in the pulp mills. More energy is used, as all the pulp is dried before it is transported. The largest volume of energy is used in the pulp mills for the cooking process, bleaching of and drying the pulp.

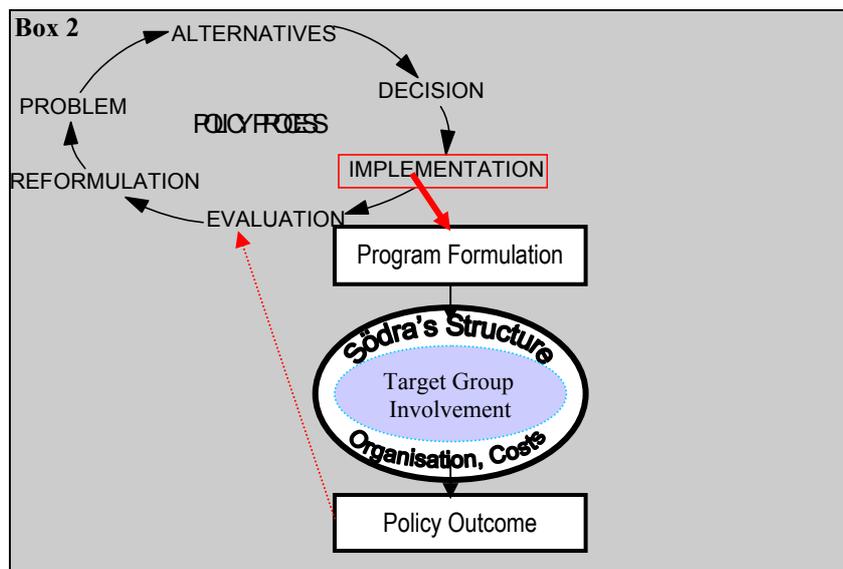
⁴ NO_x (nitrogen oxides), SO₂ (sulphur oxides), AOX (adsorbs organic halogen), COD (Chemical Oxygen Demand), N (nitrogen) and P (phosphorus).

3. Theoretical Framework

— A Conceptual Model —

The analysis is concerned with the effectiveness of the implementation process. The framework for implementation analysis incorporates basic factors that are determining the capacity for an effective implementation process. Such broad social, economic, political and cultural factors are narrowed down and incorporated in the framework through variables such as socio-economic conditions, organisation, attitudes and capabilities. (Mazmanian & Sabatier 1983 p.19) These factors can be explained like filters that the policy must pass through and they also mark the boundaries for the implementation process. (ibid.) I have chosen to elaborate with factors that are of importance when analysing the implementation process of a public policy program in a private company, corresponding to implementation theory, organisation theory and economic theory.

In order to understand how the different factors are integrated and applied to the study, an explanation is required. The figure, in box number two, is a graphic illustration of the following theoretical discussion.



Box 2, illustrates the relation between the different theoretical aspects.

The implementation is understood as a process that aims at turning a political decision into action. The implementation process passes many phases before it results in some kind of outcome. I have chosen to address aspects of the implementation process which were expected to have an impact on the outcome of the Eko-energi program.

3.1 Implementation Research – A Macro Perspective

Implementation is often thought of as the administrative process of politics, managed by civil servants. However, public policies are rarely pure public in character as modern society is a society where organisations of different kinds grow rapidly and, consequently, the political sphere is changed as well. Therefore non-public actors such as private companies can be incorporated in the policy process in order to achieve the purpose of a policy. (Hjern and Hull 1981 p.188) The Eko-energi program for example, is administrated and implemented through organisations of different kinds, from public administration to private corporations. Considering the issue, a wider definition of implementation is needed: *...the process of trying to move from a decision to program or project operations.* (Wolman 1981 p.434) This section will firstly present the context of policy implementation. Secondly, different aspects of implementation research will be outlined. The examination is followed by a discussion of different factors that are considered in implementation theory and how they are applied to the study. Thereafter structural organisational and economic factors are addressed. Finally, the different factors are combined into a theoretical framework for the study.

3.1.1 The Policy Process

Implementation research is one dimension of policy analysis. A policy can be defined as one or more ideas and the institutional arrangement that are undertaken to turn the ideas into action. (Lewin et al 1986 p.297) Policy analysis studies a process that can be understood as a cyclic procedure, describing how a problem is dealt with politically. (Premfors 1989 p.41) There are many ways of describing a policy process. A common approach is to divide the policy process into different stages. A simplified model could look like the model in figure one below.

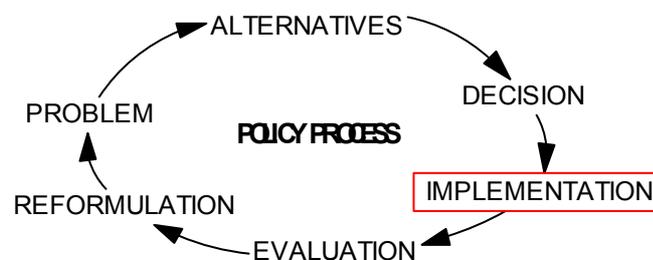


Fig.2 The model illustrates a simplified way of addressing a policy process based on a mix of the policy process as presented by Hempel and Premfors. The implementation phase (within the boarder) is the target for this study. (Hempel 1996 p.120-147 & Premfors 1989 p.44)

The model illustrates a rational and linear policy process, in which one stage sequentially follows the other. This is an idealised model, since reality is far more complicated, where the stages overlap and exists in parallel. (Premfors 1989 p.43) This is a criticised way of understanding a policy process. Critical approaches, such as the garbage can model⁵, challenges the consequential connections of the policy stages. Instead the order of things is perceived as temporal, run by coincidences rather than by rational responses to problems. Nevertheless the rational model, as presented in

⁵ The garbage can model likens decisions to bins, into which participants throw problems and solutions and from which problems and solutions are collected. (Gordenker et al 1995 p.27)

figure one, serves as an illustration of the components of a policy process and an illustration of the context for implementation. (See the example in box three.)

Box 3. The Eko-energi program is a policy program that was developed in order to **implement** a political **decision** on more efficient use of energy in Sweden. (SOU 1995:140 p.187) The decision, in turn, was a result of different energy **political problems**, the change of power system in Sweden for example. (SOU 1995:139 p.91) A policy process also consists of phases that are not addressed in the thesis: **Alternatives** is a phase in-between the realisation of a problem and a decision on the same, where a plan how to deal with a certain problem and a policy formulation is developed. (Premfors 1989 p.63) (Not to be mixed up with *program formulation* addressed in section 3.2.1) **Evaluation** often takes place after and/or parallel with the implementation in order to investigate whether the objectives of the policy decision had the required effects. The evaluation, carried out by civil servants, should not be confused with *evaluation research*, which is an aspect of implementation researches. (Lewin et al 1986 p.302) Lastly, an evaluation often results in **reformulation** of the problem and consequently new problems have to be dealt with. (Premfors 1989 p.132 & 146)

Box 3, illustrates how the components in a rational policy cycle are linked to each other.

3.1.2 Two Approaches to Implementation Analysis

As stated above, the implementation phase is the process of turning a political decision into action. The process is however full of circumstances that affects the implementation. When implementation research was introduced in the early 1970s, it was an attempt to problematize public administration of policy decisions, as the results of political programs often were found to differ from the original political intentions. (Lewin et al 1986 p.295) The research tradition came from the United States to Europe, where so called policy output analysis inspired the analysis. Policy output analysis was developed from political systems theory, which implies that the local political system was provided with an socio-economic environment, where the political system can be described with input, output plus throughput functions. (Hjern & Hull 1982 p.106f) In a system where transformation occurs there are inputs and outputs. The input is the result of the environment's influence on the system and the output is in turn a result of the influence the system has on the environment. (de Rosnay 1979 p.11) The policy process can be explained as a response to challenges from the environment; both the natural, the social and the economical environment. (Mazmanian & Sabatier 1983 p.19)

3.1.2.1 The Top-Down Approach

The early implementation research from the 1970s focused on the actual policy decisions and examined the extent to which the policy objectives were achieved. This approach to implementation is called the top-down approach to implementation research and it is a rational way of exploring policy implementation. (Sabatier 1986 p.21f)

The top-down approach is characterised by its focus on policy decisions and the evaluation-like research criteria that are examined as the implementation process is followed from the top to the bottom. Typical areas of research within the top-down approach are for example, the extent to which the attained outcome is consistent with the policy objectives. Another approach is the actions of public civil servants; whether their actions are in line with the objectives and the outline of the policy decision. (Mazmanian & Sabatier 1981 p.22) The top-down approach has been criticised for underestimating the strategies used by, for example target groups, to affect the policy and maybe divert them into their own purpose. (Sabatier 1986 p.31) Another point of criticism is that the top-down approach is likely to neglect actors other than the decision-makers. (Sabatier 1986 p.30) The kind of actors addressed within the top-down approach is mainly decision-makers and civil servants, working directly with the implementation. This, in turn, causes an abandonment of initiatives coming from the other actors, as the target group for example. (ibid.)

As established in section 1.2, one of my empirical questions to be investigated corresponds to the first research criteria; the issue of consistency with the policy objectives. Nevertheless, the actions of the involved actors are of great importance for the analysis of driving forces and barriers in the implementation process of the Eko-energi program. Therefore, I have applied a less rational approach, as will be discussed below.

3.1.2.2 The Bottom-Up Approach

In the late 1970s and early 1980s a different method emerged, the so-called bottom-up approach. It is a less rational approach to the implementation process. Instead of concentrating on the policy itself, the bottom-up approach focus on the multitude of actors that interact in the policy area. The bottom-up approach, as presented by Hjern et al., starts with identifying the network of actors involved in the implementation process in the local areas. Hjern calls this the *implementation structure*. In order to identify the network, the actors are asked about their goals, strategies, activities and contacts. Secondly, these findings are used to establish a larger network, with the purpose to identify local, regional and national actors involved in the policy process – moving from the bottom to the top. Hence information is gathered from the actors at local level, which is used to identify the implementation structure. (Hjern & Hull 1982 p.109ff & Sabatier 1986 p.34) The bottom-up approach has its limitations as well. As it relies on the participants' activities and their perception of the policy, a bottom up study risks to focus on the subjective factors the participants find important and consequently the study might lack consideration of factors that might affect the implementation. (Sabatier 1986 p.38) For example the interviewees at Södra have not considered organisational aspects to be relevant for the implementation of the Eko-energi program. However, as will be seen in section 3.3, I consider Södra's organisational structure to be of importance for the outcome of the Eko-energi program.

It is hard to define a sharp line between the two approaches. The main differences concern both the applied method (as illustrated above) and the description of the implementation phase. (Premfors 1989 p.123) The top-down perspective is a more formalised and rational approach, concerned with the effectiveness of a specific governmental program, while the bottom-up approach is more concerned with

mapping the strategies of the actors treating the policy problem and understanding of the actor interaction in a specific policy sector. (Sabatier 1986 p.36)

3.1.2.3 Application of the Approaches

A positive aspect of interdisciplinary research is that you do not necessarily have to remain faithful to one theoretical angle. Therefore I have taken the freedom to apply analysis criteria from the two approaches, even though this can seem to be a blasphemy against implementation researchers. My reason for doing so, is that the two perspectives highlights different aspects of the implementation process, that I find equally important for the outcome of the Eko-energi program in Södra.

