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Emissions Trading,

how will it influence Akzo Nobel in Stenungsund?

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PREFACE

This report is the result of an honour thesis work in Environmental Science at Göteborg University. The project was carried out at Akzo Nobel at the Sustainable Development group in Stenungsund between February and June 2005. The thesis work concerns the site in Stenungsund where two Business units, Akzo Nobel Surfactants and Akzo Nobel Functional Chemicals are active.

Working with this project has been an interesting and rewarding experience. I would like to thank my supervisors Malin Bogeskär and Knut Andrén at Akzo Nobel site Stenungsund and Håkan Pleijel at Göteborg University for your guidance and support. I would also like to address my gratitude to the participants of the thesis project's Steering team at Akzo Nobel Knut Andrén, Rolf Asphäll, Lennart Dahlgren, Klas Hallberg and Edvard Nordfors. Many thanks to the staff at the site for taking their time to help me in my work, and special thanks to Martin Hanson, Mattias Kindstrand and Majlis Lindqvist.

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SUMMARY

The European Union Emissions Trading Scheme commenced on 1 January 2005 and provides for a trade with emission allowances between companies within the European Union. The overall aim is to achieve emission reductions in line with the Kyoto Protocol at a lower cost. The cost efficiency is obtained since companies with relatively low reduction costs can sell allowances to companies with higher reduction costs. In the first trading period, that stretches from 2005 to 2007, the emissions trading only includes carbon dioxide emissions from energy installations and energy intensive industries.

Akzo Nobel is an international company operating in the business areas of pharmaceuticals, coatings and chemicals. This thesis focuses on a factory in the Akzo Nobel group in Stenungsund, a small town in south-west Sweden. The aim of the thesis has been to investigate how emissions trading has been handled at Akzo Nobel site Stenungsund, what is left to be done and how it will influence the company in the future. The work has been focused on describing routines for the company's future work and estimating the financial effect of the emissions trading by working with different scenarios.

There has been only little preparation at the site in Stenungsund for the emissions trading. The company has, however, actively worked with energy integration and has monitored the carbon dioxide emissions for more than 10 years. The suggested routines concerning emissions trading which could help to secure that the company follows laws and regulations and works with emissions trading in an appropriate manner are recommended to be implemented in the regular routines as soon as possible.

In the first trading period Akzo Nobel site Stenungsund will most probably benefit from the emissions trading, thanks to former energy integration actions. There are many factors concerning the site and regulatory issues that have an influence on the financial outcome of the next trading period. The allocation of allowances will most probably be stricter in the future, so the emissions trading can come to have bigger financial significance. The emissions trading are also thought to increase the electricity and the fuel prices.

The uncertainties of how the emissions trading scheme will develop is a weakness of the scheme, since a clear approach would increase the incentives for companies to plan long-range strategies to decrease their emissions. The political statements today, within the EU and individual countries, indicate that the greenhouse gas emissions will be reduced considerably in the future, which suggests that emissions trading will be important for the industry.

SAMMANFATTNING

Den Europeiska Unionens system för utsläppshandel startade den 1 januari 2005 och möjliggör en handel av utsläppsrätter mellan företag inom den Europeiska unionen. Huvudsyftet med handeln är att åstadkomma utsläppsreduceringar i linje med Kyoto protokollet till en lägre kostnad. Kostnadseffektiviteten uppnås då företag med relativt låga reduktionskostnader kan sälja utsläppsrätter till företag med högre kostnader. I den första handelsperioden, som sträcker sig från 2005 till 2007, omfattas endast koldioxidutsläpp från energianläggningar och energiintensiva industrier av handeln.

Akzo Nobel är ett internationellt företag inom områdena läkemedel, färg och kemi. Examensarbetet fokuserar på en fabrik inom Akzo Nobel koncernen i Stenungsund i sydvästra Sverige. Syftet med examensarbetet har varit att utreda hur utsläppshandeln har hanterats av Akzo Nobel i Stenungsund, vad som finns kvar att göra och hur det kommer att påverka företaget i framtiden. Arbetet har varit inriktat på att beräkna den ekonomiska effekten av utsläppshandeln genom att arbeta med olika scenarier och beskriva rutiner för företagets fortsatta arbete.

Det har endast varit lite förberedelser för utsläppshandeln på siten i Stenungsund. Företaget har emellertid aktivt arbetat med energiintegrering och har övervakat koldioxidutsläppen i mer än 10 år. De föreslagna rutinerna angående utsläppshandeln, som kan hjälpa företaget att följa lagar och regler och jobba med utsläppshandeln på ett bra sätt, rekommenderas att implementeras i det vanliga arbetet så fort som möjligt.

Under den första handelsperioden kommer Akzo Nobel site Stenungsund förmodligen att dra fördel av utsläppshandeln tack vare tidigare energieffektiviseringar. De finns flera faktorer beträffande siten och regelverket som påverkar det ekonomiska utfallet av kommande handelsperiod. Fördelningen av utsläppsrätter kommer sannolikt att vara mer restriktiv i framtiden, så utsläppshandeln kan komma att ha större ekonomisk betydelse framöver. Utsläppshandeln tros även öka el- och bränslepriserna.

Osäkerheterna om hur handelssystemet kommer att utvecklas är en svaghet eftersom en klar linje skulle öka incitamenten för företag att planera långsiktliga strategier för att minska deras utsläpp. Politiska uttalanden idag, inom EU och individuella länder, indikerar dock att utsläppen av växthusgaser kommer att reduceras betydligt i framtiden, och att handeln med utsläppsrätter kommer att få en ökad betydelse.

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1. INTRODUCTION

1.1 Background of the thesis project and definition

Natural global warming makes the temperature on earth around 30ºC higher than it otherwise would be, since the greenhouse gases like water vapor and carbon dioxide delay the infrared radiation that is reflected from the earth's surface before it disappears into space. Human activities like combustion of fossil fuels and changes of land use raise the concentration of greenhouse gases in the atmosphere. Scientists believe that this results in an increase of the temperature at the earth's surface which could have large consequences [http://unfccc.int, 1 March 2005].

The framework of the international cooperation concerning climate change is the United Nations Framework Convention on Climate Change (UNFCCC) and the Kyoto protocol. In 1992 the majority of the world's countries joined the UNFCCC. The "ultimate objective" of the convention is to stabilize the "greenhouse gas concentration in the atmosphere at a level that would prevent dangerous anthropogenic (human-induced) interference with the climate system" [UNEP & UNFCCC 2002].

The Kyoto protocol, adopted in December 1997, entered into force 90 days after the ratification by the Russian Federation the 16 February 2005 [http://unfccc.int, 16 Feb 2005]. The protocol contains legally binding emission targets for industrialized countries, the so-called Annex I countries.[1] The overall commitment of the Annex I countries is to reduce greenhouse gases by 5 % below levels in 1990 in the commitment period 2008-2012 [http://europa.eu.int, 31 Jan 2005]. The target which is the maximum amount of emissions that a country is allowed to emit is known as the country's assigned amount (AAU – assigned amount units) [Tietenberg, et al, 1999].

The EU's target to reduce the emissions by 8 % is divided between the member states in a "burden chairing agreement"[2]. Sweden's target under this agreement is that the emissions shouldn't exceed the emissions in 1990 with more than 4 %. Though Sweden's national target is to reduce emissions by 4 % below 1990 levels in the period 2008-2012 [Naturvårdsverket, 2004].

The European Union Greenhouse Gas Emissions trading Scheme (EU ETS) provides for a regional trading of emission allowances between industries within the EU. The scheme is considered to be one of the most important instruments for EU to reach the targets under the Kyoto Protocol [STEM 2005]. The first trading period started in January 2005 as a test period where the scope is limited. The European Commission wanted a fast implementation of a trading scheme, so that the member states and the industry would gain experience in a learning-by-doing approach. This is meant to give a head start before

[1] The Annex I countries' targets is given in CO_2 equivalents and include the greenhouse gases carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), hydroflurocarbons (HFCs), perflurocarbons (PFCs) and sulphur hexafluoride (SF6).
[2] 2002/358/EC

the international trading under the Kyoto Protocol starts in 2008 [http://europa.eu.int, 21 Feb 2005].

Akzo Nobel is an international company operating in the areas of pharmaceuticals, coatings and chemicals. The company is the world's leading coating company and one of the leading chemical producers. With headquarters in Arnhem in the Netherlands the company operates in more than 80 countries and has around 64 000 employees.

The thesis project focuses on a factory in the Akzo Nobel group in Stenungsund, a small town in south-west Sweden. There are two Business units at the site, Akzo Nobel Surfactants and Akzo Nobel Functional Chemicals. Akzo Nobel site Stenungsund is aware that emissions trading is an important issue. The main issues of the thesis were:

- How has the emissions trading issue been dealt with **up to now** at site Stenungsund?
- What are the **future obligations** of the site and which routines are needed to facilitate the site's future work with emissions trading?
- Which **financial effect will the emissions trading** have on the company during the two first trading periods?
- How will the entering in **future trading periods** influence the site?

Other issues of interest for the whole Akzo Nobel group are if further **coordination** within the company concerning emissions trading could facilitate the work and if Akzo Nobel can use the **flexible mechanisms CDM and JI** to decrease possible future reduction costs.

1.2 Aim

The aim of the project thesis has been to investigate how the emissions trading issue has been dealt with at the Akzo Nobel site Stenungsund, what is left to be done and how it will effect the company in the future. The work has been focused on estimating the financial effect of the emissions trading by working with different scenarios and describing routines for the company's future work. The possible development of the emissions trading scheme in the future trading periods and a possible coordination within the Akzo Nobel group have also been studied.

2. METHOD

Information has been gathered from literature, Internet and through interpretations of rules and regulations. Interviews have been held with representatives from Akzo Nobel, other companies and authorities concerned. This was followed by an analysis of how this information should be applied on Akzo Nobel site Stenungsund.

References to rules and regulations in the text have been shortened and are given in the order of code of the law, chapter and paragraph, for example SFS 2004:1199, chap. 8, 8§.

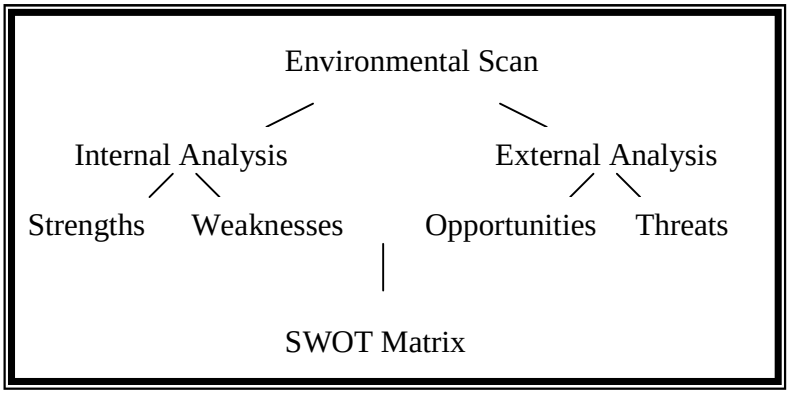
In the analysis of the financial effect of emissions trading on Akzo Nobel in Stenungsund, the site's future carbon dioxide emissions were estimated. The estimations were based on interviews with concerned personnel at the site, and the calculations were checked against previous data. The financial effect was evaluated by applying the emission forecasts in scenarios where the factors as fuel mix, allocation methodology, price on allowances and energy efficiency of the site were varied.