Even though this is an evaluation-like study, concerned with the achievement of the policy objectives and the effectiveness of the implementation of a policy program, a moderate bottom-up approach is applied. Through mapping the actors in Södra on different levels, an implementation structure emerges. From the individual level, groupings and larger entities are identified; units and departments in Södra and Södra as an entity. These different actor levels will be addressed in the case study.

The top-down approach is primarily concerned with the actions of the civil servants and not the target group. This is a consequence of top-down assumption that the government decides, authorities implement and the target group react to the policy. The formulation of the program as a voluntary agreement blurs the distinction between the two approaches in this respect. The implementation process used to be an issue for public administration. However, formulating the program as a voluntary agreement, it is implied that the private actors will have a much more active role in the implementation process. (Hjern & Hull 1981 p.188) To conclude, a bottom-up approach is applied in terms of method, while analysis criteria primarily considered by top-down researchers, are addressed in relation to the program formulation.

3.2 The contents of the framework – A micro perspective

Without going into a discussion of the complicated relation between structures and actors, it can just be noticed that the theoretical framework developed here consists of both structural and actor related factors. Structures can be defined as social, physical or ecological relation patterns between societal actors, nature or society and nature. (Lundquist 1992 p.42) Actors are individuals or collectives with some degree of consciousness and autonomy. (ibid.) Structures and actors interact and together form the setting for activities, such as implementation activities. Structural factors can be likened with the bricks in a construction that set the frame for the activities taking place within the construction. Concerning the present case, a number of both structural and actor oriented conditions that limit or enforce the implementation process have been identified. A part from implementation theory, these factors correspond to organisation and economic theory. The first set of structural mechanisms concerns the formulation of the Eko-energi program.

3.2.1 Formulation of the Program

A program's success or failure is connected to the formulation of the policy program and not only to the actual implementation process. (Sabatier & Mazmanian 1986 p.25, Wolman 1981 p.435) There are a number of conditions for the formulation of a policy program, which affect the implementation of a policy. Two conditions that are of importance for the Eko-energi case are addressed. These factors are as follows:

- **Clear and consistent objectives.** Clear objectives are viewed as providing both standards for evaluation and an important resource to the implementers. (Sabatier 1986 p.23) Vague objectives make the implementation and evaluation harder as the stated objectives are open for interpretation. A disagreement about the meaning of a policy leads to frustration and distrust in the ability of the policy makers, having a pessimistic impact on the trust in solving the real problem. (Wolman 1981 p.439) This is not necessarily the case. A program, like Eko-energi, can be formulated with broad concepts and soft goals without being an object for conflict. It could actually be rather creative if different values (within an acceptable range) can be considered. An implementation can still be effective with a certain degree of dynamics embedded into the policy program. (Sabatier 1996 p.29)
- **Regulatory mechanisms.** The incorporation of regulatory mechanisms in the policy decision, such as legislation, is believed to be an important instrument for compliance of the program. (Sabatier 1986 p.23) A program that is regulated by a law and where enforcement mechanisms, such as sanctions, are incorporated forces the involved actors to implement it or at least prioritise the policy program before other programs. (ibid.) There also exist those who believe that a carrot is more effective than a stick. A carrot could be an incentive, where the regulated entity receives financial support, advises or access to valid information. However, the use of incentives requires that the self-interest of the target group correspond to the policy objectives. (Wolman 1981 p.445)

3.2.2 Organisation Structure

The thesis is focused on the implementation process of the Eko-energi program in Södra. Therefore it is essential to address both structures and actors within Södra that determine the firms' activities in this respect. In this section, structural conditions in terms of organisation structure are addressed. The coming section (3.2.3) refers to costs and other economic mechanisms that structure Södra's activities.

Södra's activities, everything from production to implementation of public programs, are kept together and managed through its organisation. Hence, Södra's activities can be determined by the target group's ability to effectively implement a policy. The ability, in turn, can be constrained by factors in the organisation's design for example. This paragraph discusses a few structural factors that are found within the organisation theoretical issue area.

Organisation theory studies the structure and design of organisations. Organisation theory takes on a macro perspective, analysing the behaviour of organisations and organisational effectiveness. (Robbins 1990 p.7)

An organisation can be defined as:

... a consciously co-ordinated social entity, with identifiable boundaries.
(Robbins 1990 p.4)

An organisation has some sort of formal co-ordination of the members of the organisation that controls the interactions in the organisation. This is called organisation structure and defines how tasks are to be allocated, the division of responsibility areas, how decisions are made and so on. (Robbins 1990 p.5) Organisation structures can be static, dynamic or something in between. The degree of dynamics in the structure creates the possibilities for change in an organisation. (Gortner et al 1987 p.124) Concerning a company, the organisation structure characterises the company culture and sets the boundaries for the employees' actions. Consequently, factors in the organisational structure affect the company's ability to implement a program like Eko-energi and to take energy issues into consideration. (Gillberg 1999 p.103) Such factors, like flat or hierarchical organisation or the degree of decentralisation for example, can be categorised into different issue areas. Within organisation theory formalisation and centralisation are two categories (among others) discussed. These two factors, and some of their implications for the organisational structure, are addressed in the study.

- **Centralisation**, concerns the location of the decision-making in the organisation, for example. In a hierarchical organisations decision-making is highly centralised, where only the senior executives have a decision right. Meanwhile, in flat organisations the decision-making is decentralised and authority is dispersed downward in the hierarchy. (Robbins 1990 p.6) A more decentralised structure, where the employees have a larger responsibility, favours change, as the personnel on lower levels is more likely to see the needs in the organisations operations, compared to the top-management. (Gortner et al 1987 p.124)
- **Formalisation**, is the degree to which an organisation relies on rules and procedures in order to direct the behaviour of the employees; what kind of responsibilities they have e.g. Some organisations operate with a minimum standard regulation, others have a lot of regulations and guidelines instructing the employees what they can and can not do. (Robbins 1990 p.6) More implicit policies that set the company attitude to different issues. The set of rules, procedure and policies sets the company culture. (Robbins 1990 p.96-101) Formalisation is related to specialisation of the work tasks in a company. Industrial work on the shop floor is often highly specialised and formalised. Blue-collar workers normally perform repetitive activities. (ibid.) The degree of specialisation can have an impact on the possibilities to implement new energy efficient equipment and behaviour, as will be seen in section 4.3.2. Highly formalised rules are likely to decrease the rate of change, as a static structure limits the dynamics in the organisation. Employees are expected to handle issues in a specific way, resulting in uniform output. (Robbins 1990 s.93) Possibilities for change will be perceived as limited in a highly formalised organisation, both by the management and the regulated employees. The change of a rule is both costly and time consuming, but most of all it is hard to change well-established behaviour patterns. (Gortner et al 1987 p.124)

3.2.3 Costs

The range of factors discussed so far, has concerned both internal functions in the company where the implementation takes place, and external factors in terms of the formulation of the policy program. Naturally, there are a lot of factors (internal and external) that affect the implementation process that will not be mentioned here. Nevertheless, there is one structural factor, apart from the organisation structure, that is vital for a company that will be discussed here and that is the issue of costs.

The overall aim of most companies is to maximise profit. In this context, costs play an essential role in the process of achieving a maximised profit. (Sloman 1991 p.139) Without going into economic theory in depth, some aspects of production costs and investments will be considered here, as they have showed to have an impact on Södra's implementation of the Eko-energi program. Production costs depend on the amount of input and the price the input has. Apart from the input costs of labour and natural resources used in the production process, physical capital, such as plants, machinery and tools, are of importance. (Sloman 1991 p.140) First of all the prices of these factors are of importance. The higher the price, the higher the production costs. This is naturally something that firms want to control in order to be able to maximise profits. (Sloman 1991 p.165) These aspects of production costs are important considerations for a company when they are planning investments in new technology for example. If a company has a short run vision of their activities, these are considerations that might steer their plans. However, production costs are also dependent upon the productivity incorporated in these factors. The greater the productivity of, for example a piece of equipment is, the higher output and consequently the lower production costs are achieved. (ibid.) In relation to such considerations it can be worthwhile for an industry to consider a higher initial cost for machinery, if the output is greater compared to a cheaper alternative. These kinds of concerns are easier to consider for a company if life-cycle cost assessment is applied. A life-cycle perspective on new investments can also be an important factor for including energy costs in the picture. (Christiansson et al 1994 p.134)

An additional important aspect of investments is pay back time. The benefit of an investment does not occur at once. It takes some years, sometimes many years, for an investment to pay off. Investments in equipment, for example, signify that the company change financial capital into physical capital (such as the production costs factors discussed above). (Sloman 1991 p.140, 309) Obviously it is important for the company that the investments made, add to its capital stock, instead of diminishing it. (Sloman 1991 p.309) Pay back times can be calculated in different ways. (Sloman 1991 p.318) Nevertheless, it has been found that energy end-users (the energy consumers), like the pulp- and paper industry, often requires a return of invested capital in energy efficient measures, in one to three years. (Christiansson et al 1994 p.133f)

3.2.4 Actor Involvement

Apart from the structural related conditions above there is an actor level that also has an impact on the implementation process. Actors can be defined as either individuals or groups, which have a certain degree of consciousness and autonomy. (Lundquist

1992 p.41) Here, the term actors is used generally for all actors involved in the implementation process, both from the authorities and from Södra. However, a certain group is more in focus than other actors in the implementation process are, which is the target group – the receivers of the policy.

In this particular case the target group, consisting of the employees at Södra including management and operational staff, plays an essential role in the implementation process. Södra and its activities is not only the target for the policy program, it is also actively participating in the program as implementers, due to the voluntary nature of the policy program. If the target group does not support the objectives of the policy program the policy will be harder to implement. The actions or lack of actions, of the target group is of importance for a successful implementation of the program. (Mazmanian & Sabatier 1981 p.9)

The Eko-energi program is about changing energy use patterns. Some of the required changes can be dealt with through change to more energy efficient technology. Still, technology can not solve all the problems related to energy consumption. Consequently some factors that might determine the target group's involvement in the implementation process are addressed.

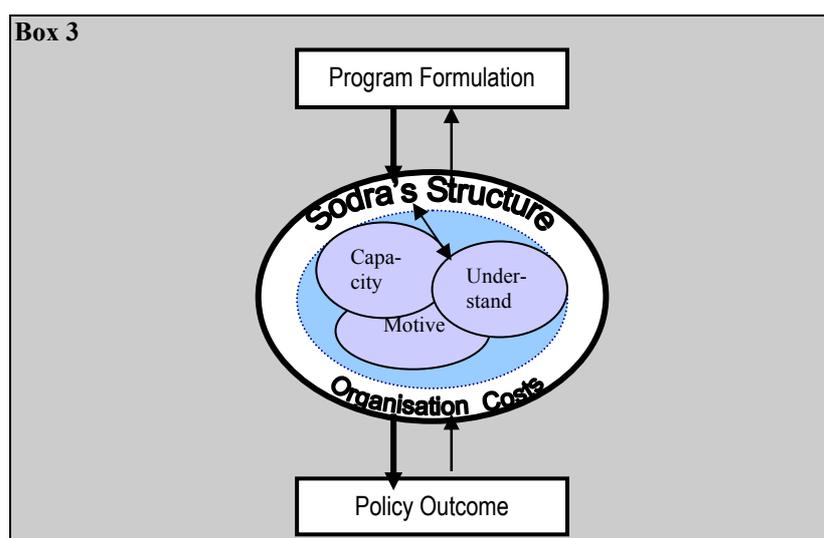
Three qualitative words sum up the actors potential for an effective implementation: Will, can and understand. (Lundquist 1992 p.75f) These are qualities of the target group that are important prerequisites for an effective implementation. (ibid.)

- What are the target group's **motives**? Do they want to implement the policy at all and how do they want to do it? (Barret & Fudge 1981 p.13f) The motivation for participation in a policy program is not only a question of interest in the policy issue, it might just as well be a question of advantages or threats related to the policy. It can also be a question of whether the actors know their motives? Sometimes the motives behind a certain action are unclear even to the performer her/himself. (Barret & Fudge 1981 p.13f) This is related to;
- Do the actors **understand** the contents of the policy? This is connected to the formulation of the program discussed above. An unclear formulation makes it more difficult for the actors to understand what is expected of them. (Lundquist 1992 p.76) Even if the actors understand the formulations of the program, they might not understand the context of the program. For example, if a person at Södra responsible for parts of the implementation of Eko-energi, understands the contents of the program, but not the relation to more abstract issues as climate change and sustainable development, she/he might not prioritise the policy program;
- Does the target group have the **capacity** to implement the program? Does she/he have sufficient access to relevant resources, both in terms of money, time and human capital? (Barret & Fudge 1981 p.13f) Do the actors have the knowledge and skills required for an effective implementation? (Sabatier 1986 p.23) Lastly, do the actors have enough with influence and capacity? (Lundquist 1992 p.76)

3.3 The Theoretical Framework

Södra and its activities are in the focus of the study. Therefore a further explanation of the relation and interactions between the internal functions in Södra is provided. The model in Box 4, can seem to be an illustration of a static relation between the structural components in Södra's organisation and connection to costs, and the activities of the actors. However, Södra, in terms of a company, is seen as an open system, where the structure and actors are in constant interaction. An open system also interacts with its environment; exchanging material, energy and information for example. The open system has both inputs and outputs, through which the surrounding environment changes Södra's organisation structure and the organisation modifies its environment through constant interactions. (de Rosnay 1979 p.7) Applied to the study, such a perspective implies that the Eko-energi program enters Södra, where it interacts with its structures and actors and ends in an output – the result of the policy implementation.

Södra's management of the implementation is not only affected by internal functions and by input of external factors (that are not expressively addressed here), it is also affected by feedback from the outcome. (Lundquist 1992 p.105)



Box 3, illustrates the theoretical framework developed for the case study.

In conclusion, the theoretical framework consists of factors that affect the implementation process of the Eko-energi program in Södra in different respects:

- The program formulation, which interacts with the internal factors in Södra;
- Södra's organisational structure and relation to costs is affecting and affected by;
- The target group's involvement, determined by their will, capacity and understanding of the policy program, which in turn affects;
- The outcome of the Eko-energi program in Södra, which has a reverse effect on Södra's activities.

4. Case Study

4.1 The Policy Program

4.1.1 The Politics behind the Eko-Energy Program – Problems and Decision –

The demands of reduced CO₂ emissions together with the phase out of nuclear power set new constraints on the Swedish energy system. Accordingly the energy demand in Sweden must be reduced if a 60 per cent reduction of CO₂ emissions in a nuclear free society is to become reality.⁶ (Naturvårdsverket 1999 p.17f) Nevertheless, the industry sectors' energy use is expected to increase 0,8 per cent per year and the electricity use 0,9 per cent. (NUTEK 1997 p.12) Therefore energy efficiency in all societal sectors is of importance. Together with an increased use of renewable energy sources and an exchange of old energy- and transport systems and combustion equipment, energy efficiency is conceived as the most important measures to be undertaken in Sweden. (ibid.)

Today's Swedish energy politics is a result of an energy policy decision from 1991. The same energy policy decision was the starting point for the Eko-energi program. According to the policy decision from 1991 the phase out of nuclear power would depend upon the results of energy conservation projects, supply of energy from environmentally acceptable energy sources and the possibilities to maintain internationally competitive electricity prices. (NUTEK 1997 p.30 & STEM 1998 p.2) Since fossil fuels have an impact on the climate, it was also stated that combustion of fossil fuel should be avoided and changed for bio fuels in the future energy system. (SOU 1995:139 p.92) In 1994 a parliamentary energy commission was appointed. The task of the commission was to study the change of the energy system, as decided upon in 1991. It was suggested that the change of the energy system should be given time in order to achieve the policy objectives from 1991. The commission also concluded that no decision should be taken concerning the date for decommission of the last nuclear reactor. However, it was decided that one nuclear power reactor should be closed. (NUTEK 1997 p.31) The first reactor, Barsebäck 1, was closed the first of January 2000. The commission report resulted in a political decision in 1997. The decision brought about an energy policy program, which objective is to safeguard the availability of electricity and energy from renewable energy sources on terms that are competitive internationally. (Näringsdepartementet 1999)

Additionally, the climate political decision from 1993 presented a more concrete strategy for a climate policy. It was decided that the emissions of CO₂ from fossil fuel sources should be stabilised at 1990s emission level by the year 2000. This goal will

• ⁶ In 1998 nuclear power accounted for 46 per cent of the total electricity production in Sweden. (STEM 1998 p.5)

no be met. (Naturvårdsverket 1999 p.14) On the contrary, the CO₂ emissions have slightly increased during the last decade. The CO₂ emissions from the industry and transport sector, for example, have increased by three and four per cent respectively between 1990 and 1997. (STEM 1999 p.30f) In 1994, the Framework Convention on Climate Change was ratified and the parliament has in the course of events changed the Swedish climate goals. The goals include a stabilisation of the content of CO₂ to less than 550 ppm (parts per million) in the atmosphere and that the content of the other greenhouse gases should not increase. (Naturvårdsverket 1999 p.7)

Through the 1991 energy policy decision, 965 million SEK were allocated for *the program for more efficient energy use*, over a period of ten years from 1988 until 1998.⁷ The aim of the program was to develop measures for facilitating a transformation of the energy system away from a dependency on nuclear power and to improve the environmental aspects of the energy system. (SOU 1995:140 p.187) Swedish National Board for Industrial and Technical Development (NUTEK) became the responsible authority for implementing the program. (NUTEK 1997 p.38f) The program has resulted in several subprograms, of which one was the Eko-energi program. Other programs concerned technology procurement, dissemination of energy efficient technology and information programs. (ibid.)

4.1.2 The Eko-Energi Program Formulation

The Eko-energi program aims at energy conservation in the private sector. The program was initiated in 1992-1993 by NUTEK and it is an agreement directly between the national authorities and individual companies. The program was first administered by NUTEK and has later been transferred to STEM (Swedish National Energy Administration). The program has been joined by a total of about 30 companies, involving about 80 plants or sites. (Kågström, Åstrand & Helby 2000 p.4-7) The participants are a mix of companies, from the services sector to the manufacturing sector, and with low as well as high energy intensity, even though there was a certain focus on the manufacturing industry from the authorities. However, the program was joined by two major paper-pulp industries in Sweden, StoraEnso Skoghall and Södra. (Lewald 1999)

The program is designed around five goals, shown in box number five.

- | |
|--|
| <p>The program goals:</p> <ul style="list-style-type: none">• More efficient use of electricity in the industry;• Reduced energy costs;• Reduced need of energy production;• Reduced use of fossil fuel;• Reduced emissions of CO₂ |
|--|

Box 5, presents the overall goals for the Eko-energi program.
(Source: The standard agreement formulated by NUTEK)

⁷ A program for more efficient energy use was introduced already in 1988, which was strengthened and developed by the 1991 energy policy decision. (NUTEK 1997 p.38f)

The first program formulation was only concerned with electric energy, focusing on lighting, ventilation, regulation devices, comprised air and motors. It was later changed to include all forms of energy. The focus on electric energy reflects the 1991 energy policy concerned with phasing out nuclear power whereas the expansion reflects the growing emphasis on climate change and reduction of fossil fuel emissions. (Kågström, Åstrand & Helby 2000 p.4-7) An additional explanation for the authorities first focus on electricity seems to depend on the American Environmental Protection Agency's project *green lights*: A voluntary agreement on electricity efficiency in the real-estate sector, that was used as a source of inspiration and guideline for the formulation of the Swedish Eko-energi program. The industries that entered the program at an early stage, signed an agreement limited to electric energy. This was the case for Södra which signed a written agreement in November 1994. (Lewald 1999) Södra's representatives did not bring up the issue of including other forms of energy into the agreement either. Södra's management representatives think that process energy is of a different dimension, as it is far more complex than the electricity issues at stake in the program. (Interview with M. Fagerlind and R. Lövblad)

4.1.2.1 The Program Objectives

The program's overall goals are narrowed down into more specified objectives, which also constitute the actual content of the voluntary agreement. As the objects of the Eko-energi program are formulated in form of an agreement, the authorities and the participating company have committed themselves to comply with the objectives of the program, as listed in box number six. There is an obvious focus on "soft" goals rather than "hard" goals. Even if the companies must establish saving goals and plans for energy efficiency measures, there are no specified saving limits, time limits, conservation plans or sanctions incorporated in the program. The authority's commitment is a bit more concise and short term compared to the companies' commitment, especially concerning the energy audit and education on procurement routines that the authorities are responsible for. These are contributions that are conducted in the beginning of the implementation phase in the companies in order to get them started with the long-term objectives.

The authorities commit themselves to provide the participating companies with:

- Free environmental and energy audit by external consultants.
- Support certification according to ISO 14001 or EMAS standards.
- Contacts at the Energy Authorities (NUTEK/STEM)
- Education and development of procurement routines.
- Use of the Eko-energi label for promotion purposes.

In return, the companies are committed to:

- Formulate an environmental and energy policy.
- Establish long-range energy savings goals.
- Establish goals concerning the energy and effect needed.
- Establish a plan of action concerning energy efficiency measures.
- Conduct procurement along NUTEK/STEM approved ENEU-94/LCC standards.
- Report planned and implemented energy saving measures to the authorities.
- Participate in the program activities.

Box 6. These are the objectives, expressed in form of an agreement that the participating parties have committed themselves to. The authentic program text is not very much longer than this outline. (Source: The standard agreement formulated by NUTEK)

The program is formulated around the ideas of the EMS - Environmental Management Systems (EMAS – Eco Management and Audit Scheme, and ISO 14001). Not only does the program promote certification according to EMAS or ISO 14001 standards, it is also focusing on internal continued improvement of environmental matters in the firm and not on governmental control, just like the EMS standards. (Kågström, Åstrand & Helby 2000 p.5) Hence, Eko-energi is aiming more at change of attitudes than at measurable energy conservation. Even though the agreement that Södra signed is very similar to the outline in box number five, it lacks the specification concerning authority support for EMAS/ISO 14001 certification. It was left out as Södra had started with an EMAS certification process before the Eko-energi agreement was signed. For Södra's sake the Eko-energi program has mainly concerned the first point in the program formulation; the issue of a free environmental and energy audit. The authorities provided (and financed) the plants with an energy audit, conducted by external consultants chosen by the energy authorities. The audits were presented in a report, which included a description of the current energy situation in the company and a list on potential electricity efficiency measures that the company should implement. The potential energy efficiency measures that were addressed in the audit reports concerns different electric measures in buildings as light, ventilation and electrical motors for pumps for example. As a consequence of the audit report, the implementation of the Eko-energi program in Södra turned to be a question of whether the suggested electricity efficiency measures should be implemented or not.