Finally Akzo Nobel site Stenungsund's conditions to handle the challenges of emissions trading were evaluated in a SWOT analysis. A SWOT analysis is a helping tool in identifying the company's Strengths and Weaknesses, and examining the external Opportunities and Threats. The internal and external analyses led to the following strategies:

- **S-O strategies** to pursue opportunities that suit the company's strengths
- **W-O strategies** to overcome weaknesses to pursue opportunities
- **S-T strategies** identify ways to use the strengths to reduce vulnerability
- **W-T strategies** to prevent the weaknesses from making the company vulnerable to external threats [http://www.quickmba.com, 18 May 2005].

The SWOT Analysis framework can be seen in *Figure 1*.

Figure 1: The SWOT Analysis Framework [http://www.quickmba.com, 18 May 2005]



3. RESULTS

3.1 European Union Emissions Trading Scheme and project based mechanisms

In the Kyoto Protocol three flexible mechanisms are defined: Clean Development Mechanism (CDM), Joint Implementation (JI) and Emissions Trading (ET). These flexible mechanisms have the overall purpose to reduce the cost of achieving the Kyoto targets. The cost efficiency is provided since the mechanisms give the possibility for a country to benefit from reductions in other countries [http://unfccc.int, 5 April 2005].

The use of emissions trading or tradable permits systems to mitigate environmental or resource problems is nothing new. Trading schemes have been used since the 1970s, within a range of areas such as air pollution, fisheries, water management, waste management and land-use. To obtain practical experience Denmark and the United Kingdom have already introduced national schemes for CO_2 emissions trading [OECD 2004].

3.1.1 The European Union Emissions Trading Scheme

The European Union Greenhouse Gas Emissions trading Scheme (EU ETS) provides for a regional trading of emission allowances between industries within the European Union. During the first trading period 12 000 installations representing 45 % of EU's total CO_2 emissions and 30 % of the overall greenhouse gas emissions is covered by the scheme. The scheme is thought to bring down the costs of achieving the Kyoto target per year from 6.8 billion € to 2.9-3.7 billion € [European Commission 2004].

The main principle of the emissions trading is that the companies in the trading sector are issued emission allowances that don't cover their present emissions. Since the participants are short of allowances they can either reduce the emissions or buy allowances on a market. Cost-efficiency, which is the main objective with emissions trading, is obtained because companies with relatively low reduction costs can sell allowances to companies with higher reduction costs that need them to maintain or increase the production [http://www.ieta.org, 9 Feb 2005]. Another objective of emissions trading is that the profit from sold emission allowances will motivate the development and use of clean technologies [http://europa.eu.int, 21 Feb 2005].

The framework of the emissions trading scheme is given by the Directive 2004/87/EC, the so-called Trading directive, which describes the conditions of the emissions trading within the European Union.

The emissions trading scheme is based on the following principles:

- **National Allocation Plan:** At the beginning of a trading period every country has to present a national allocation plan (NAP), which describes by which principles the allocation will be done, the total number of allowances that will be issued and a

preliminary description of the distribution between the different installations. The NAP must fulfill certain criteria and can be rejected by the European commission [http://www.naturvardsverket.se, 14 Feb 2005].

- **Issuing of allowances:** The participants in the scheme are issued emission allowances, EUAs (European Union Allowances), based on the country's allocation method. An EUA constitutes a right to emit 1 ton CO_2 [SFS 2004:1199, 3 chap., 5§].
- **Compliance period:** The EU ETS is divided into trading periods. The first stretches from 2005-2007 and the following periods will be five years. The first period is a test period and the next will coincide with the Kyoto Protocol commitment period 2008-2012.
- **Coverage:** The scheme will only cover carbon dioxide in the first trading period.
- **Participation:** The participants in the emissions trading scheme are installations exceeding certain levels within the sectors of energy, production and processing of ferrous metals, mineral industry and industrial plants for production of paper, board and pulp from timber [Trading directive, Annex 1].
- **Monitoring and compliance:** Each company with installations covered by the scheme has to apply for a permit to emit carbon dioxide. The companies shall monitor their emissions and surrender EUA corresponding to the emissions at the end of a trading year. The operators who fail to fulfill this obligation will be charged with a penalty.

A transfer between Annex I Parties in a national or regional trading scheme, like the EU ETS, must be reflected under the assigned amount accounting rules of the Kyoto Protocol [http://unfccc.int, 4 March 2005]. This is secured since at the beginning of 2008 the transfers of allowances to another Member State will involve corresponding adjustments of AAUs under the Kyoto protocol [Trading directive, Article (10)].

3.1.2 The Clean Development and Joint Implementation

The Linking directive, Directive 2004/101/EC, links the emissions trading in Europe to the project based mechanisms in the Kyoto Protocol: Clean Development Mechanism (CDM) and Joint Implementation (JI).

In CDM and JI projects reductions of greenhouse gas emissions or enhanced carbon "sinks" are generated.[3] CDM projects provide for a possibility for Annex I countries to invest in projects within non-Annex I countries, developing countries that do not have targets under the Kyoto Protocol, resulting in certified emission reductions (CERs). In JI projects Annex I countries invest in projects in another country who has a commitment under the Kyoto Protocol resulting in emission reduction units, ERU [http://unfccc.int, 31 Jan 2005].

[3] A sink provides for an increase in the uptake of greenhouse gases from the atmosphere through land use, land-use change and forestry (LULUCF) [http://unfccc.int, 5 April 2005].

The overall costs in achieving the emission targets will be reduced since the emission reductions in developing countries and the Eastern Europe generally can be achieved at a lower cost [http://unfccc.int, 31 Jan 2005]. An aim with the mechanism is to increase the development and the transfer of more environmental friendly technology and knowledge. Another core object is to help the countries in the third world to reach sustainable development through CDM projects [Linking directive (3)].

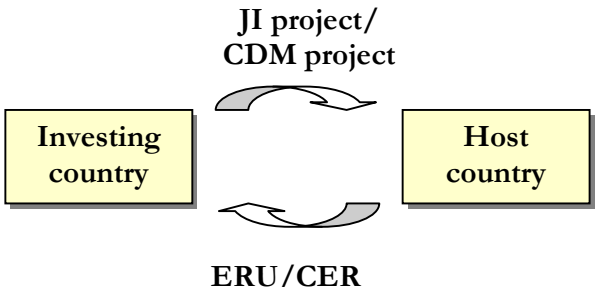


Figure 2: Model for JI and CDM projects

The product of the projects, CERs and ERUs, can be used to meet targets or to sell on the market [STEM 2005]. Companies can use CERs from CDM projects starting in 2005, but credits from JI project, ERUs, can't be used until 2008 [Linking directive (5)].

How to carry through a CDM and JI project is decided by the rules of the Kyoto Protocol, the Marrakech accords and interpretations by different agencies [Hijino, Emi; 9 March 2005]. The Linking directive establishes additional regulations that are described in *Annex 1*. Many issues concerning the linking of CDM and JI credits to the EU ETS are still being discussed and the directive is planned to be implemented into Swedish law by the 13 November 2005 [Hijino, 9 March 2005].

In contrast to emissions trading the project-based mechanisms generate credits when a project reduces emissions below an agreed baseline. The participants in the project voluntarily apply for an approving of the project, so that the reductions can generate the credits [OECD 2004]. It is important that the owners of a project can demonstrate that the project will lead to additional greenhouse gas reductions that would not have occurred in absence of the project, so called additionality. Therefore a baseline analysis that describes what would have happened if the project had not been carried out is of great significance. This baseline will be used to calculate the emission reductions achieved in the project [UNDP 2003]. In *Annex 2* CDM and JI projects are described more in detail.

The past price of CDM and JI credits, approximately 3-5 € per ton CO_2 equivalents (CO_2e) [4], has been lower than the price of EUA. The difference in price is due to the risks associated with the projects, like the risk that the project will not work as planned or be approved [STEM 2005].

[4] The six greenhouse gases in the Kyoto protocol have different Global warming potentials (GWPs), that is different abilities to trap heat in the atmosphere. The GWP provides a construct for converting emissions of various greenhouse gases into a uniform measure of CO_2 equivalents [http://www.eia.doe.gov 13 May 2005]. For example methane has the GWP of about 20; one ton methane corresponds therefore to 20 CO_2e.

3.2 Emissions trading at Akzo Nobel site Stenungsund

This chapter focuses on the past and future work on emissions trading at Akzo Nobel site Stenungsund.

3.2.1 Site information

The Akzo Nobel factory in Stenungsund is operated by two Business Unities, Akzo Nobel Surface Chemistry and Akzo Nobel Functional Chemicals. There are two production-units at the site: Production Ethylene amines and Production Surfactants. Products that are produced at the site are ethylene oxides, glycols, ethanol amines, ethylene amines, amine derivates, surfactants, and mixtures of produced and/or bought products [EIA 2002].

Table 1: Production units at the site [EIA 2002]

Production-unit	Factories	Sub factories
Ethylene amines	Ethylene oxide and glycol factory	-
	Amine factory	Amine derivate factory
		Ethanol amine factory
		Ethylene amine factory
Surfactants	Emulgot factory	-
	Special tensides factory	-

Site Stenungsund has the following carbon dioxide emission sources:

Steam boilers

There are two steam boilers at the site, boiler 2 and 3, which produce steam to the factories. Boiler 2 is only used in exceptional cases, but with a full production it is intended to be taken in continuous operation [Andrén, 1 Feb 2005]. The main fuel used in boiler 3 is burn gas from Borealis cracking plant situated in the same industrial area. The energy contents are comparable to natural gas and it consists for example of hydrogen gas, propane, ethane and butane in varying ratios. In case of a stop in the deliverance of gas; propane or oil from Borealis' cracker or burning oil is used as fuel [Kindstrand, 7 March 2005]. Today the steam boiler 2 is run on oil, but since it will be used continuously with a full production the boiler most probably will be rebuilt so it will be able to run on gas [Andrén, 1 Feb 2005].

Waste incinerator

The waste incinerator, which combusts waste water and organic products, also generates energy in the form of steam.

Chemical processes

Emissions of CO_2 are generated as a byproduct in the production of ethylene oxide. Part of the carbon dioxide is sold to AGA and the rest is released to the atmosphere. The exothermic reaction also generates steam that is used in the factory.

Oil furnaces for heating
Two oil furnaces fueled on burn oil class 1 produces heat for two houses, the research laboratory "Berget" and "Villa Bikupan".

Back-up units for power production
On the site there are also three back-up units (158 kW, 600 kW and 552 kW) fueled by diesel oil in case of a failure of power supply.

3.2.2 Up to now?

One of the purposes with this thesis is to discuss what has been done concerning emissions trading at the site in Stenungsund before 2005.

3.2.2.1 Preparations
At the end of 2003, when the Trading directive was established, Alf Adamsson analyzed the possible financial effect of emissions trading on the site in different scenarios. This survey was carried through before many issues concerning emissions trading were established. The issues that were considered to be critical for Akzo Nobel site Stenungsund were:

- The definition of an installation, would the processes or waste incinerator be included;
- Which allocation method would be used;
- Last minute influence on the National Allocation Plan and
- The rules concerning monitoring, reporting and verification of emission data.

A conclusion of the inventory was that the "strategy, timing and the reasoning in the application for permit and allocation of allowances is critical in limiting the negative impact".

3.2.2.2 Application process
There was a shortage of time for the application process, because the laws and regulations concerning emissions trading were established at the beginning of the summer in 2004 and the applications should be submitted at the end of the summer. In March 2004, the site received a new environmental permit allowing an increased production and the company prepared for a rebuilding of the site. This led to a few difficulties, since the questions in the applications were very detailed and a lot of information was supposed to build on historical emissions [Andrén, 1 Feb 2005].