According to Sabatier and other top-down theorists, a lack of clear and consistent objectives could be problem, as there could be different opinions about the implications of the objectives. The kind of conflict they had in mind is a conflict between the authorities and the target group. The program formulation has not caused any conflict between the authorities and Södra. On the contrary, it seems like the soft formulations and the fact that the authorities aimed at long-term goals based on voluntary actions from the beginning have contributed to a more positive attitude from Södra towards the program. As discussed in the theory chapter, a policy program formulated with broad concepts and soft goals can still be implemented effectively and does not necessarily have to be an object for conflicts. (Sabatier 1996 p.29) The firm representatives interviewed agree on that Eko-energi was a positive initiative in the sense that a dialog was possible with the authorities. Södra's representatives compare with environmental legislation where no choice is left for the industry and the authorities are not open for alternative suggestions from the industry. (Interviews with Södra Cell personnel) A conflict, or more precisely a misunderstanding, arose however from the program formulation in Södra, between the top-management and employees at plant level working involved in the Eko-energi program. The top-management responsible for the Eko-energi program in Södra where from the beginning aware of the program's limitation to electricity, while several employees expected all energy forms to be included in the program. Once these employees realised that the program was limited to electricity, their interest dropped as they thought that process related energy issues were of much more importance. The cause was not an imprecise program formulation, but lack of communication within the company.

The Eko-energi program has now entered a new phase. No more companies will be able to join the program and no more energy audits will be conducted. Eko-energi will continue for another three years. The companies' energy conservation projects will be

followed up during this period. Parallel with the out-phasing of the current profile, STEM has begun to work with new tasks. Based on the experiences from the Eko-energi program, STEM will draw out some good examples and compile information material that will be spread. In addition the authorities are working on an energy management system. (Interview with K. von Kronhelm) There seem to be several reasons for the change of the program and its conclusion. From the first of January 1998 Eko-energi was transferred to STEMs budget, as grant from *the Program for More Efficient Energy Use* expired. STEMs lack of funds has affected the change of direction of the Eko-energi program and its deadline. (Interview with A. Lewald) Apart from the lack of funds, the program formulation with its focus on EMAS-like criteria, became out dated. In the beginning of Eko-energi, EMAS and ISO14001 were rather new phenomenon on the market. Hence, it was easier to attract companies to participate as the authorities could offer them support in the certification process. Now the environmental management systems are common and companies do it on a voluntary basis without a “carrot” from the authorities. (ibid.)

4.1.2.2 Regulatory Mechanisms

The Eko-energi program has been formulated as a kind of voluntary agreement. A voluntary agreement could be anything from a voluntary environmental certificate, such as different environmental management systems (EMAS and ISO 14001) and eco-labelling schemes to more structured regulations with a binding contract. (Krarup 1999 p.5) The major difference between traditional command-and control regulations and voluntary agreements, is that the agreement is voluntarily entered and result in a commitment that is recognised by governmental authorities. (Hanks and Sillén 2000 p.10)

Voluntary agreements are often used in addition to other policy measures undertaken to affect the industries energy use. In Sweden other policy measures in the energy field consist of CO₂-tax, subsidies to research and development, procurement programs, labelling and testing and information dissemination. (Krarup & Ramesohl 2000 p.17) There are different reasons for considering formulating a policy program like a voluntary agreement. Some would argue that voluntary agreements are more flexible and easier to balance with other economic, social and environmental policy objectives than common steering instruments as tax and regulations. (IEA 1997 p.11) Voluntary agreements can also be of interest when dealing with policy areas that often are met with negative attitudes. Thus can voluntary agreements provide an arena where the policy makers and a certain group, like the industry can meet. It opens up for positive response to the policy problem from the industry, which often meets environmental legislation with a negative reaction. (Gillberg 1999 p.108) A problem regarding voluntary approached concerns the risk of misuse by politicians who see a way to avoid hard and unpopular political decisions. Introducing energy taxes, for example, is politically risky, as there is an opposition in society to increased taxes. (Elliot 1998 p.127) Voluntary agreements can still be an interesting complement to traditional steering mechanisms, as traditional policy implementation strategies require a complex and expensive administration. However it can be discussed to what degree voluntary agreements are more cost efficient than traditional regulations. Somehow voluntary agreements also require an organisation that secures governmental action, financial support, and enforcement mechanisms. (Gillberg 1999 p.108)

Voluntary agreements, like the Eko-energi program, do not incorporate sanctions or are regulated by law.⁸ The Eko-energi program is totally based on positive incentives and voluntary actions. The Eko-energi program is some kind of gentleman's agreement. To be more precise, the Eko-energi program is better defined as a *Public Voluntary Program*, which is characterised by a low level of negotiation but a higher level of public-private interaction than for example self-regulations as EMAS. (Hanks and Sillén 2000 p.10) As there are no enforcement mechanisms integrated in the Eko-energi program formulation that demand the participating companies to act in line with the program, the authorities have incorporated incentives that were thought to motivate fulfilment of the program objectives. The Eko-energi program is steering the target group through information and possibilities to increase the environmental profile. (Premfors 1989 p.126) There are economic incentives incorporated as well. In the Eko-energi program the authorities are attracting companies by offering energy audits and support in EMAS work. The main part of the authority budget has been payment of the energy audits. As will be discussed further, the Eko-energi program in Södra came to focus on the energy audits. Economic incentives are frequently used steering mechanisms. They are not as enforcing as command-and-control regulations, but through providing or withdrawing money, an actor can be steered in a certain direction. (ibid.) The economic incentives in the Eko-energi program do not have such a strong impact. They have more been a way of attracting companies to participate in the first place, not mechanisms for enforcing compliance with the program. Therefore the use of incentives requires that the self-interest of the target group correspond to the policy objectives. Otherwise it is likely that the voluntary program will not reach the policy objectives. (Wolman 1981 p.445) As will be seen in the coming sections, the implementation of the Eko-energi program is subjected to what benefits the target group find in the program.

4.2 Södra's Organisational Structure⁹

4.2.1 Degree of Centralisation

Centralisation is a question of where in the company the actual decisions are taken; in the top or in the bottom of the organisation. The degree of control over the decision-making in the company is a measure of centralisation. The larger the organisation, the greater the need for structures that allow control and co-ordination, in order to enable the members of the organisation to move in the same direction. (Scott 1992 p.261) It might be considered logical then, that an organisation structure should be highly centralised and hierarchical in order to enhance control. That is not necessarily the case. Many organisations pass on decisions down to lower levels in order to be more flexible. Seen from a system perspective, a company needs to respond rapidly to changing conditions in the environment, if it is going to survive. (de Rosnay 1979 p.23) Otherwise it risks losing its position or in the worst case to disappear from the

⁸ Sanctions can be incorporated into voluntary agreements even though it is not very common. In Denmark for example, voluntary agreements are used as a part of a national policy to reduce CO₂ emissions. A voluntary agreement was introduced, offering tax deductions for the energy-intensive industry that signed. If the industry did not sign, they had to pay tax that is about three per cent of the firm's turnover. (Hanks and Sillén 2000 p.47f)

⁹ The discussion, analysis and assumptions in sections 4.2, 4.3, 4.4 and chapter 5 are based on a compilation of interviews conducted with employees and managers in Södra, where no other reference is made. (See list of interviews in the reference list.)

market. (Scott 1992 p.349) Subsequently, decentralisation of decision-making can be a solution. Decentralisation facilitates fast actions because the information does not need to be processed vertically from the top-management down to the operational levels. In a decentralised organisation the ones closest to the problem issue can act upon it. (Robbins 1990 p.110) A decentralised decision-making requires a flat organisation structure. (Robbins 1990 p.6) Södra, which is a rather large and complex organisation, has a flat organisation structure with a high degree of decentralisation. However Södra's organisation is not purely decentralised, it is rather a mix of both centralised and decentralised decision making procedures.

A flat organisation is characterised by few levels of managers between the top-management and the operational employees and less central supervision and control. The opposite is a hierarchical structure with many levels between the top and the workers. (Robbins 1990 p.87) In Södra there are few management levels. The directors for the different functions of the organisation also form part of the executive management. Under them there are middle managers that are responsible for a plant or a service unit. At the plants lower managers, with responsibility for issue specific areas, such as maintenance, process or environment, are located. Issues such as investments, purchasing, information, EMAS-registration, and sales are centrally run in Södra, while everything related to the manufacturing process is dealt with directly by the divisions and plants.

4.2.1.1 Allocation of Responsibility

The Eko-energi program was identified as a program dealing with energy issues at plant level, therefore the implementation of the program came to follow the most decentralised structures, which was shown to be both a barrier and driving force for the implementation of the program, as will be discussed in the following sections.

There is a direct link between Södra's decentralised structure and the location of responsibility for the Eko-energi program. The first decision to participate in the Eko-energi program was taken by the Board of Directors after Södra had been contacted by civil servants at the energy authority. Södra's lawyer and administrative director Mr. Fagerlind was given the central responsibility for the Eko-energi program. Mr. Fagerlind's role has primarily been co-ordination and transmission of the Eko-energi program to the divisions. The responsibility was soon transferred to the different divisions and units, as the contents of the Eko-energi program were thought to concern electricity issues at plant level. In most cases the Eko-energi program has been treated as any other project, and has thereby also competed with other projects for time and resources, both human and financial. Here, it should be noted that no central dictate existed that demanded the divisions to implement the program. The Eko-energi program was rather presented as an opportunity open for participation by interested units. Nevertheless, not all units were invited to participate in the Eko-energi program. Södra's top-management decided that the Eko-energi program was only to be implemented in the divisions Cell and Timber, which means that the third industrial division Södra Wood Fuel was excluded. According to Mr. Fagerlind the decision was taken because the other divisions, apart from Timber and Cell, hardly have any operational activities or are purely administrative. Södra Wood Fuels is a comparatively small division with only one wood powder plant, few employees and not a lot of machinery. The environmental manager at Södra Wood Fuel did ask for participation when he heard about the Eko-energi program, thinking it would have

been an excellent occasion to look over the energy consumption with help from governmental funds.

Concerning then, the divisions that were invited to participate, Södra Cell and Timber, the implementation process of the Eko-energy program started in those units where interest was shown, which were Värö pulp mill and Alex sawmill. By now, all the units within Södra Cell and Timber have participated in Eko-energi in one way or another. Plant managers or middle managers at division level have participated in the initiation phase of the Eko-energi program but the responsibility was transferred to technical managers, electricity officers or other employees in the plants. The initiative to participate in Eko-energi at plant level was taken by management in some plants and by technical staff in others.

The allocation of responsibility of the Eko-energi program has thus followed the firm's decentralised organisation structures. The main differences between the structures for issues that are considered environmental and process related issues are that for the environmental work a central co-ordinator and management body exists and more importantly, a central directive, which oblige all the plants to implement EMAS, exists. (Södra's Environmental Report 1998 p.12)

The president of Södra has the formal responsibility of the environmental policy of the company. The environmental work though, is the responsibility of the centrally placed environmental staff, consisting of an environmental director, who co-ordinates Södra's environmental activities, and an environmental auditor. In accordance with Södra's flat structure, every division and plant manager has the responsibility for the environmental work in her/his organisation. Each operational division, has an environmental officer, with the responsibility to monitor and give advises. Every pulp mill has their own environmental manager, responsible for permits and supervision. A difference from the overall decentralised structure is that an environmental committee exists, which is a inter-organisational group that meets to discuss common environmental issues. (Södra 1998 p.11)

In summary: The allocation of the responsibility of the Eko-energi program is a consequence of Södra's flat and decentralised organisation. However it is also a question of Södra's perception of Eko-energi. The program was considered to be a program dealing with minor electricity efficiency measures by Södra, and not as an environmental program in the first place. This assumption is strengthened by the fact that Södra did not choose to implement Eko-energi through its already existing organisation for environmental issues, even though the program formulation clearly signals a relation between to environmental considerations and energy. According to Södra's environmental manager the Eko-energi program treats only marginal energy issues in relation to the energy consumption in the production processes. Therefore a combination with the EMAS work has not been considered from a central level. The two programs came to have different organisational and financing structures.

4.2.1.2 Lack of Support from Top-management?

Allocation of responsibility along the decentralise structures meant that the Eko-energi program became an issue for the units to deal with directly. A decentralised and flat organisation structure is also characterised by less central supervision and interference in the activities compared to an hierarchical organisation. (Scott 1992 p.349) Despite the positive affects such routines have had on the implementation process, to be discussed in section 4.3, there are implications that indicates that the implementation of the Eko-energi program would have benefited from a stronger central commitment to the objectives of the program. This especially concerns the pulp mills and Södra Cells involvement in Eko-energi, where there has been a gap between the central decision to participate in the Eko-energi program and the response in Södra Cell.

The first pulp mill, Värö pulp mill, to implement Eko-energi had been participating in the Eko-energi program from the start of the program implementation. Värö's electricity manager at the time, (now retired) was invited to participate in the first contacts with the authorities, when Eko-energi still was on the central management's table. This does not mean that Värö was controlled by the top-management, nor did they receive more central support than the other plants. It was more a question of an interested electricity manager that the top-management happened to have heard of. After the program was implemented in Värö pulp mill in 1995 nothing happened for some years in Södra Cell. Further involvement was put on hold. There is a possibility that the management of Södra Cell did not want to bother Mönsterås and Mörrum with more work, especially as the Eko-energy program has touched on, for the pulp mills, marginal energy issues, such as lighting and ventilation. Mönsterås has been going through two major investments periods lately and the director believes that there has not been any room for another project. According to the employees involved in the Eko-energy process in Mörrum, they found out about it in one of the company magazines "Södran". They contacted the head office wondering what it was all about. Apparently Södra Cell had started the implementation process in Mörrum earlier, but the responsible person changed position and the initiative was lost somewhere. As a result to the employees' enquiry, the plant entered the Eko-energi program. The Mörrum pulp mill signed an agreement in 1997 and the audit was done in 1998. The Mönsterås pulp mill entered Eko-energi in June 1999, which meant that an audit was conducted. No further actions will be taken for now because of the reconstruction of the mill.

The response to the Eko-energi program in Södra Cell was rather weak, compared to Södra Timber. In Södra Timber the program was initiated between 1995 and 1996. Once one sawmill entered Eko-energi, the others followed quite soon. This is confirmed by the environmental co-ordinator at Södra Timber, who at the time worked at the sawmill where Eko-energi first was implemented. The different responses to the Eko-energi program correspond to high level of autonomy each division has freedom to make their priorities and definitions. It is evident that the contents of the Eko-energi program attracted Södra Timber more than Södra Cell, because of the differences in organisation and production process. First of all Södra Timber is a smaller entity, (about 13 per cent of Södra's entire organisation), employing around 500 persons, compared to Södra Cell which comprise of 58 per cent of Södra and employs 1500 persons. Even though Södra Timber consists of more plants (six sawmills), each sawmill is less autonomous compared to Södra Cell, where

each plant (three totally) has a larger responsibility for its production. (Annual Report 1998 p.11-13) A possible conclusion is that a less complex organisation increases the rate of implementation. However, this has to be seen in the light of the differences between Södra Cell's and Timber's production processes. Södra Cell has a complicated production process, with many steps and high levels of energy use. The huge plants consist basically of a complex system of pipes and pumps, where it is hard to make minor revisions without shutting down or change the larger parts of the production system. Moreover, the pulp mills are more reliant on thermal energy than electricity. Södra Timber on the other hand, produces sawn timber, which is a less technical complicated process. Furthermore the production steps are separated from each other and it is easier to make changes. Hence, the kind of electricity conservation measures (speed regulation devices, change of lighting and ventilation etc.) stipulated in Eko-energi program formulation do not relate to the process issues in the pulp mills to the same extent as in the sawmills. Therefore Eko-energi received better response in Södra Timber.

Apparently, the Eko-energi program has not been prioritised in all the Södra units. Stronger commitment and supportive actions from the top-management in order to give the program higher priority would have been beneficial for the implementation process. Not necessarily in terms of control or dictate, but in form of encouragement and follow up of the activities that did take place. As it was, the responsibility was delegated downwards the organisation without any form of monitoring. A way of achieving higher prioritisation is through establishing a central body with the task to manage energy issues for example. There is no central body for energy issues in Södra. There used to be a centrally placed energy co-ordinator. The co-ordinator worked as a consultant in reality, mostly with the pulp mills even though his responsibility area covered the entire Södra. When the co-ordinator retired, he was not replaced. Instead Södra has increased the capacity and knowledge on energy issues in every plant, at least in the pulp mills, in correlation to the decentralised structure, partly through employing more people with such skills. The environmental manager in Mörrum, thinks it works better this way. It is more practical and easier to get response for your ideas, he says. Others feel a lack of some sort of technical manager or co-ordinator in the central organisation: A person to brainstorm and discuss energy technical issues with. This can be compared to the environmental organisation where competence is found on both low and high levels in the organisation. There is a central environmental body, plus the environmental managers, responsible at both division and plant level. More over, there is an inter-organisational environmental committee, where environmental issues can be discussed.

Even though appointing a co-ordinator is not necessarily the solution, it is evident that there is a need for co-ordination of energy issues in Södra. As it is now the decentralisation has defined a company culture with autonomous plants with little exchange and co-ordination, especially concerning production process related issues. (Gillberg 1999 p.103) If stronger central involvement in process technical issues is perceived as a threat to the plant activities and the responsibilities of the plant managers, an organisation for exchanging information might be a good idea. The flat organisation structure and the big responsibility areas for each manager in Södra complicate co-ordination between the plants. For instance it seems like the experiences from the Eko-energi program in Värö pulp mill were not communicated within Södra Cell. (Robbins 1990 p.89) The interviewees confirm that there is little

exchange of experiences between the plants. In general the employees in the pulp mills have little exchange of experiences among each other, especially concerning energy issues.

To conclude, the lack of central support and commitment to the Eko-energi program has been a barrier for the implementation. It is not control that is needed as much as co-ordination of energy issues. There is a lack of exchange of information and ideas on energy issues within the company. Therefore some sort of committee for such exchange would be a fruitful, similar to the organisation for issues identified as environmental. Another possible solution that would have been beneficial for the implementation of the Eko-energi program is an incorporation of energy issues into the existing environmental structure, but then energy has to be redefined from a production technical issue to an environmental concern. The matter relates to formalisation and standardisation of company rules and procedures, to be discussed below.

4.2.2 Formalisation and Standardisation

Even though the initiative to implement the Eko-energi program in Södra Cell has been negatively affected by the companies decentralised and flat organisation structure, there are examples where the decentralisation has been an advantage for the implementation of the Eko-energi program. In a decentralised organisation the employees have more responsibility and more freedom to act. The degree of formalisation and standardisation of an organisation regulates the freedom to act.

Formalisation is measure of standardisation of procedures in an organisation and it is closely connected to the centralisation/decentralisation. The set of rules, procedure and policies sets a company culture that causes the members of the organisation to move in the same direction, which enables co-ordination and control. The larger and more complex the organisation, the higher the need for a formalised structure, which allows control and co-ordination. (Scott 1992 p.261) Formalisation is also way to secure an effective performance from the employees at a low cost. With a well-written manual a work task can be done competently by someone with far less experience and education than a specialist on the area to a lower cost for the company. (Robbins 1990 p.96) Formalisation can concern explicit job descriptions or organisational rules that regulate the behaviour of the employees, which ensures stabilisation of work processes. (Robbins 1990 p.100) Formalisation can also be unwritten procedures; more implicit policies that sets the ruling company attitude to different issues. (Robbins 1990 p.96-101) Being a rather large organisation with a complex production, Södra has high degree of standardised procedures, both concerning the production process and routines for procurement and investments. It has already been discussed how the implementation of the Eko-energi program has been affected by company procedures that identifies energy as production process issue. Formalisation and standardisation on other levels have affected the implementation process as well. The program has been affected by the differentiation of work tasks, for instance. Secondly, formalisation of procedures and polices such as implementation of projects and procurement has affected the implementation.

4.2.2.1 Standardisation of Work Activities

Concerning the work activities, formalisation tend to vary within an organisation, certain jobs are highly formalised and others not. Södra's division of labour is based on categorisation of different occupations that correlates to different functions in the company, such as maintenance, process engineering, electricity or environment. The work at the lowest level, the plant operatives, is the most formalised, being both repetitive and highly specialised, while more complex activities are less standardised. (Robbins 1990 p.92ff) High degree of specialisation supposedly leads to higher efficiency. One's skills increase through repetition and time is saved as less time is used for changing tasks. (Robbins 1990 p.85)

The high degree of formalisation of the operative staff's work tasks depends to a great extent on process technical issues. The production process in the different plants is highly mechanised, and the workers basically supervise different steps of the process. In the pulp mills, a lot of the work is done through supervising computer systems. In the sawmills persons are located at different production steps, such as the conveyer, sawing, drying and so on. The more standardised routines, the less input the employees have on the how the work should be carried out. A highly formalised working procedure does not favour initiatives for changes from the lower levels in the organisation, as standardisation limits the employees from engaging in alternative behaviour and removes the need for employees to consider alternatives. It is both time consuming and costly to change behaviour and well establish and functioning procedures. (Robbins 1990 p.95) Despite the constraints formalisation puts on the workers possibilities to have input on their tasks, the operative staff in Södra holds possibilities to influence their work through participation.