Table 2: The application process concerning emissions trading

January 2004	Presented information to SEPA i.e. base information to the NAP
August 2004	Application for the emission allowances at SEPA
September 2004	Announcement of the issued emission allowances by SEPA
September 2004	Application of the carbon dioxide permit to the County administrative board (CAB)
November 2004	Complementary information to the application to CAB
December 2004	Received the carbon dioxide permit

The chemical sector is not included in the trading period 2005-2007, but site Stenungsund is included in the emissions trading since it has combustion installations (the boilers) with an installed thermal input exceeding 20 MW [SFS 2004:1199, 2 chap., 12§]. If one operator carries out several activities within the same line of business and in the same site, the capacities are added together. [SFS 2004:1205, 17 §] Therefore two oil furnaces for heating and the three spare units are also included in the emissions trading, even though their CO_2 emissions are small.

The emissions of CO_2 from the processes are not included in the trading scheme, because only the processes described in the 9 § in SFS 2004:1205 are included. The combustion installation which burns dangerous wastes is not considered as a combustion installation in the law of emissions trading. Therefore, the emissions from the waste incinerator are not included [SFS 2004:1205; 14§].

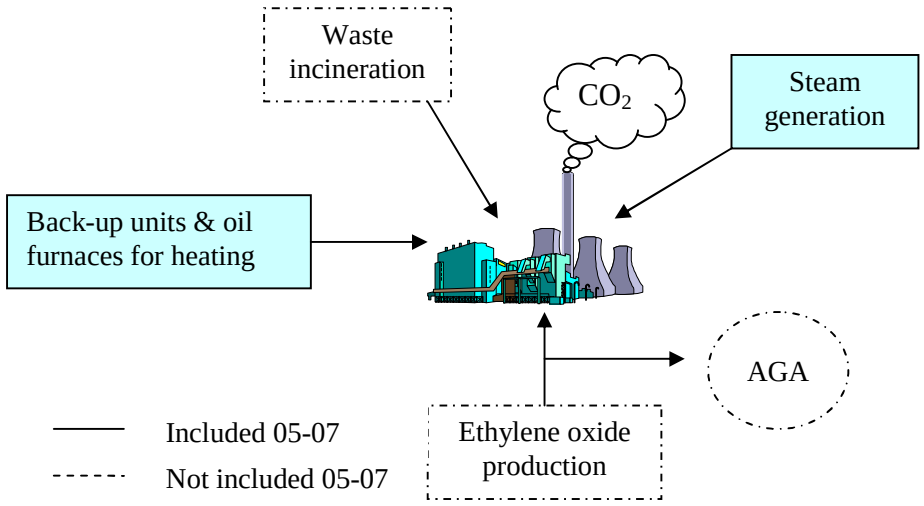


Figure 3: Carbon dioxide sources at site Stenungsund

Each company included in the emissions trading has to apply for allowances at the Swedish EPA. The general principle is that the companies were issued allowances based on historical emissions. Akzo Nobel site Stenungsund was considered to be a "new participant", because the site had a new environmental permit allowing an extension that had not been put into operation when the NAP was delivered to the European Commission [SFS 2004:1205 8§]. Being a new participant Akzo Nobel site Stenungsund was issued allowances based on a production increase in contrast to "existing installations".

Site Stenungsund was assigned fewer allowances than they applied for, in all 3.7 % less than the applied amount (3.3 % less according to the recalculations of the prognosis in the application for the CO_2 permit).

Table 3: Applied and issued EUA 2005-2007
[Application CO_2-permit; http://www.naturvardsverket.se, 25 April 2005]

	2005	2006	2007	Total
Estimated CO_2 emissions (tCO_2/year)	45 220	59 500	66 640	171 360
Issued EUA (1 EUA = 1 tCO_2)	50 260	56 485	58 975	165 720
Difference (%)	+1,1	-5,1	-11,5	-3,3

The operator of an installation included in the emissions trading has to apply for a CO_2 permit at the CAB. The CO_2 permit, where the monitoring methodology is established, is issued if the operator is believed to be capable to monitor and report the emissions in a reliable way [SFS 2004:1199, 2 chap. 5§]. This means that the company monitoring methodology must be in accordance with the guidelines concerning monitoring from the Swedish EPA [NFS 2005:6].

3.2.3 Site Stenungsund's future obligations

The previous chapter described what has been done at the site concerning emissions trading so far, or more correct the process before the emissions trading started 1 January 2005. This chapter addresses future obligations at site Stenungsund which could help to secure that the company follows laws and regulations; and is aware of the possible benefits of emissions trading. When this thesis project was prepared, staff at the site worked with issues concerning emissions trading. Therefore the routines at the site are not discussed in detail.

Generally the emissions trading is advised to be implemented into the regular routines and become a part of the ordinary work at the site as soon as possible. During this trading period the company will learn-by-doing and the trading scheme will most probably be amended. Consequently it is desirable that the company looks over the routines continuously.

The significance that a company will give to emissions trading is evidently dependent on the installations emissions and the future demands of emission reductions. It is important that Akzo Nobel site Stenungsund has a strategy concerning emissions trading or more accurately a strategy of how to manage the future cap on greenhouse gases and its consequences. Questions that Akzo Nobel can answer in developing the strategy are:

- What significance does emissions trading have for the company?
- Can it influence the prices of the products?
- What risks does the company face?

To be able to evaluate how many resources should be put on the issue of emissions trading the company is advised to keep up with the development of the trading scheme and future reduction targets.

- Akzo Nobel Stenungsund is advised to create an emissions trading strategy and follow-up on the development of the trading scheme and future reduction targets.

3.2.3.1 The annual process of emissions trading

The annual process *(see Figure 4)* of emissions trading can be divided into four main steps:

1. Applying for emission allowances at the beginning of a trading period;
2. Monitoring of the emissions during the year;
3. Verification of the monitoring and the report by a third party; and
4. Submission of emission allowances covering the emissions at the end of the year.

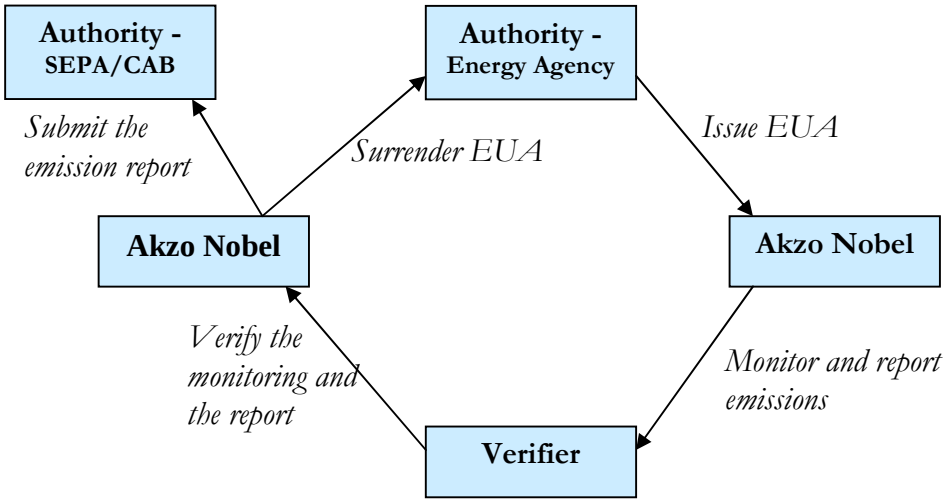


Figure 4: Annual process of emissions trading

1. Applying for emission allowances

The National Allocation Plan for the trading period in 2008-2012 shall be published and notified to the Commission before 30 June 2006. Based on the NAP the Swedish government must decide the total quantity of allowances that it will allocate in 31 December 2006 at the latest [SFS 2004:1199, 3 chap., 3§].

- Before the establishment of a NAP Akzo Nobel site Stenungsund shall report the information that will be required by the authorities [SFS 2004:1199, 3 chap., 2§].
- The company has to apply for emission allowances at the Swedish EPA before the beginning of a trading period. [SFS 2004:1205 18§] The preliminary time for the application for allowances for trading period 2008-2012 is in January-February 2006 [http://www.naturvardsverket.se, 23 March 2005]. The company will be issued allowances based on the allocation methodology decided in the NAP.

The information that must be given in the application for allowances before the next trading period is dependant on the rules concerning allocation that will be decided in January 2006 [Karlsson, 1 April 2005].

Akzo Nobel site Stenungsund has an account in the Swedish web based emission registry where the allowances are issued in the beginning of each trading year *(see Annex 3 section 3)*. All the transactions of emission allowances will be made from this account.

- Akzo Nobel must have two representatives with access to the company's account in the emission registry. The representatives are advised to have an understanding of the processes in the registry, where the transfers of EUA are entered and approved.

2. Monitoring of emissions

The CO_2 emissions must be monitored according to the conditions in the permit and the regulations from Swedish EPA *(see Annex 3 section 2)*. The monitoring and the annual emission report will be verified by a third part to assure that the emissions have been determined with a high degree of certainty. It is of importance to work towards a verifiable monitoring and data management system.

Assumptions, references, activity data, emission factors, oxidation factors, transformation factors and other monitoring data shall be gathered, reported, compiled, analyzed and documented in a manner that makes it possible for the inspector and the SEPA to understand the determination of the emissions [NFS 2005:6, Annex 1].

- Akzo Nobel site Stenungsund is recommended to have routines for monitoring and reporting of carbon dioxide emissions.
- To be able to save the data concerning monitoring and reporting in a transparent and correct manner requirements are set on the format where the data is saved.
- Akzo Nobel needs routines for the quality assurance and control procedures to monitor and report emissions in a reliable way. The quality assurance and control procedures must comprise [NFS 2005:6, 34-35§§]:
    - Responsibilities and competence;
    - Identification of sources and material flows;
    - The methods for monitoring and calculations;
    - The interaction of monitoring methodology and reporting processes;
    - Determination of activity factors, emission factors and oxidation factors;
    - Calculation of the emissions from combustion of wastes, amount CO_2 transferred to another installation and the total amount of fossil CO_2 from the installation;
    - The measuring equipment used;
    - Internal reviews of both reported data and quality system;
    - Correction and preventive action; and
    - Reporting and filing.
- Information concerning the monitoring of CO_2-emissions must be documented and filed according to the regulations to allow for the verifier to asses the yearly report. A list of the information that shall be retained is given in 40 § NFS 2005:6.

3. Reporting and verification

At the end of every year Akzo Nobel has to submit a verified emission report according to the regulations from Swedish EPA.

- The report shall include the aggregated emission of CO_2 during the past calendar year, a description of the measuring and calculation methods, an appreciation of the uncertainty of the calculations and information about the quality assurance and control [SFS 2004:1199 2§]. This report must be submitted to the Swedish EPA and CAB before 31 Mars at the end of at trading year [NFS 2005:6, 36§].

The report shall be verified by a verifier accredited by SFS 1992:1119 concerning technical control [SFS 2004:1199, 5 chap., 4§]. The verification of the reports shall address the reliability, credibility and accuracy of the monitoring [Trading directive Annex V]. The verifier shall verify that [NFS 2005:6, 44§]:

- the yearly emissions from the site correspond to the actual emissions
- the monitoring is in accordance with the permit and the regulations concerning quality assurance and control procedures in 34-35 §§ NFS 2005:6
- the company has notified changed conditions *(see Annex 3 section 4)*
- the emission report fulfills the conditions given by law
- the operator has checked the emission data by comparing data between the years and comparing values in the same magnitude calculated in different manners
- the company has changed to a higher tier if it is technically practicable and not connected to unreasonable costs.

- Akzo Nobel site Stenungsund is advised to appoint an external verifier as soon as possible. It would be favorable to let a verifier revise the monitoring and data management system after the first six-month period. Then possible errors can be corrected in time. An issue of concern on a large scale is the need of competence building to have enough verifiers for the verification [Karlsson, 9 March 2005].

4. Submission of emission allowances

- By 30 April in 2006 and each following year Akzo Nobel site Stenungsund must present an amount of EUA covering the emissions from the installation the preceding trading year to the authority of the registry, i.e. Swedish Energy Agency [SFS 2004:1199, 6 Chap. 1§]. The submission of emission allowances will be done from the company's account in the emission registry.

Swedish EPA shall publish the names of operators that do not fulfill this obligation with a press release [SFS 2004:1205 43§]. An operator has to pay an emission penalty to the government for each ton of CO_2 not covered by a surrendered EUA in the end of a trading period (40 €/ tCO_2 2005-2007 and 100 €/ tCO_2 2008 and forward). The operator is also obligated to surrender emission allowances equal to the excess emissions in the end of the trading period in the following year [SFS 2004:1199 8 chap., 7§].

3.2.3.2 Fulfilling the requirements of notification and other laws

There must be routines to secure that the concerned employees are aware of the requirements of notification and other regulations that can give sanctions if not followed *(see Annex 3, section 4 and 5)*

3.2.3.3 Forecasting of emissions

In the application for allowances for trading period 2005-2007, the Akzo Nobel site Stenungsund made an emission prognosis. Forecasts are also necessary when the company predicts the need to buy allowances or look over abatement costs at the site.

- Emission forecasts should be based on planned production and decided energy efficiency actions. Since there are several people involved in emission forecasting it is recommended that the background data is well documented.
- It is advised to forecast the boilers steam production, since it is essential for the CO_2 prognoses. With an extended production Mattias Kindstrand [7 March 2005] foresees an increasing need to forecast the steam consumption at the site. During normal operation the supply of steam is secured by the two boilers, but during operational problems the steam supply will be more limited with an increased production

In *Figure 5* the process of emission forecasting can be seen. It is advised to evaluate the effect of future trading years in different scenarios once a year.

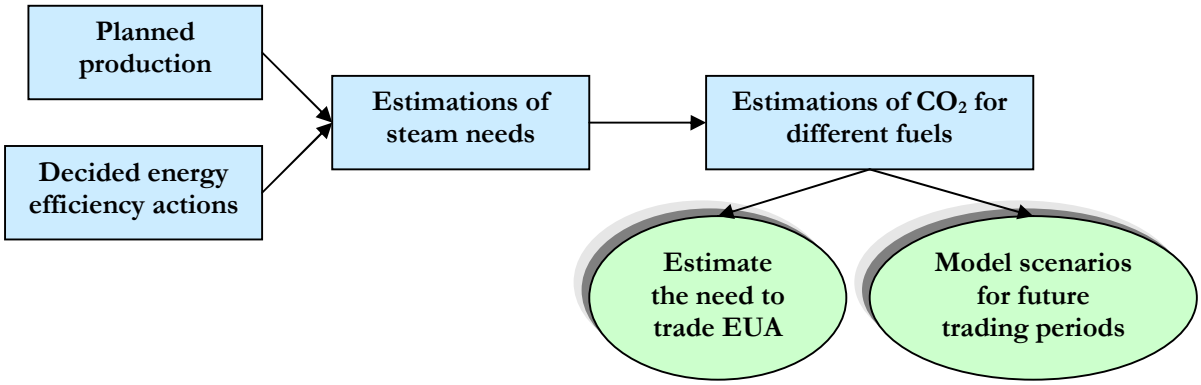


Figure 5: Process of emission forecasting

3.2.3.4 Future measures to reduce emissions

Akzo Nobel site Stenungsund has had incentives to decrease the site's energy consumption, such as decreased cost for CO_2-tax and electricity costs. Emissions trading constitute a new incentive to increase the energy efficiency of the site. The trading with allowances has the characteristics that a company also can benefit from abatement actions from sold allowances.

- Calculations on possible energy integrating actions are recommended to comprise the value of emission allowances.

3.2.3.5 Trading with emission allowances

3.2.3.5.1 How do you trade with allowances?
Akzo Nobel in site Stenungsund was issued allowances in 2005 worth 800 000 €, by the market value of 16 €/EUA 2005 in April 2005 [www.pointcarbon.com]. Schieldrop [2005] describes the EU ETS market as "a new and immature market, currently with a limited amount of active participants, mostly from the power and energy sector and the majority presumably net short allowances".

In the initial studies that were made the price on EUA was expected to be much lower than the value is today says Heikki Herttuainen [4 May 2005] at GreenStream Network Ltd. One explanation for the elevated price can be that the companies with a short position have reacted faster to secure compliance than the companies who have a surplus, says Herttuainen [4 May 2005]. Other reasons can be increased energy prices and political decisions that limit the emissions in the trading sector [MiljöRapporten DIREKT 30 May 2005]. The market participants are though thought to increase, thus stabilizing the market. The tension and volatility are thought to increase gradually towards the end of the first trading period [Schieldrop 2005].

The price of allowances is decided by supply and demand. The carbon market is complicated and some of the key factors that determine the price of allowances are:

- **Policy and regulatory issues:** total supply of EUA and treatment of new installations determined in the NAPs; the rules for project based mechanisms and banking, and future status of the Kyoto protocol [Point Carbon 2004].
- **Possible connections to other trading systems:** the EU ETS can be linked to greenhouse gas trading schemes of other countries that are listed in Annex B in the Kyoto protocol. This can affect the supply and demand of allowances.
- **Weather:** temperature, rain fall, and wind speed.
- **The marginal costs for emission reductions within the system:** the inclusion of additional sectors and countries in for example Eastern Europe can lower the marginal cost.
- The use of credits from project based mechanisms.
- **Market fundamentals:** such as economical growth, energy consumption and fuel prices [STEM 2005].

According to Schieldrop [2005] a lot of the reductions have to be achieved by fuel switching from coal to gas. Therefore the CO_2 price will be linked to the price of coal, gas and oil.

There is no part of the legal framework that regulates how and where the trading will take place. The trading with EUA is planned to work as a traditional value paper market and anyone, both juridical and physical persons, can buy and sell allowances [SOU 2005:10, 2005]. Akzo Nobel site Stenungsund can trade directly with each other or act through brokers, banks or other intermediaries [http://europa.eu.int/, 9 Feb 2005].

Bilateral trades[5]**:** The advantage of trading directly between companies is that there are no costs to intermediaries. The administrative costs to find a corresponding need, the lack of understanding of the carbon market and the risk that the trade will not be realized can make it less beneficial though. All the procedures like writing contracts, deciding a price etc. have to be handled by the companies.

Brokers: Brokers can match Akzo Nobel site Stenungsund with other companies that want to trade with allowances and provide the company with market information. The company will be charged with a commission fee by the agent that facilitates the transaction. The allowances are delivered by a transfer from seller to buyer on the registry and payment shall be in accordance with the terms of the contract [http://www.evolutionmarkets.com/, 5 May 2005]. Firms of brokers can also offer portfolio management, but this is more useful for companies with large allocated amounts

Trading pools is a possibility provided by GreenStream Network Ltd. for companies with small allocated amounts. The purpose with the pool is that the members will have stronger position on the market, where it is harder to trade with small and odd amounts of EUA. The companies within the pool can also trade with each other and the companies are provided with market information [Herttuainen 4 May 2005].

Market: Nord Pool, the Nordic Power Exchange, provides trading and clearing of EUA as forward contracts (forward settlements) where the minimum contract size is 1 000 ton. Nord Pool is the other party in Exchange trades of EUA and guarantees physical delivery to buyer and cash payment to seller [http://www.nordpool.com, 5 April 2005]. EXC/IPE, EEX and EXAA are other markets that provide for trading with EUA.

Kema Nord kraft purchases electricity for Akzo Nobel in Sweden and Finland and secures future electricity prices at Nord Pool. Kema Nord kraft's broker Sydkraft that facilitates the trades, is paid an annual fee that concludes brokerages. Akzo Nobel site Stenungsund can trade with Sydkraft as broker by an addition to the existing contract with Kema Nord kraft and for a fee for each trade [Widmark, 13 May 2005].

The basic structures of trading allowances include:

Spot trades - immediate settlement: The bid and offer are set on the trade date with delivery and payment occurring in a standard timeframe shortly thereafter.

Forward settlement: The terms are set on the trade date, but delivery and payment are done on a future date, which is specified at the time of trade.

Options: The parties buy or sell options which can be in many forms. A call option is a right, but not an obligation, for a buyer to purchase EUA/reduction credits at specified price at the strike date. A put option is a right for the seller to sell EUA/reduction credits at a set price on the strike date [http://www.ieta.org, 13 Feb 2005].

[5] Bilateral trades means that a buyer and seller execute a transaction directly, without an intermediary or centralized system [http://www.co2e.com, 7 Feb 2005].

When a trade is realized the transaction must be registered in the account in the emission registry *(see Annex 3 section 3)*. It is important to notice that the national registry has nothing to do with the CO_2 market. A completed transaction between two parties is only accounted for in the registry.

3.2.3.5.2 Trading strategy
Companies are issued the allowances each year at least two months prior to the date they are required to present EUA to cover the previous year's emissions. This gives the companies an opportunity to "borrow" allowances [Point Carbon 2004]. Allowances are valid during a trading period so excess EUAs can be saved within a period [SFS 2004:1199, 4 chap., 2§]. If a company wants to save excess allowances between the years within a trading period it does not have to inform the authorities. Though the allowances cannot be saved to trading period 2008-2012. For the following five-year periods it is allowed to save EUA between the trading periods, so-called banking [SOU 2005:10, 2005]. The banking of EUA provides compliance flexibility and price stability.

The main trading strategy of Akzo Nobel site Stenungsund will probably be to minimize increased costs and if possible maximize the possible income from sold EUA. Some main trading strategies can be:

- balance the allowances and the actual emissions at the end of 2007
- balance the allowances and the actual emissions at the end of a trading year
- follow the market and the site's compliance to sell and buy EUA when the price is advantageous

If the company only has a slight difference between the emissions and the allocated amount a less ambitious strategy can be chosen. A risk is though that the price of EUA is unprofitable at the end of a trading period.

3.2.3.6 Accounting for emission allowances
In a Swedish government bill it was given that the assets that the emission allowances constitute shall be classified and valued after normal accounting principles. [Prop. 2004/05:18] How to account for the allowances is an important issue that is not easy to solve. Some of the questions needed to be answered are: if the allowances are a net asset or a liability; how will the asset/liability be measured (market value/expected value); and when a potential penalty should be recognized and how it should be measured [http://www.ieta.org/, 9 May 2005].

The International Financial Reporting Interpretations Committee (IFRIC), which is a part of the International Accounting Standards Board (IASB), has issued a draft of how the allowances shall be recorded for accounting. The draft received over 40 comment letters of which only a few supported the proposition [http://www.ieta.org/, 9 May 2005]. While waiting for the final decision from IASB companies make own interpretations of how the allowances should be accounted for [Flening, 18 May 2005].

Some of the implications companies face are how to price allowances at a fair value without a liquid market; taxation and impairment of assets. [http://www.ieta.org/, 9 May 2005]

3.2.3.7 Decision process and meetings

As the allowances have a financial value the issue concerns several parts of the company. Therefore, the contact between different departments is essential. Information has to be exchanged between the engineers working with forecasting of emissions and monitoring, the staff responsible for trading and the economical department responsible for accounting.

The decision to buy or sell emission allowances should be based on actual and forecasted emissions and the market situation.