The workers in Södra have not played a leading role in Södra's environmental work generally. However they have participated and have had possibilities to influence the implementation of the Eko-energi program, as a consequence of Södra's standard working procedure on how to implement different projects and technical solutions in the plants. The common working procedure in most of Södra's plants for projects is that everyone involved in a project takes an active part in the project process. This is an informal project procedure that is not written down in a manual. According to one informer it is very hard to install new equipment or make any changes, if the ones who are going to work actively with the equipment are not motivated and participating in the project. More precisely, the implementation process of projects has the form of a discussion in project groups. Concerning the implementation of the Eko-energi program and the incorporated energy conservation measures, discussions have taken place between the persons involved in the Eko-energi program in the plants where some of the energy conservation projects were implemented. The discussions have concerned which suggested energy conservation projects to implement and how it best should be done. Especially when it comes to technical issues the operational employees have been participating, discussing specific solutions and coming with comments on the project. Their involvement in the implementation of the Eko-energi conservation measures has not had a determining impact on the implementation process, neither in terms of a barrier or a driving force. The actors that did influence the implementation process were their superiors; electricity officers, process and production officers and managers.

Engineers and other professionals tend to have jobs with a lower rate of formalisation. Where formalisation is low, the employees have more freedom in work. (Robbins 1990 s.93) In Södra the officials and lower managers at plant level have specialised work areas, but much more freedom to carry out their tasks and comply with the responsibilities compared to the workers, as a result of the flat and decentralised organisation structure. The high degree of specialisation indicates that the employees in Södra know their specific tasks well. For example, process and maintenance engineers are highly aware of energy related problems, as it is part of their work and education. From an energy efficiency perspective this has favoured awareness of and understanding for energy issues, especially as some employees have electricity and or energy as their specific work area. Less restricted work gives more space for consideration of alternative work procedures. In Södra alternatives to the present energy management have been addressed before the Eko-energi program from lower management and officers in the organisation. For example, in Kinda sawmill where an active and self-motivated electricity department exists, the electricity officer had pointed out and suggested several energy efficiency measures over the years, without receiving much attention from his superiors. The Eko-energi program was welcomed there, as Eko-energi was thought to be a good opportunity to get response for the departments' ideas.

From an energy efficiency point of view, a high degree of formalisation does include an additional interesting aspect; formalisation and standardisation of work tasks requires training. In Södra the workers dealing with different process steps, such as boiling, are given special training before attending their positions. The training not only provides employees with work skills, it also provides them with knowledge and attitudes. (Robbins 1990 p.101f) Unfortunately the kind of training that the workers get, does not include issues like energy efficiency or environmental issues. However specific education is given on environmental issues, in line with the company commitment to EMAS. From a long-term environmental perspective, it could be useful to incorporate environmental and energy issues into the normal training, which concerns the daily activities where the actual environmental and energy related activities take place. The training could be a channel for increasing energy and environmental awareness.

4.2.2.2 Formalised Procedures

The reasons for the previous lack of response for energy efficiency measures from the superiors are related to the decision-making procedures and procurement routines in Södra. Energy efficiency measures are often depending on the possibilities to purchase and install energy efficient technology. Such technology is often more costly than less efficient alternatives. The need for new technology has been an issue for the implementation of the Eko-energi program. As discussed above, electricity officers and others working with the production process have seen the potentials for energy efficiency and cost reductions of the production in new more energy efficient technology. However, Södra's old procurement and decision-making routines did not allow them to speak up, despite the flat organisation structure. Investments used to be decided upon by administrative and economic staff, that did not work with process related issues. Now, technical staff is more actively involved in the procurement procedures. In one of the sawmills for example, the technical staff attend to meetings on purchasing and can have a say on the issue from his perspective, even though the final decision is in the hands of the manager still. In this way, the technical staff can

make the administrators more conscious about the long-term benefits of more expensive but more energy efficient equipment. It is possible that the Eko-energi program has inspired the change of procurement routines, even though it is impossible to say which affects are caused by Eko-energi and what is caused by the EMAS certification process. In the Eko-energi program formulation it is stated that energy issues have to be taken into concern when purchasing new technology, according to *ENEU '94*. *ENEU'94* is a guide for procurement, which provides a measure on the life cycle costs of the investment and where the investments' energy, maintenance and capital costs can be calculated. (SOU1995:140 p.209) Not all the plants are using *ENEU'94*, but they are using some sort of procurement routines that do take energy and environmental considerations into account. Hence, Södra's old investment and procurement routines have not been beneficial for energy efficient thinking. The new routines, with changed standard procedures, allow technical staff with energy knowledge to participate in the decision-making process.

In summary, decentralisation in relation to formalisation of routines has not only been a barrier to the implementation of the Eko-energi program but also a driving force. The decentralisation and working procedures allow individuals with an interest in energy efficiency to work actively in an energy efficiency direction. A change can be traced in procurement and investment routines, where technical staff now participates. Even though it is hard to tell what triggered what – the Eko-energi program, the EMAS process, it is clear that environmental awareness is increasing together with the ability to take energy efficiency into consideration.

4.3 Costs

As said in the theory chapter, the overall aim of companies is to maximise profit. From such a perspective production costs are important. The higher the price on, for example physical capital, such as facilities and machinery, the higher the production costs. (Sloman 1991 p.140) These considerations of production costs are important for a company when they are planning investments in new technology. If a company has a short-term vision of their activities, they might be focused on the initial cost of the investment, without including productivity and lifetime into the calculations. (Sloman 1991 p.165) Södra's investments used to be coloured by a short term thinking to a greater extent than they are today, especially concerning smaller investments in new equipment. It happened rather frequently that the cheaper alternative was chosen even though a more long lasting, energy efficient technology existed on the market. These kinds of concerns are easier to consider for a company if life cycle cost assessment is applied. A life-cycle perspective on new investments can also be an important factor for including energy costs in the picture. (Christiansson et al 1994 p.134) The *ENEU'94* procurement routine used by Södra, addresses the life-cycle costs, which includes energy costs of the investments. Life cycle cost assessment can provide an additional picture of the costs, including operational costs. (ibid.) Södra's staff on plant level is aware of such implications. Still, administrative personnel, that are not familiar with the production process in detail makes the final decisions. The second best or even the third best alternative from an energy efficiency point of view is often chosen, due to its lower price. Investments in energy efficiency are also constrained by the access to capital.

Södra has faced some years with negative results, due to oversupply on the world market. Both the prices on paper pulp and sawn timber were affected negatively. In 1998 the consolidated result, after financial income and expenses, fell to -34M SEK (-4M Euro). The turnover was 7.3G SEK (0.8G Euro) in 1998 and exports were equal to 4 100M SEK (460 M Euro). Still Södra is optimistic about the future, as the market prices have started to rise. Investments amounted to 1 250M SEK (143M Euro) in 1998, of which the majority was used for the ongoing extension of Mönsterås saw and pulp mill. If capital is limited, companies tend to require short payback times on their investment. (Christiansson et al 1994 p.133f) The hard financial situation has had an impact on Södra's participation in the Eko-energi program as a short payback time have been required for the investments in energy conservation measures. The sawmills have in general implemented the energy efficiency measures, suggested in the in relation the energy audit, they found economically realistic. The problem has been that most measures have a payback time on eight to ten years, but Södra Timber needs a payback time between two and four years. The picture is similar in Värö pulp mill, where smaller measures with a payback time shorter than a year has been implemented in the first place. Such measures include speed control devices and change of lighting in the facilities. Mönsterås and Mörrum pulp mills have not implemented any Eko-energi measures, partly because they have not found any measures with reasonable payback times, which is about a year for smaller investments.

In relation to the issue of short payback time and lack of capital it must be mentioned that every unit finances investments from their own budget until a certain limit, while big investments are an issue for the central budget. There are some employees who wish for central funding of the Eko-energi related investments. Their argument is that specific energy efficiency measures done in the plants contribute to Södra's total environmental image and total energy conservation. Therefore the central body should contribute to the investments done in the units. The way the budget is separated is naturally a consequence of Södra's flat and decentralised organisation structure. The employees which for central funding for energy efficiency measures can be interpreted as a need for a stronger central commitment to the implementation of Eko-energi.

Another economic constraint often mentioned in relation to energy efficiency in Sweden, are the low energy prices. Low prices can cause low priority of investments in energy efficient equipment. If there are no economic benefits related to the cost of energy that could motivate investment in energy efficient technology, interest is likely to lack for such investments. If energy prices were higher (for example, through including externalities such as climate change costs, in the price), it could be an economic incentive for the industry to invest in energy efficient technology. (ibid.) Even though Södra is an energy intensive industry, I have not found a clear connection between low energy prices and lack of energy efficient investments in Södra. On the contrary, the target group at plant level seems to be conscious about the costs and are interested in cutting them. A less qualified but interesting explanation, put forward by some interviewees, relates to Södra's culture. Södra is a co-operation, owned by its members, who in many cases are farmers owing smaller pieces of forestland. A thought expressed by employees in Södra is that farmers in general are highly conscious about costs, including energy costs. Playing with the thought, it would be possible to assume that an overall cost consciousness among the members

has dispersed and coloured the company culture. However, there is no proof what so ever for such conclusions.

Investments in energy efficient technology are constrained by the decision-making procedure, where administrative personnel has the last say even though technical staff has more impact on the decision-making than before. Investments are also limited by the company's access to capital and world market prices, which in turn determine the requirements on a short payback time. It is likely that Södra's financial staff is aware of life cycle costs by now, but they are pressured by a hard economic situation, which does not allow them to invest in the most energy efficient technology.

4.4 Influences on Actor Involvement

4.4.1 Motives

Södra wanted to implement the Eko-energi program, at least initially. The general motives of joining the program seem to have been an interest in energy efficiency issues. The top-managers and some middle managers claim that energy conservation issues are vital to the company, because of the energy demanding industrial processes that Södra performs. The management claims to be aware of the high levels of energy consumption in the industry, compared to other business sectors. Consequently they found the Eko-energi program interesting.¹⁰ The employees at the plants gave an additional explanation to Södra's interest in the Eko-energi program. They thought primarily that the participation in the program was a good possibility to get an energy audit done for free and receive assistance in monitoring possible energy conserving measures. For example, in Södra Timber's saw mills the Eko-energi program was welcomed. Especially since the program seems to have been presented as an opportunity to have an energy audit done, something that the sawmills had not experienced before. It should be noted that the kind of electricity conservation measures that were considered within the Eko-energi program, as speed regulation devices for fans, conveyer belts etc., were not conceived as marginal measures by the sawmill staff. On the contrary energy savings up to 60 per cent were calculated for some of the suggested measures. Hence, Södra's motives for joining the Eko-energi program are a combination of an interest in the policy issue and an interest in the advantages incorporated in the program. More over, the Eko-energi program does not include any threats, like sanctions, to Södra. Consequently there are hardly any risks associated with an implementation of the program.