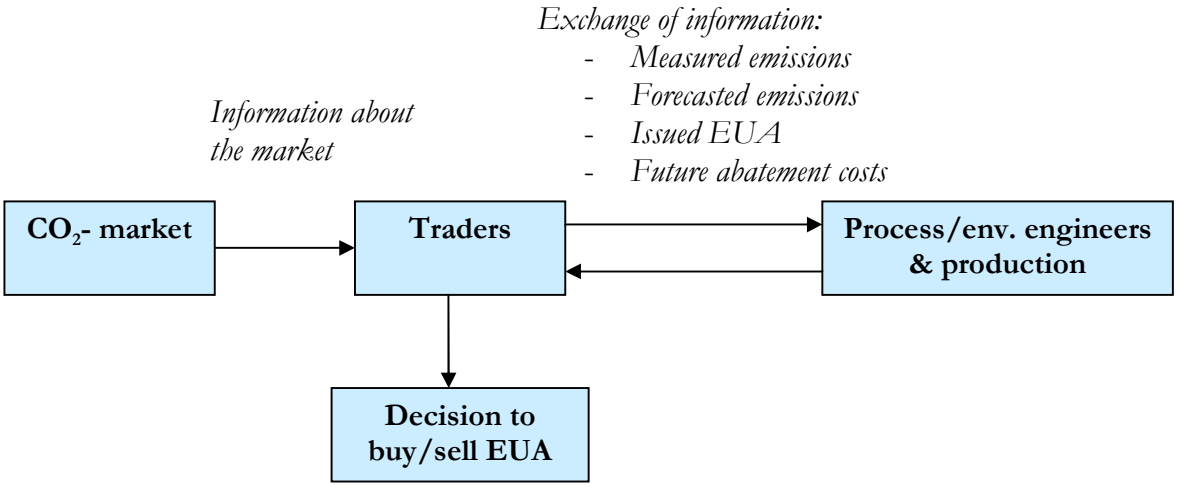


Figure 6: Decision process to determine the need to buy or sell EUA

To be able to handle the emissions trading meetings between different departments are suggested to be held.

- Each quarter of the year before the EUA should be accounted for in the quarterly report an internal control of the situation is recommended. The check is advised to comprise the actual emissions, the forecasted emissions in the trading period and the balance between the actual and forecasted emissions with the issued allowances. A meeting could be held with the concerned staff, with the purpose to see over the need to buy or sell allowances.
- Each half year in June-July before the decision of the budget and the TOP (Three years Operating Planning) process it is advised to have a closer control to look over of the actual and the future situation.
- It would be an advantage if the data of CO_2 emissions are checked before they are accounted for in the financial quarterly report or used as information to discuss the

need to trade EUA. The control can be an internal revision or just a comparison to previous monitoring data.

3.2.3.8 Summary and important dates

In *Figure 7* the obligations discussed above are summed up.

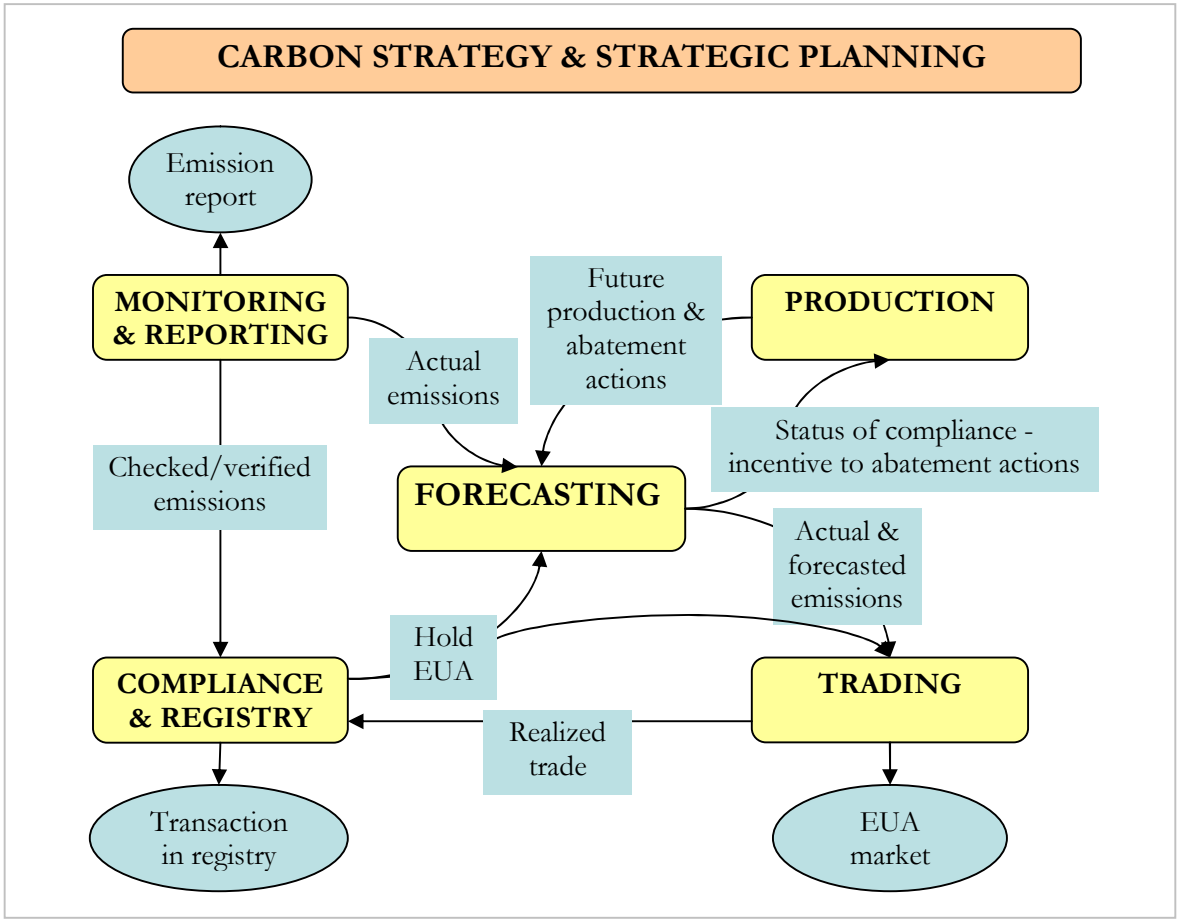


Figure 7: Summary of routines

Some important dates concerning emissions trading are stated below.

15 May 2005	New rules on verification emission reports will enter into force replacing NFS 2004:9
13 November 2005	The linking directive will be implemented into Swedish law
Jan-Feb 2006	Apply for allowances for the trading period 2008-2012
31 March 2006	Last day to present the annual emission report and for the verifier to approve the emissions in 2006
30 April 2006	Last day to transfer EUA covering the emissions in 2006
30 June 2006	Swedish NAP will be published and notified to the European commission

31 December 2006	Last day to publish the decision on allocation of emission allowances
31 March 2007	Last day to present the annual emission report and for the verifier to approve the emissions in 2007
30 April 2007	Last day to transfer EUA covering the emissions in 2007

3.2.5 Past and forecasted emissions

To be able to forecast the Akzo Nobel site Stenungsund's future need for emission allowances a prognosis of the future emissions of the site has been estimated.

3.2.5.1 Past emissions

The production at the site in the past 10 years can be seen in *Figure 8*. The production at the site increased with 25 % between 2003 and 2004.

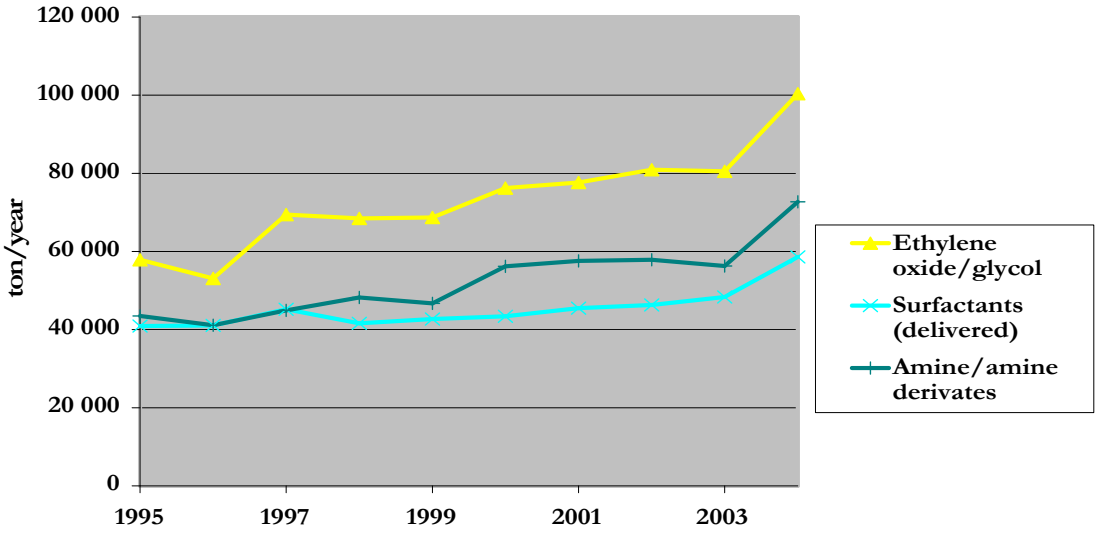


Figure 8: Production 1995-2004 [Environmental reports 1995-2004]

By comparing the steam production with the CO_2 emissions in the past seven years it can be seen that the emissions have decreased per GWh. This is due to an increased use of burn gas as fuel during these years. On account of energy integrating measures at the site the energy production from the boilers was approximately the same in 2003 and 2004 in spite of a large increase in production.

Table 4: Produced steam and emissions of carbon dioxide 1998-2004

	1998	**1999**	**2000**	**2001**	**2002**	**2003**	**2004**
Steam (GWh)	212	188	190	221	220	195	195
Emissions (tCO_2/year)	53 337	49 493	41 782	49 038	46 304	42 965	41 000
CO_2/GWh	252	263	220	222	210	220	210

Neither the emissions from the waste incinerator nor the ethylene process are included in the trading scheme. In the past years the emissions from the waste incinerator have been approximately 6000 ton/year. Part of the CO_2 emissions that are generated in the process are sold to AGA and the rest are released into the atmosphere. It is the parallel competing reaction to the ethylene oxide process that produces CO_2 by the following reactions:

$C_2H_4 + ½O_2 \rightarrow C_2H_4O$ + heat (1)
$½C_2H_4 + 1½O_2 \rightarrow CO_2 + H_2O$ + heat (2)

Table 5: CO_2 generated in the ethylene oxide process

	1998	**1999**	**2000**	**2001**	**2002**	**2003**	**2004**
EO (ton)	66 194	65 411	72 821	75 735	77 887	78 195	97 052
CO_2 to atmosphere (ton/year)	16 566	19 481	24 043	17 457	21 770	25 000	29 000

3.2.5.2 Forecasted emissions

In 2004 Akzo Nobel site Stenungsund received a new environmental permit, which allows an increased production *(see Table 6)*. According to the regulations the company therefore received allowances based on future production in trading period 2005-2007. The allocation for each year was achieved by multiplying the yearly increase in steam production expressed in GWh with a benchmark (83 ton CO_2/GWh) and adding this to the past emissions [SFS 2004:656 30 §].

Table 6: Maximum production by the new and old environmental permit

Product	**Maximum production/year; former environmental permit**	**Maximum production/year; new environmental permit**
Ethylene oxide	80 000 ton - of maximum 22 000 ton for glycol	150 000 ton - of maximum 50 000 ton for glycol
Surfactants	80 000 ton	100 000 ton
Amines	80 000 ton - of maximum 5 000 ton amine derivates	120 000 ton - of maximum 5 000 ton amine derivates

The forecasting of emissions in the application of allowances was based on discussions with the marketing section concerning the future production. With this information engineers calculated how much steam was needed in the factories. This led to an extrapolation of the steam consumption in correlation with the production increase [Andrén, 1 Feb 2005].

3.2.5.2.1 Prognosis of the CO_2-emissions 2005-2012

The future steam production from the boilers has been estimated by subtracting the produced steam from the EO-processes and the waste incinerator from the future energy need of the factories. The forecasted CO_2 emissions are vastly dependent on the future production at the site. For trading period 2005-2007 there is only one production forecast, but there are two main scenarios for 2008-2012:

1. The production will be the same as projected in 2007
2. Extension approaching a full production in 2010

In *Figure 9* emissions from the site can be seen in the two scenarios. The emissions decrease slightly in 2008 compared to 2007 in the scenarios. The reason for this is that the boilers are thought to run on gas, since boiler 2 is planned to be rebuilt so it can be run on gas.

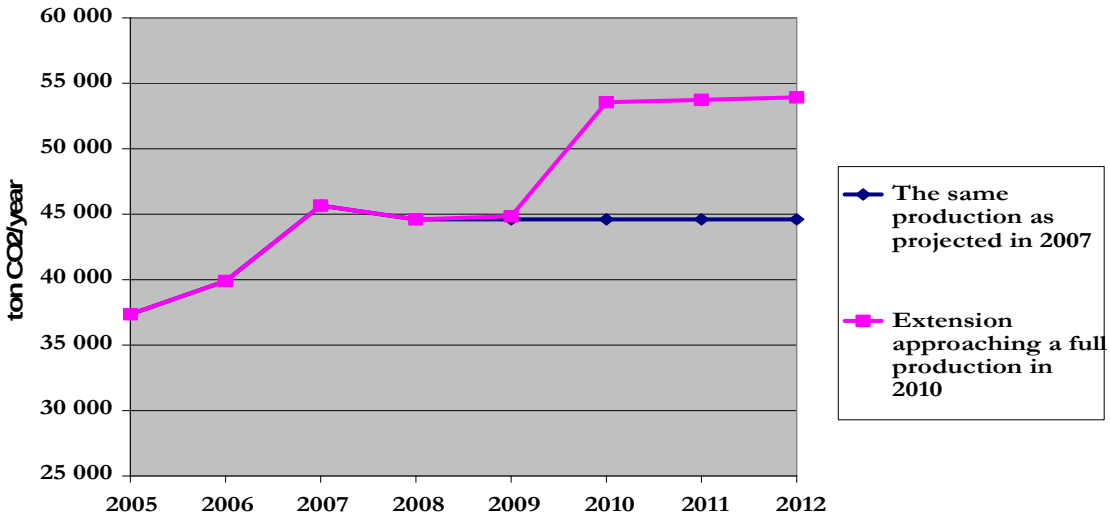


Figure 9: Emission forecast provided an increased production and an extended factory

There are many factors influencing the actual emissions as production, future abatement actions and future fuel use. If Borealis cannot deliver burn gas, other fuels such as propane or oil from Borealis' cracker or burning oil is used leading to larger emissions. Boiler 2 fueled with oil is operated each week for maintenance and during a failure of the boiler 3 [Kindstrand, 7 March 2005]. Other differences are that the contents of the gas fuel, due to the processes in the cracker, vary in time resulting in different emissions [Lindqvist, 4 March 2005].

3.2.5.2.2 Differences between the prognoses

The prognosis calculated in the application for allowances can be seen in *Table 7*. In the application of the permit the calculations of the emissions had been adjusted slightly according to the regulations from Swedish EPA [Lindqvist, 4 March 2005].

Table 7: Prognosis of steam consumption and CO_2 emissions in the applications

	2005	2006	2007
Steam (GWh)*	225	300	330
Burn gas (ton/year)*	16 150	21 250	23 800
CO_2-emissions (ton/year)*	45 400	59 700	66 900
CO_2-emissions (ton/year)*	45 220	59 500	66 640
Issued emission allowances	50 260	56 485	58 975

Application emission allowances 2004; Application permit 2004*

The forecast in the application for allowances differs from the prognosis in this thesis project. The reason for this is that the prognosis in the application was based on the factory's conditions in 2003. Therefore, the following energy reduction actions are not included:

- Energy optimizing actions carried though in 2003 that saved 4 MW and lowered the energy consumption per produced ton amine with 15 %.
- A new waste incinerator produces 5-6 ton steam per hour.

If you compare the prognosis in the application with a scenario where the generated steam from the waste incinerator and the energy efficiency action in 2003 are excluded the two scenarios overlap within a 10 % error range *(see Figure 10)*.

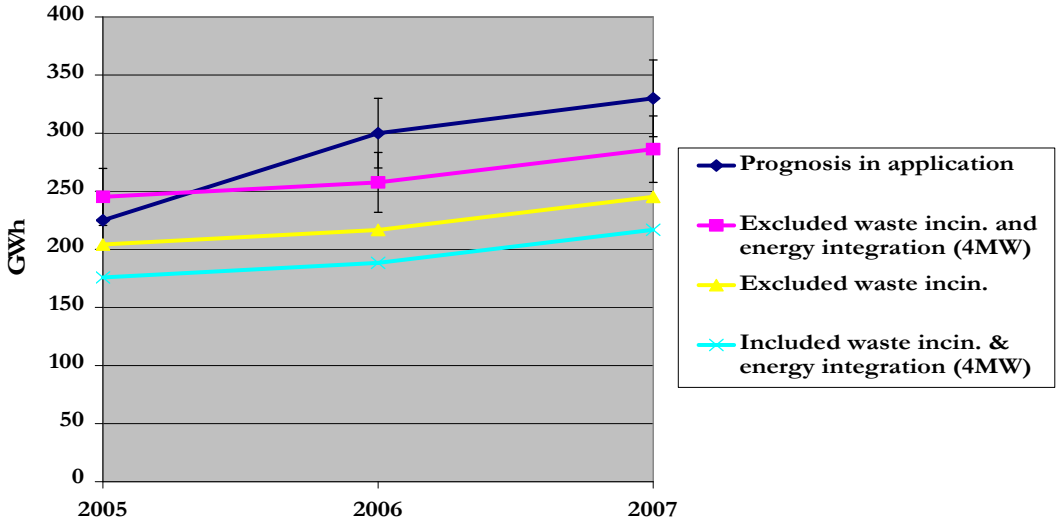


Figure 10: The difference between the prognosis in the application and the forecasts in this thesis project

Akzo Nobel site Stenungsund has also become more efficient in running the factory, partly because the staff has learnt more about the function, and partly because the factory is more efficient if it runs on a higher capacity. The production increase between 2003 and 2005 is not that big so the latter has not a large influence on the emissions [Hanson, 15 April 2005].

3.3 Coordination within Akzo Nobel

The purpose with this chapter is to look at the coordination concerning emissions trading within the Akzo Nobel group and to compare the allocation methods between the countries where the Akzo Nobel's sites are situated.

3.3.1 Other business units included in the emissions trading

The Chemistry sector is not a participant in the first trading period, but Akzo Nobel sites with energy installations exceeding 20 MW are included. Hans Feenstra, at Akzo Nobel Energy, has performed an inventory concerning the installations and quantities included in the first period of the emissions trading scheme. The result can be seen in the *Table 8*.

Table 8: Akzo Nobel sites included in the trading scheme 2005-2007

Country	Site	BU	Allowances 2005-07 (kton/year)
Belgium	Ghlin	Polymers	20
DK	Mariager	Salt	131
	ANS	Salt	26
Germany	Emmerich	SC	16
	Greiz	Innovation	16,6
Netherlands	Arnhem (*)	Energy	34
	Delfzijl (*)	Energy	2096
	Hengelo (*)	Energy	459
	R'dam (*)	Energy	223
Sweden	Casco Kris	Ind. Fin	7,7
	Stenungsund	FC	55
	Stockvik	Kema N.	56
		S.C.	9,8
Total			**3150,1**

(*) Cogeneration sites

The majority of the Akzo Nobel's emission allowances have been issued to the combined heat and power plants (cogeneration sites) in the Netherlands. Cogeneration units in the Netherlands are owned through joint ventures between Akzo Nobel and a public company. The public company will be responsible for the trading with allowances for the factories in the Netherlands [Feenstra, 5 March 2005].

The conclusions made from the inventory were that there would be no corporate approach concerning emissions trading. The most important issue for the installations

outside the Netherlands is compliance at the end of the period, in order to avoid a shortage of emission allowances [Feenstra, 5 March 2005]. We are concerned for the future financial situation for sites in some countries, says Gert van Ingen [30 June 2005]. Therefore, Akzo Nobel is looking for abatement actions to increase the potential savings.

Akzo Nobel Energy has a coordinating responsibility concerning emissions trading and informs the site's included when questions are raised. We are advising the site's to wait for realistic figures before they decide to sell or buy emission allowances. Akzo Nobel is aiming on further coordination in the future [van Ingen, 30 June 2005].

3.3.2 Differences between the countries allocation plans

Michael Grubb, an expert in the Economics of Climate Change of the University of Cambridge, claims that the governments have been too generous in their allocation of allowances in fear of giving the companies competitive disadvantages. He thinks that there will be very few buyers on the market and that the prices will fall. The reason for this is, according to him, the lack of any strict rules governing the allocation [Pearce, F. 2005].

Heikki Herttuainen [4 May 2005] at GreenStream Network Ltd. says that in the initial studies the price on EUA was expected to be much lower than now. One of many explanations for the elevated price can be that the companies with a short position have reacted faster to secure compliance than the companies who have a surplus, says Herttuainen.

The National allocation plan that sets the basis for the countries' allocation of allowances must fulfill certain criteria given in the Trading directive as it can be seen in Annex 7. Lars Hydén, who took part in the evaluation of the NAP, argues that this was the most complicated task the EU has come up with. The issue became difficult mostly for the following reasons [Hydén, 9 March 2005]**:**

- *CO_2 versus other greenhouse gases:* The trading only includes CO_2 and the Kyoto target concerns six greenhouse gases. Countries justified increases in the trading sector with measures to reduce emissions of other greenhouse gases that were described in loose terms.
- *Trading sector versus Non-trading sector:* Most of the reduction to reach the Kyoto target was going to be carried out in the non-trading sector.
- *2005-2007 versus 2008-2012*: The countries claimed that everything is going to be fixed in the next period.
- *Consideration to CDM and JI:* Some countries considered reductions that are planned to be achieved through CDM and JI.

To issue more allowances than the sectors have planned to emit was not allowed and it was considered as unallowable state aid. Though a country can have a very optimistic business-as-usual (BAU) prognosis which justifies a generous issuing of allowances. Lars Hydén [9 March 2005] says that the Commission cannot question a country's development and must accept a country's prognosis of emissions.

3.3.2.1 General about the allocation

In general the caps imposed on the trading-sector are less strict than they would have been if these sectors would have made an equal contribution to meeting the Kyoto targets as other sectors, or if the use of the Kyoto Mechanisms was not planned. Even though twelve countries stated that they will use JI/CDM credits only three had current purchasing programmes (Austria, Italy and the Netherlands). Since only 8 out of 18 countries have given sufficient information to allow a comparison between the cap and the Business-As-Usual developments it is hard to estimate the environmental benefit of the EU ETS [Ecofys UK 2004].

The allocation was in general more generous to the industrial sector than the energy sector within the trading sector. Usually this is justified by the larger reduction potential in the energy sector. Another argument is that the industry is exposed to international competition and therefore a smaller possibility to transfer the costs to the consumers [STEM 2005:2].

Before the differences between the allocation plans are discussed further four different allocation principles will be described.

Allocation free of charge

- Grandfathering: Each installation's share of the national emissions cap is based on their historical emissions. Deciding issues as base year and treatment of early action so that companies which have made early reductions will not get a disadvantage can be very complicated [http://www.ucd.ie/, 9 June 2005].
- Benchmarking: Allowances are allocated by using a performance standard, such as average emissions per ton product. This allocation method favors energy efficient companies [Mavrakis, Konidari; 2003].
- Projected emissions: The allocation is based on estimations of the company's future emissions, which favors companies that intend to expand [http://www.ucd.ie/, 9 June 2005].