The actual implementation of the Eko-energi program were in the hands of the target group – technical and energy staff in the plants – There involvement has been more or less voluntary, therefore it is of interest to address the motives for implementing Eko-energi of the principal actors. In Södra Timber, Kinda sawmill was the most successful implementer of the energy efficiency measures, according to the management. The Kinda electricity officer, a dedicated person, had pointed out and suggested several energy efficiency measures over the years, but without receiving much attention from his superiors. He was motivated to work with Eko-energi, as he

¹⁰ The paper and pulp industry account for 45 % of the Swedish industries' total energy use, which can be compared to the iron- and steelworks industry accounting for 14 %. (STEM 1999 p.18)

thought that it was a good opportunity to get response for his ideas. Hence, the electricity officer's motivation was a consequence of his knowledge and interest in electricity efficiency. His position is rather unique in Södra Timber. In no other sawmill an electricity officer or a person with energy related skills could be found. (This can be compared to Södra Cell, where most of the actors involved in the Eko-energi programme in Södra have primarily been managers at the plant-level, engineers and technicians working with maintenance, process or electricity issues on full-time bases.) Consequently the level of understanding of electricity issues is limited in the other sawmills. When the other sawmills need knowledge in the area, they either contact Kinda or hire external knowledge in terms of consultants.

As mentioned before, Eko-energi came to concentrate on the energy audits and energy efficiency measures suggested in relation to the audits in Södra. This is important to consider when addressing motivation in the pulp mills. In Värö pulp mill the motives to implement Eko-energi somewhat resemble with the Kinda case. Värö's electricity officer at the time was a self-motivated person, with a personal interest in efficiency and environmental issues, according to his co-workers. The electricity officer had participated in the first step of the program and therefore Värö pulp mill came to implement Eko-energi soon after the central agreement was signed. In Mörrum pulp mill, the situation was rather different. Electrical and technical staff thought that Eko-energi seemed to be an excellent opportunity to get an overall picture of the energy situation in the plant. What they were not aware of was the fact that Eko-energi only deals with electricity issues, mostly related to buildings and not so related to process technical issues. As they found out about the nature of the program, they became disappointed and the motivation to implement the efficiency measures decreased.

Interest in energy efficiency matters on an individual level, in combination with the attraction of a free energy audit, have been a driving force for the implementation of the Eko-energi program. The low motivation in some cases has not affected the implementation process below a non-intervention level.

4.4.2 Understanding

The Eko-energi program was not highly prioritised in Södra. Several reasons for that have been discussed. Is this possible that the low priority is a result of lacking understanding of the program contents?

Well, within Södra there is a clear understanding of energy issues, especially on plant level. The employees in Södra are generally conscious about the importance of energy efficiency and the energy demanding industry they are running. Especially the target group that consists of personnel working with electricity or energy issues in the production process on a daily basis. Almost all the persons encountered have stressed that energy efficiency is part of their daily work. But energy efficiency is above all, a matter of saving money. One way of doing that, and conserve energy at the same time, is through obtaining a smooth and efficient production process. More than one engineer has pointed out the fact that the smoother the production process is, the less energy is used per unit and the higher the production and the product quality. A part from the cost-efficiency motives behind energy efficiency awareness, there are other possible explanations: There seems to be a tradition of long and faithful employment. The majority of the managers have started on lower levels in the company, as process

engineers for example. Several of the encountered persons have worked within Södra for many years, sometimes for decades. This kind of company culture favours a continuation of traditions and values and set an informal and unwritten company policy. (Robbins 1990 p.96ff) At least two employees I talked to, have worked long enough within Södra to remember the difficult situation during the energy crises. The Värö pulp and sawmill was built during the energy crises era in 1972, which has had an impact on the structure of the plants. For example they have had a heat recovery system since the start in the early seventies. (Interview with Björn Ljungberg)

However, the relation between environmental concerns and energy is not always that clear in Södra. As discussed, energy issues have not been dealt with from an environmental perspective, but from a production process viewpoint. Energy has not been thought of as an environmental issue in first place, but as a cost. There are, however, employees in the target group that do have a clear understanding of the relation between environment and energy, especially the encountered environmental managers and officers. As one person said, cutting emissions might require increased energy consumption. Still, their awareness of the close relation between energy and environment is not yet reflected in the overall structure and company policies. Nevertheless, a change of the understanding of the relation between energy and environment is visible. First of all, Södra is obliged to take energy consumption into considerations in the environmental work as result of the EMAS certification process. (Environmental Report 1998 p.6) Furthermore, some units, Unnefors saw mill and Mörrum pulp mill, have included energy goals in their environmental- and goal plans.

Even though the program formulations are soft and not precise, there does not seem to have been any problem to understand the essence of the Eko-energi program. On the contrary, the high level of knowledge has rather been a driving force for the implementation process, as it spurred the initial interest in the program. Hence, the rather low prioritisation of the Eko-energi program is not a consequence of lacking understanding of energy and efficiency per se. However it seems like the context of the program – the relation to more abstract issues as climate change and sustainable development – has been less clear. It is not reflected in the implementation of the program anyhow. The ruling perception of energy has most likely been a draw back for the implementation.

4.4.3 Capacity

So far it can be concluded that there were enough with both knowledge and skills, at least on energy-related issues, and motives to implement the Eko-energi program. But where there enough with time and human resources to attend to the Eko-energi program?

The target group that came to be involved in the implementation of the Eko-energi program did not get any extra time appointed from the top-management in order to implement the program. Nor has any person been appointed to work with Eko-energi exclusively. The chore to implement the program has been added on to the ordinary work tasks. Several informers have expressed that they have lacked time to deal with the kind of energy issues that the Eko-energi program deals with. However the participation in Eko-energi gave some of them an opportunity to look into such issues that they did not have time for earlier. Hence it has been up to the appointed implementers to manage their time, which correlates to the decentralised organisation

structure of the firm. The interested ones have spent time on the issue, others have spent minimum time required, as they prioritised, to them, more important work tasks.

From a bottom up perspective the issue of influence is often dwelt upon. The level of influence sets constraints on the capacity to implement the Eko-energi program. (Lundquist 1992 p.76) It has been discussed how some of the employees working with energy issue have felt that they have not received the attention from the superiors that was wanted, in relation to energy efficient investments. Nevertheless it has also been discussed how committed and interested persons have influenced the implementation process. Hence the capacity to implement Eko-energi has very much been a matter of personal skills and interests.

Regarding capacity in more general terms, there is no reason to doubt that Södra has enough capacity to implement the Eko-energi program. Nevertheless, there has been a lack of capacity to see the life cycle perspective of the entire production process – the cyclic relation between raw material and energy from the cradle to the grave. (Elforsk 1994 p.3) Within Södra there has been a good understanding of the relation between raw material and energy input and the production process. But they have been less aware of the output of their product, and consequently a holistic picture of Södra's place in society. However, it appears like the life cycle report, presented at the Mörrum pulp mill in addition to the Eko-energi audit report, has influenced the awareness, at least at plant level. Interviewees in Mörrum agree that the lifecycle report made them conscious about the impact their product has on society. They also told how an intense discussion on the end use of their product started among the plant staff. The insight possibly favours an environmental vision of things and has an impact on future capacity to implement energy efficiency measures.

All together, the actors' involvement in the Eko-energi program has been affected by their capacity, understanding and motives. These categories are inter-related and dependent upon each other. It can be concluded that Södra administer profound knowledge on energy related issues, which is a requirement for running the production processes. At the same time it can be concluded that the same depth of knowledge and understanding of environmental concerns is lacking, although the overall awareness in the company is rising. The exceptions of the Eko-energy program have been coloured by the understanding of energy and efficiency issues, which in turn has influenced the motivation for work actively with the program. The implementation of the Eko-energi program has been a subject for individual motivation to turn knowledge and time into action.

5. Discussion of Results

5.1 To what extent are the program objectives achieved and what is the outcome of the Eko-energy program in Södra?

5.1.1 Achievement of the Program Objectives

5.1.1.1 The Energy Audit

As stated before, the implementation of the Eko-energi program in Södra came to concentrate on the energy audits provided by the authorities. Even though it is not stated in the program formulation that Södra must implement the energy conservation measures suggested in relation the audit, there is an implicit expectation from the authorities that the companies should implement them.

All the pulp mills and sawmills have had an energy audit done. The audits were conducted differently in different units. In some cases the consultants worked independently. In other cases the technical employees (engineers etc.) participated in the auditing by providing the consultants with facts and figures on the energy situation; supply, consumption and own production. At least two plants, one saw mill and one pulp mill, had a similar experience: The consultants basically put together already existing facts and figures and presented them in a nice report. As one person said “ It was nice getting in writing what we already knew”. Their experience, that the consultants did not bring any new knowledge to the plant, can be explained by the staffs’ general knowledge of energy issues. The audit resulted in a report on the current electricity situation and suggestions on electricity conservation measures. Here follows a list on the principal measures implemented (I have chosen to describe the measures that the interviewed persons have highlighted themselves):

- The head office in Växjö participated in the Eko-energi program through changing the heating system from electricity to district heating. The shift of heating system cost six million SEK (0.7M Euro). The project was partly subsidised by NUTEK. NUTEK paid 200 000 SEK (23 000 Euro) through VEAB (Växjö Energi AB) for reconstruction of the heating system, lighting etc. in the head office. The payback time was five years and it was calculated on the net sum of the reconstruction costs. According to Magnus Fagerlind at least one third of the previous energy costs have been saved.
- Södra Timber has installed peak control equipment in all sawmills. The equipment cuts the peaks of power consumption by turning-off some equipment when the total power consumption becomes too high. This mainly saves money, as the power bill includes payment for the maximum capacity demanded. It may also

have some CO₂ reducing effect, if company peaks tend to coincide with system peaks. Värö sawmill has installed load-measuring and frequency controlled fans in the air pumps for bark and chips. It saves energy, as the power of the fan is adapted to the load. In Kinda frequency controlled fans have been installed in the drying plant. Around 40 per cent of the energy use has been saved. Kinda has also changed an air blow system for chips to a kind of belt conveyer. This was calculated to reduce the electricity use by 94 per cent from 1 400 MWh to 84 MWh. Kinda's electricity officers believes the figures is closer to 50 per cent.

- Värö pulp mill implemented the conservation measures they found technically possible and economically reasonable. They needed a short payback time for the projects, preferably not more than a year for smaller projects. The recommended measures that Värö has left to implement are incorporated into their ordinary project portfolio - A folder with potential projects and investments. The representatives from Värö say that is not likely that the left measures will be implemented separately. They will be considered when bigger changes have to be done that touch upon the Eko-energy measures. Värö pulp mill has installed speed control on motors in pumps and other motors and lighting with longer life cycle. One of the lighting measures was calculated to save 100 MWh/year by the consultant. Värö has also installed temperature steering of heating equipment. The investment was calculated to cost between 100-200 000 SEK (11 500-23 000 Euro). One of the maintenance staff, working with electricity issues, has estimated Värö's total savings to 250 MWh per year on the Eko-energi measures, more or less 50.000 SEK (5 700 Euro) (calculated on 1998's electricity prices).
- In the Mörrum pulp mill the subject was handled quite similarly. In the sense that the recommended measures from the energy audit were put in the Mörrum project folder right away. The Eko-energi measures will not be handled any differently from other projects. The reasons for that are twofolded. First of all, the employees I talked to agreed that they all looked forward to the energy audit report. However they became rather disillusioned, as they understood that the audit and suggested measures only dealt with minor electricity issues and not with the energy consuming production process. Secondly, they do not agree on the methods the consultant used for calculation of the measures. According to the representatives from Mörrum the consultant's calculations are simplified and lack important considerations. Mörrum's calculations show that the measures will be more expensive and less efficient. The only measure they found worthwhile so far concerns the parking lot, where time controlled equipment is going to be added to the electricity outlets used in cold weather warm up the engines while parked. The electricity savings are estimated to 40 MWh/year. The change had to be done anyway, meaning that it is not a direct result from the Eko-energi audit, even though the measure exits in the list of suggested measures.
- As Mönsterås is going through the largest reconstruction ever and has closed down their plant for the last installations, they have decided that they will not look into the recommended Eko-energi projects until the new plant has been in operation for a while.¹¹ They can not motivate any new investments at this stage. Besides, the technical officer I spoke to in Mönsterås, agrees with his colleagues

¹¹ The plant should be operating again by now (April 2000).

in the other pulp mills: the Eko-energi program only deals with small projects. The big ones, they take care of themselves, he says. Nevertheless energy efficiency has been addressed in the reconstruction work. Mönsterås has invested in a new turbine for example, which will make the production process more efficient. This is however not a part of the Eko-energi program.