Auctioning

- The emission allowances are auctioned, so the allowances are sold to those who value them most [Mavrakis, Konidari; 2003].

3.3.2.2 Differences between the "Akzo Nobel countries"

The Akzo Nobel sites that are involved in the emissions trading are situated in Belgium, Denmark, Germany, the Netherlands and Sweden. Therefore the differences in the allocation of emission allowances between these countries will be discussed. There are many different ways to compare the NAPs, I have chosen to look at:

- the general allocation method
- the possibility to change the years in the base year
- growth factors and/or reduction factors
- the possibility to apply for early action

Table 9: General allocation methodology

Country	General allocation methodology
Denmark	The industry, in contrast to the electricity producers, were allocated allowances corresponding to the emissions in the base year [STEM 2005:2].
Belgium – Walloon region	The allocation to the industry is based on voluntary agreements between the Government and the different lines of businesses. The reductions in the agreements are translated to a CO_2 reduction by a greenhouse gas index. An installation's base year emissions is multiplied by the greenhouse gas index, an index for production forecasts and a correction factor so that the emissions correspond to the overall cap [STEM 2005:2]. The greenhouse gas index for the chemical sector are in 2005 to 2007 between 98.81 – 97.99 (defined on a baseline of 100 for the reference year) [Belgian NAP 2004].
Germany	The allocation will be based on historic emissions in the base period. The overall reduction factor in the trading sector is 0.996, but this is divided unequally between the installations. Process related emissions, installations which meet the criteria for early action status and new installations have the reduction factor 1. CHP installations get an additional allocation of 27 tCO_2/GWh [IVL 2004].
Netherlands	Allocated allowances = HE * P * EE * C (HE) = average individual historic emissions; (P) = adjusted for sector production growth 2003-2006; (EE) = relative energy-efficiency; C = allocation factor (that is 0.97 for all installations to keep the emissions within the set cap). Energy efficiency is an important issue in the allocation methodology and it is based on the installations participations in either Benchmarking Covenant or the Long-term Agreement [IVL 2004].
Sweden	Allocated allowances = average emissions 1998-2001 Exceptions are that the energy sector will receive 80% of past emissions (except for CHP which receives 100%) and installations with process related emissions will receive allowances according to projected increased emissions 2005-2007 [IVL 2004].

In *Table 10* the allocation methodologies and the use of flexible mechanisms can be seen.

Table 10: Allocation methodologies and the use of flexible mechanisms

Country	Kyoto target (% of base year)	Change base year	Allocation methodology	Early action	Growth factor	JI/CDM reach Kyoto targets
Belgium - Walloon region	-7.5%	No	BM-agreement	No	Yes, factory level	1,1 Mt/yr 05-07[6]
Denmark	-21%	No[7]	Hist	No	No	3,7 Mt/yr to be bought in 2008-12
Germany	-21%	No	Hist	Yes	No	No
Netherlands	-6%	No	Hist/ benchmarking	Yes	Yes, sector level	20 Mt/yr will be purchased, 15.4 Mt/yr contracted, budget set aside for remaining.
Sweden	4%	No[8]	Hist	No	No	No.[9]

In spite of the 15 % reduction compared to the BAU prognosis and the planned use of credits from project-based mechanisms **Denmark** is not in line with the fulfillment of the Kyoto commitment. [IVL 2004] Denmark either has to make further reductions in 2008-2012 or invest in more JI/CDM projects.

Germany is well on its way to reach the Kyoto target, included the reduction from the trading sector (0.2 %) and the non-trading sector (0.6 %). It leaves a 2 % reduction in the Kyoto commitment period. **Sweden's** allocation is generous, and this can be explained by the fact that the emissions today are below the Kyoto commitment. To be able to reach the national target of -4 %, Sweden needs to further reduce emissions by 2.2 Mt CO_2e for 2008-2012 [IVL 2004].

The **Netherlands's** emissions in 2000 were 9 % less than the Kyoto commitment, but compliance will be achieved through the use of JI/CER credits (20 MtCO_2/year). [IVL 2004] The **Walloon region** estimates excess emissions of 1.1 Mt CO_2e per year in 2008-2012 but that this will be covered by JI and CDM [Ecofys UK 2004].

[6] Federal level: 2,46 Mt/yr 08-12

[7] If the emissions in 2002 are higher than the mean value of 98-02; emissions from 2002 will be applied.

[8] In case of an exceptional event, at least 10% lower emissions than the "normal" years, the installation receives allowances based on the "normal" year.

[9] Sweden is though engaged in CDM and JI projects and there are today political discussions about including these credits in the national target [Sahlin, 12 May 2005].

Table 11: The allocation compared to the emissions in the base year and BAU

	Total allocation compared to emissions in base year (%)[10]	**Allocation to existing installations compared to emissions in base year (%)[11]**	**Cap relative to projected BAU (%)[12]**
Belgium – Walloon region	+5,3	+4	+4,2
Denmark	+5	0	-15
Germany	-0,4	-1	0
Netherlands	+9	+5	+3
Sweden	+14	+5	Not provided

Conclusively the allocation methods are similar in many ways: allocation of allowances free of charge instead of auctioning, reserve for new entrants and allocation in proportion to historical emissions [STEM 2005:2]. But the allocation methods differ in other aspects as the use of JI/CDM credits, crediting of early action and consideration to production growth. Lars Hydén says that a harmonization of the method of allocation is desired by all member states [Hydén, 9 March 2005]. If the methods were harmonized the reduction factors would though still differ between the countries depending on different distance to the Kyoto commitment and the use of JI and CDM.

[10] STEM 2005:2
[11] STEM 2005:2
[12] Ecofys 2004

3.4 Future trading periods

The first trading period is a test period so the scheme will most probably develop over the years. Though there is a genuine uncertainty of how it will develop. An issue which is most important for the Akzo Nobel group is when or if the chemical industry will be included in the scheme. In the early discussions of the trading scheme an inclusion of the chemical sector was considered. But since it represents less than 1 % of the overall emissions and the number of installations are very large, approximately 34 000, the sector was not included. The inclusion of waste treatment installations was not considered to be appropriate since it is complicated to measure the carbon content of combusted wastes [Zetterberg, L., 2002].

3.4.1 The distance to the Kyoto-commitments and post-2012 talks

According to the European Environment Agency only four countries of the EU-15 are on track to meet their commitments by the burden chairing agreement: France, Germany, Sweden and the UK. However initiatives like EU ETS and investments in CDM and JI projects can lead to an achievement of the commitments [http://org.eea.eu.int, 1 April 2005]. The ten countries that joined the EU on 1 May have their own targets of 6 or 8 % under the Kyoto Protocol, except for Cyprus. The emissions of most of these countries are far below their target, since their economies have been restructured [http://europa.eu.int/, 2 April 2004].

The Kyoto protocol first commitments period is the first step that only results in a marginal effect on the climate change. The discussions on the future international work will start in 2005 in the so-called Post-2012 talks [Naturvårdsverket 2004:2]. The European Union and individual countries have already established long-range goals though.

The European Council established in 1996 a long-range goal of a maximum increase in the temperature of 2 °C [Naturvårdsverket 2004:2]. The European Commission outlined core elements for post-2012 strategy in February 2005 [http://www.europa.eu.int, 4 April 2005]. The European council announced that it will consider “medium and long term emission reduction strategies, including targets” in spring 2005 [http://europa.eu.int/, 5 May 2005].

Sweden’s long-range goal is to stabilize the concentration of greenhouse gases at 550 ppm CO_2e (450 ppm CO_2). In 2050 the emissions per capita shall be lower than 4.5 ton CO_2e per capita. The target of 550 ppm is thought to be in correlation the goal to avoid a temperature increase of 2 °C [Naturvårdsverket 2004:2]. Germany’ target is to decrease the emissions with 40 % between 1990 and 2020 if the emission from EU will be reduced with 30% at the same time, and Great Britain will act for a decrease of the industrialized countries with 60 % to 2050 [Naturvårdsverket 2004].

The future emission reductions needed to reach set goals is depending on many factors, but estimations show that if the emissions shall stabilize at 550 ppm greenhouse gases (450 ppm CO_2) and the same emission per capita shall be reached in 2050, the emission

reductions needed in the industrialized countries have to be approximately 80 % and 65 % in Sweden [Naturvårdsverket 2004:2].

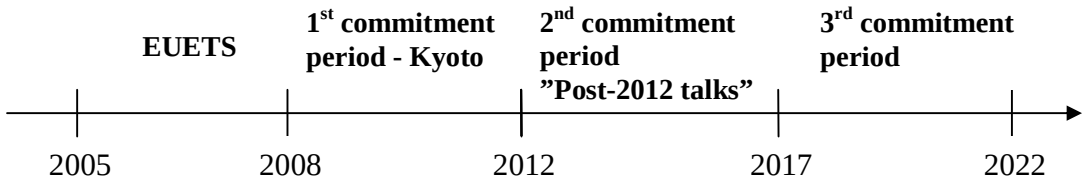


Figure 11: Time scale of the emissions trading

To be able to achieve a worldwide reduction of the greenhouse gases the international participation in the combat towards climate change has to be extended according to European Council [Commission Communication Climate Change, 2005]. Today the USA has not raticified the Kyoto Protocol and large emitting developing countries have no binding targets. Also the EUETS can be widened to include other countries by linking it to other greenhouse gas trading schemes of countries that are listed in Annex B in the Kyoto protocol.

3.4.2 Future amendments of the trading scheme

The European Commission will review the trading directive after the period 2005-2007 and this will result in a report that shall be submitted to the European Parliament and the Council by 30 June 2006. In the report the issues of inclusion of additional sectors and/or greenhouse gases and a further harmonization of the allocation methods will be considered *(the whole list of the issues can be seen in Annex 8)*.

By the Trading directive each member state can broaden the trading scheme to include additional activities, installations and greenhouse gases from 2008 after an approving by the Commission [Trading directive Article 24]. If Sweden wants a one-sided inclusion this must be decided before the NAP is presented to the Commission 30 June 2006. Conclusively, there are two possibilities for the inclusion of other sectors and greenhouse gases in 2008: one-sided inclusion in Sweden or a harmonized inclusion in EU.

In 2001 a delegation with parliamentary composition, the FlexMex 2 delegation, was summoned by the Swedish government to prepare a suggestion for a Swedish system and regulations for the flexible mechanisms in the Kyoto Protocol. One of the purposes with the investigation’s final report was to discuss possible needs of changes of the scheme to the trading period 2008-2012 [SOU 2005:10, 2005]. This final report is the first step in Sweden’s work to plan for trading period 2008-2012. It will be one of the basis information to the Government bill that will be taken into force 1 January 2006 concerning among other things the allocation method [Asplind, 7 Feb 2005].

Conclusively the delegation doesn’t recommend that Sweden should make any changes of the trading system unilaterally, but that we should work for a harmonized change of the Trading directive.

- The delegation recommends an inclusion of transportation, but it does not think that this will be possible until 2013.
- Since the calculations of the emissions from other greenhouse gases are today associated with big uncertainties the delegation doesn't recommend an inclusion of other greenhouse gases. The delegation advocates an inclusion of the aluminum sector which emits perfluorocarbons, since aluminum can be a substitute for steel products.
- The delegation recommends the government to act for a change in the trading directive so that 10 percent of the allowances must be sold on the market or auctioned in the trading period 2008-2012. The delegation advocates that the revenues from other allocation methods should be used to reduce taxes that distort competition.[13]
- Both the Swedish government, institution and the delegation are positive to benchmarking, since it can allow installations which have lower emissions than the average per produced unit to get compensation in free allocated allowances. Benchmarking can however just be used for products that are comparable between different installations, like the steel industry, electricity and heat in the energy sector, pulp and paper industry and oil refineries. The delegation recommends the government to act for a compulsory allocation of allowances based on international benchmarks for appropriate sectors.