Even if there are no figures on achieved electricity savings in the different plants, the majority of the persons in Södra believe that the Eko-energi program has been more successfully implemented in the sawmills than in the pulp mills, in terms of conserved kilowatt hours – a statement that can neither be verified or falsified. However, all the plants have in common that they have failed to establish a plan of action for the energy efficiency measures. The measures that have been implemented were considered in direct relation to the time of the energy audits. The suggested measures were included into a project portfolio together with other possible future projects, for which no time plan exist.

5.1.1.2 Energy Goals

In the program objectives it is stated that the company should formulate an environmental and energy policy, establishing long-range saving goals and estimating the energy need, partly in return for support of EMAS certification. As Södra already was in the implementation process of an environmental management system¹², when Eko-energi was signed, an environmental policy already existed. Authority support of the certification process was consequently never an issue. The environmental policy that Södra has formulated does include energy issues. It is stated that raw materials and energy must be “utilised as efficient as possible.” (Environmental Report 1998 p.5) The issue is not developed further in the policy. Nevertheless the units have formulated energy goals on their own. Each division and some plants have their own environmental policies or goals, depending both on the decentralised organisation structure and the EMAS standard, encouraging commitment from all the parts of the organisation. (Europeiska gemenskapens råd 1993) The Mörrum pulp mill, for instance, formulated the following energy related goals in 1998:

- Reduce the use of fuel oil to less than 14 000 m³ 1998. (In 1997 the consumption was 16 772 m³) However, the goal was not reached. The fuel oil consumption increased to 23 185 m³. This is explained by a rainy season and that the wet bark in the bark boilers needed more fuel, among other things. The goal for 1999 is less than 20-litres/tonne pulp during the winter and 3 l/tonne during the summer.
- The energy consumption should not be more than 700 kWh/tonne produced pulp. The goal was reached and the work will continue during 1999, but in a reformulated version, directed at specific parts of the equipment.

The sawmills have also included energy concerns in their long-term environmental goals (1998-2001). In the Unnefors Sawmill's goal plan, for example, it is stated that the electric energy consumption should be reduced by five per cent per m³ sawn timber.

¹² The Värö pulp mill was certified in 1997, Mörrum in 1998 and Mönsterås is about to be certified.

Different opinions exist about the status of Eko-energi compared to EMAS. Some informers think the two programs are very different and incompatible, others see a relation and explain the separation of the two as a question of management organisation and finances. A general conclusion is that the Eko-energi program strengthens EMAS. The conclusion is supported by the fact that both Mörrum pulp mill and the sawmills have included energy issues in their environmental goals. Even though, it is impossible to tell whether the goals have been formulated as a consequence of the continuing EMAS process or if they are a result of the Eko-energi program. At least a clear case does not exist, where it is possible to say that a specific goal formulation is a consequence of the Eko-energi objectives.

Concerning the remaining program objectives, they have been achieved; Södra has received training on life cycle cost based procurement, in terms of a one-day seminar held by a consultant. It seems like most plants are practising procurement along the ENEU '94 standard. The standard has at least led to new practice in the sense that energy issues are taken into account when deciding on investments and purchasing new technology. The only objective that Södra has totally failed to accomplish is reporting the implemented energy efficiency measures to the authorities.

5.1.2 The Outcome of the Eko-energy Program

From a short-term perspective the Eko-energi program has not resulted in changes excessively above the non-intervention level. Even though all the plants in Södra Timber and Södra Cell went through an energy audit, the actual energy efficiency measures undertaken in Södra have not resulted in a great number of conserved kilowatt-hours. No one can say exactly how many kilowatt-hours the Eko-energi program has conserved, as no assessment or measurements have been done on the Eko-energi related efficiency projects. Only in Värö pulp mill the impact of Eko-energi has been estimated, to 250 MWh/year. All the interviewed personnel, working directly with energy efficiency measures, says it is hard to calculate the exact savings, as the measures are integrated in a system of projects for the production process and the energy consumption is not constant in the plants. The consumption depends on a lot of factors, as what kind of raw material that is processed, the season, the quality of the raw material and so on.

Even if Eko-energi did not result in considerable energy efficiency measures, some changes in the company routines can be traced, which are interesting from a long-term perspective. The program has contributed to increase the awareness of the importance of energy efficiency issues. Especially staff in higher positions says that they have become more aware of energy efficiency and particularly electricity related efficiency issues. Until now energy, including electricity has been a concern for engineers and technicians working directly with the processes and not for the decision-makers, who finally decide over the investments. Hence, there has been a gap between practitioners in the plants and the decisions makers. Practitioners believe that the gap has been reduced over the last years. The decision-makers are now, not only looking at the costs but also on environmental and energy concerns. Electricity matters are now components in the decision making process and long-term thinking has also been introduced when it comes to looking at costs and production process issues. Technical

staff is taking part in the decision making process. Consequently they have better possibilities to influence the decisions and the decision-makers when it comes to new or reinvestments in energy efficient technology.

The Eko-energi program seems to have had an effect on the company's environmental vision. The environmental work has been expanded from emission abatement to include energy. It is difficult to say what is a result of the Eko-energi program and what is a result of the continuous improvement incorporated in the EMAS-standard. (Europeiska gemenskapens råd 1993) Nevertheless, Södra has started to incorporate energy into the environmental work. The plants have set their own energy goals, reflecting an increased awareness of energy efficiency.

In summary; the actual outcome of the Eko-energi program in Södra has not changed Södra and its production process considerably, to become more efficient. However, there are indications that the program has strengthened a change in attitudes and routines that in the long run might contribute to a higher energy efficiency.

5.2 The Principal Driving Forces and Barriers

The implementation process has gone through Södra's organisation structure, where it has interacted with procedures, routines and actors. Some of the factors, interrelating with the implementation process, have either driven the implementation process forward or held the process back:

- The motive for entering the program was an interest in energy efficiency, according to the top-management. The statement must be seen in the light of the program formulation allowing the companies to strengthen their environmental image through voluntary actions, not commanding much activity from the company. Hence, the soft formulations have been a driving force for the initiation of the program in Södra.
- An important driving force for the actual implementation process was the offered energy audits. The energy audits were perceived as a good possibility to get an overview of the energy consumption, reflecting the company divisions' and plants' self-interest. Despite the positive motivation enhanced by the audits, the contents of the energy audit, being limited to electricity issues, stopped or held back the implementation process.
- As the contents of the program did not attract a high prioritisation of Eko-energi, the implementation process came to be an issue for individual interest in energy and electricity efficiency issues at plant level.
- The implementation of the energy efficiency measures was not only hindered by lack of prioritisation, it was also held back due to the requirement of short payback times.
- Though the introduction of Life Cycle Cost-standards for procurement routines the perception of costs is changing. The former routines (still in operation to a certain degree) have imposed a barrier for the implementation of energy efficient equipment.
- The implementation process has benefited from the profound knowledge of energy issues, as there is an overall awareness of the importance of energy issues,

which is increasing and transmitted up-wards the organisation; from technical staff to the top-management.

- However, the knowledge has not been reflected in the perception of the program: The target group identified and understood the contents of the Eko-energi program according to the well-established routines and company policies. This implies that energy is considered as a production process issue and cost, and not as part of the environmental concept. This perception has not been an obstacle per se, but it caused a choice of implementation routine that has affected the outcome of the program. As the program was considered to deal with energy issues and not environmental issues, it came to be a case for the plants, following the most decentralised implementation structures in Södra's organisation. The decentralised structure have imposed both barriers and driving forces to the implementation:
- There has been a low central commitment to the program, both caused by and causing low prioritisation of Eko-energi, which in turn have left out central support for the implementation process.
- The decentralised structure also incorporates bad communication between the plants and between management level and plants. It is likely that a more intense exchange of experiences would have favoured the implementation of Eko-energi.
- However, the decentralised division of responsibility allows high levels of responsibility for technical staff encouraging freedom to act. As central support has been missing, the implementation process has benefited from the bottom-up initiatives, coming from electricity officers and others. But the target group also has the freedom not to act, so than again, the implementation process has very much been an issue of self-motivation and personal interest.
- The low priority of the Eko-energi program was not helped of the time constraints the target group experienced.

Driving forces	Barriers
<ul style="list-style-type: none"> • Soft program formulations • Free energy audit • Personal interest in energy and environmental issues • Energy knowledge • Decentralisation of responsibility 	<ul style="list-style-type: none"> • Program limitation to electricity • Short payback times • Previous procurement routines • Lack of central commitment and support • Lacking communication • Lack of time

Box 7. Summary of the principal driving forces and barriers to the implementation process.

6. Conclusion

The Eko-energi program and the energy efficiency projects have been a minor appendix to the everyday life of the firm. Södra has stipulated multiple goals, such as profit, EMAS-certification and increased production. The Eko-energi program was related to this issues and found to be of less importance. Consequently the Eko-energi program was exposed to low prioritisation and an ineffective implementation.

Despite the low input in implementation activities from Södra and the poor results of the energy efficiency measures, a more effective implementation would not have changed the short-term outcome considerably, as the program was limited to electricity issues and Södra is running energy demanding production process, where such concerns belong to the minor agenda. Hence, a higher degree of implementation of the energy efficiency measures would not have resulted in a substantial difference in conserved kilowatt-hours, comparing to Södra's total energy consumption, meaning that the Eko-energy program did not target energy efficiency high above a non-intervention level. Switching to a long-term perspective, the implementation of the Eko-energi program must nevertheless be considered a success, regarding the initial intentions of the program makers, which were to spur an increased environmental awareness and commitment in companies. In Södra, formalised procedures for procurement and decisions making are changing, starting to incorporate energy issues. The perception of energy is expanding to include environmental aspects and energy goals are formulated. Despite the positive long-term implications, more could probably be achieved and in a shorter time if the central commitment was stronger. The implementation of the Eko-energi program was based on the key target group's interest and self-motivation.

A voluntary program could move the industry closer to a sustainable energy use, through generating learning and communication between actors that contributes to a shift of attitudes and routines. The Eko-Energy program targeted companies in the environmental front and its merit was to strengthen an ongoing process. In this respect voluntary programs can be good compliment to other policy instruments, intensifying their objectives and enhancing actor participation.

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990824 Roland Lövblad, Environmental Director, Head Office