3.4.3 Interviews

Today important issues for the next trading period are not yet decided. Two interviews have been held with two persons that have worked and are working in the European Union concerning emissions trading.

3.4.3.1 Interview with Lars Hydén

Lars Hydén took part in the evaluation of the National allocation plans in the European Commission. For the time being he is working in the Supreme Court of Environmental law. The interview was held on the 11 April 2005.

Will more installations be included in 2008?

Even for the present trading period the countries had a possibility to include additional installations[14] and to exclude installations from the trading scheme[15]. But in the first phase the countries were a bit drowsy and did not know which installations they had within the country.

[13] When the allowances were allocated in 2005 the delegation recommended an uncomplicated allocation method by practical reason. This decision was taken as the implementation was on a tight schedule so all the allowances were allocated free of charge.

[14] Installations that carry out activities listed in Annex 1 below the given capacity limits could be included, so called opt-in.

[15] Certain installations can be temporary excluded until 31 December 2007 by Article 27 in the Trading directive.

Lars Hydén questions if the Trading directive will be changed to lower the capacity limits or include more installations already in 2008. The NAPs must be notified to the Commission by 1 July 2006, so if the member countries want a change of the directive the time frame is terribly tight. The process is long, so Lars doubts that it is possible even if the EU would wish for a change.

Will the allocation of allowances be restricted?
If the countries are serious about achieving their Kyoto commitments under the burden sharing agreement the allocation will be more restricted. Especially if the countries realize that the efforts to reduce traffic and emissions from the non-trading sector have not been effective when the compliance period is getting closer. Lars Hydén emphasizes that it is important to understand that the EU Commission cannot force the member states to make stricter allocations.

Will other greenhouse gases be included?
Lars Hydén says that this is not his area but he assumes that the EU will concentrate on enlarging the trading of carbon dioxide to include for example air traffic, instead of including other greenhouse gases.

3.4.3.2 Interview with Madeleine Infeldt
Madeleine Infeldt is working at the Climate change unit DG (Directorates-General) Environment within the European Commission. At the moment its work mostly concerns the review of the emissions trading Directive, Post-2012 issues and renewable energy sources. An interview with Madeleine Infeldt was held on 29 April 2005 to know about her personal opinion about how the scheme will develop.

Which amendments of the scheme are mostly discussed at the moment?
Any amendments discussed today are not feasible until 2013 as harmonized solution within the EU. This is because amendments would be decided through the co-decision procedure, which takes too long for proposals to be adopted before 2008. The two sectors mostly considered for an inclusion are the chemical sector and aviation. Before the establishment of the Trading scheme there were discussions about an inclusion of the chemical sector. The sector however claimed early action credits for previous reductions of other greenhouse gases than CO_2, since the extent of these reductions were large. There were concerns that this would have led to a generous allocation with easy earned allowances.

Being a heterogeneous sector there is a possibility to include some parts of the chemical sector. The relationship between emissions from combustion that are already included in the trading scheme and the emissions from processes will be investigated. An inclusion of a sector is not motivated if the emissions from combustion dominate, since the combustion emissions are already included with the current scope. Investigations are trying to create an image of the sectors that are not included. One of the factors that are important is if the sector produces a replaceable product for a product produced by a company within the trading sector. An inclusion of such a sector could reduce distorted competition.

Madeleine Infeldt says that an inclusion of other greenhouse gases is still being analyzed. Madeleine Infeldt believes that if the scheme will be extended they will not lower the threshold values for the trading sectors already included.

Allocation

Madeleine Infeldt says that the member states show an interest in the possibility to auction emission allowances. The allocation of allowances for trading period 2005-2007 required a lot of work, so auctioning seems like a smart allocation method, where the companies can buy what they need. There are some issues that need to be decided, for instance how big share will be auctioned, and if only one sector or all sectors will be issued through auctioning. Recycling schemes are considered, so that the money will be brought back to the companies in some form.

Many countries have been interested in the use of benchmarking, but they soon recognized that this is hard. It is difficult to set a fair benchmarking value and decide which sectors are suitable for benchmarking. If a harmonized benchmarking allocation system will be implemented you also have to decide a factor to adjust for the country's distance to the Kyoto target.

4. DISCUSSION & CONCLUSIONS

4.1 Up to now

Except for the study of the possible effects of the emissions trading there have been little preparations at the site in Stenungsund. This is understandable since the implementation of the regulations into Swedish law has been rapid and there has been a lack of regulatory certainty. The company has succeeded to send the applications needed to fulfill the obligations given by law.

4.2 Future obligations

To trade with emission allowances between companies within the EU is something new for the site, but it can be based on the companies working procedures. The site is well aware of their energy consumption and has actively worked with energy integration. Even though the regulations in the trading scheme set conditions on the accuracy of the monitoring, the site has monitored the emissions in more than 10 years.

Conclusively the added obligations concerning emissions trading are recommended to be implemented in the regular routines as soon as possible to create an understanding for the issue. There is always a risk that new additional issues as emissions trading becomes less prioritized since it is added to the staff's regular work.

4.3 The financial effect of the emissions trading on site Stenungsund

To estimate the overall financial impact that the emissions trading scheme will have on the site both estimated costs for the emission allowances, indirect costs of increased electricity and energy prices and increased administrative costs have to be considered. This thesis project forecasts the estimated cost for allowances based on forecast of emissions.

4.3.1 The financial effect of emissions trading period 2005-2007

The financial effect of emissions trading on Akzo Nobel site Stenungsund in 2005-2007 has been analyzed in two scenarios described in *Table 12* by comparing forecasted emissions with issued allowances. In scenario **"Fuel mix: as in 2004"** the factories steam consumption per produced product and the fuel mix is based on actual figures in 2004. In scenario **"Fuel: oil**" the factories steam consumption per produced ton product is based on actual figures in 2004 but the fuel used is oil.

Table 12: Description of the different scenarios of the financial effects of trading with emission allowances in trading period 2005-2007

	Fuel mix: as in 2004	**Fuel: oil**
Factories energy consumption	Based on actual figures in 2004	Based on actual figures in 2004
Fuel mix	As in 2004 (1500 ton oil rest burn gas)	Oil from the cracker

As seen in *Figure 12* Akzo Nobel site Stenungsund will have a surplus of emission allowances thanks to energy integrated actions and the new waste incinerator that generates steam. The financial outcome if the fuel base is oil instead of a mostly gas as in 2004 is less favorable.

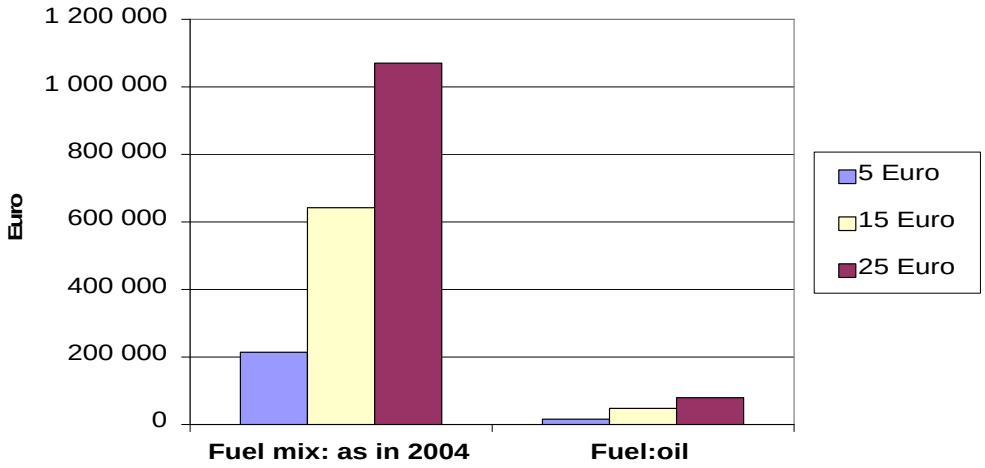


Figure 12: Financial effects of trading with emission allowances for three possible prices of the allowances in 2005-2007

The scenarios are based on a forecasted production, so the real outcome depends on the future production. The factories' steam consumption was based on actual steam consumption figures in 2004. According to Martin Hanson [4 May 2005] energy integrating actions are planned for 2006 and further on, so the company has the possibility to change their position. The fact that the factories become more energy effective with a larger production is not accounted for in any of the scenarios since the extent is hard to predict.

In the scenarios the emission factor and net caloric value used are the same as in 2004. Starting in 2005 these factors will be measured. If the mean value of the measured factors in January-March is used in the calculations the emissions will be approximately 1600 ton more during this period. Since the factors have fluctuated during the first three months due to variations of the gas fuel's contents the factors used in 2004 were used in the scenarios.

Consequently the actual financial outcome of the first trading period is dependant on many issues as discussed above, but the company will most probably have excess EUA to sell due to former energy efficiency actions.

4.3.2 The financial effect of emissions trading period 2008-2012

Many important issues as allocation method (allocation free of charge/auctioning, allocation based on historical emissions/benchmarking etc.) and reduction factors are not yet determined for the trading period 2008-2012. The forecast of the production becomes also more uncertain with an increased distance in time. Therefore the differences between the scenarios described in *Table 13* will be evaluated based on two different production forecasts: one where the production will be the same as projected in 2007 and the other where the production is approaching a full production in 2010.

In scenario **"Allocation as in 05-07"** the site is issued emission allowances by the same method as in 2005-2007. Though this scenario will only come into question if the site is considered to be a new participant when the site is extended to approach a full production by the environmental permit. Mikael Möller [20 April 2005] at Swedish Plastic and Chemicals Federation doubts that an increase in production within an environmental permit will be considered as a new installation. In the other scenarios the allocation is based on past emissions with different reduction factors.

In all the scenarios the CO_2 emissions from the processes and the waste incinerator are not included, base year is 1998-2001 and the allowances is allocated free of charge. The fuel base is burn gas, but if oil would be used as fuel instead the emissions would be approximately 37 % higher. The factories' steam consumption was based on actual steam consumption figures in 2004.

Table 13: Description of the different scenarios of the financial effects of trading with emission allowances in trading period 2008-2012

	Allocation as in 05-07 (only if the site is extended)	**Grandfathering 100 %**	**Grandfathering 90 %**	**Grandfathering 80 %**
Allocation	100 % of the mean value of past emission in the base year, and new entrant allocation 83 ton/GWh per increased production	100 % of the mean value of past emission in the base year	90 % of the mean value of past emission in the base year	80 % of the mean value of past emission in the base year
Allocation free of charge /auctioning	Allocation free of charge	Allocation free of charge	Allocation free of charge	Allocation free of charge
Base year	1998-2001	1998-2001	1998-2001	1998-2001
Included installations	Same as in 05-07	Same as in 05-07	Same as in 05-07	Same as in 05-07
Factories energy consumption	Based on actual figures in 2004	Based on actual figures in 2004	Based on actual figures in 2004	Based on actual figures in 2004
Fuel mix	Gas	Gas	Gas	Gas
EUA	5/15/25 €	5/15/25 €	5/15/25 €	5/15/25 €

The financial effect if the production will be as projected in 2007 can be seen in *Figure 13*. If the company receives 100 % of the past emissions Akzo Nobel site Stenungsund will have a surplus of EUA in trading period 2008-12 thanks to energy integrating actions and the new waste incinerator that produces steam. Another factor is that the fuel used in the base years was mostly oil. Akzo Nobel site Stenungsund will need to buy EUA to cover the emissions in the grandfathering scenarios with reduction factors of 0.8 respectively 0.9. This is if the factory will consume the same amount of steam per product.

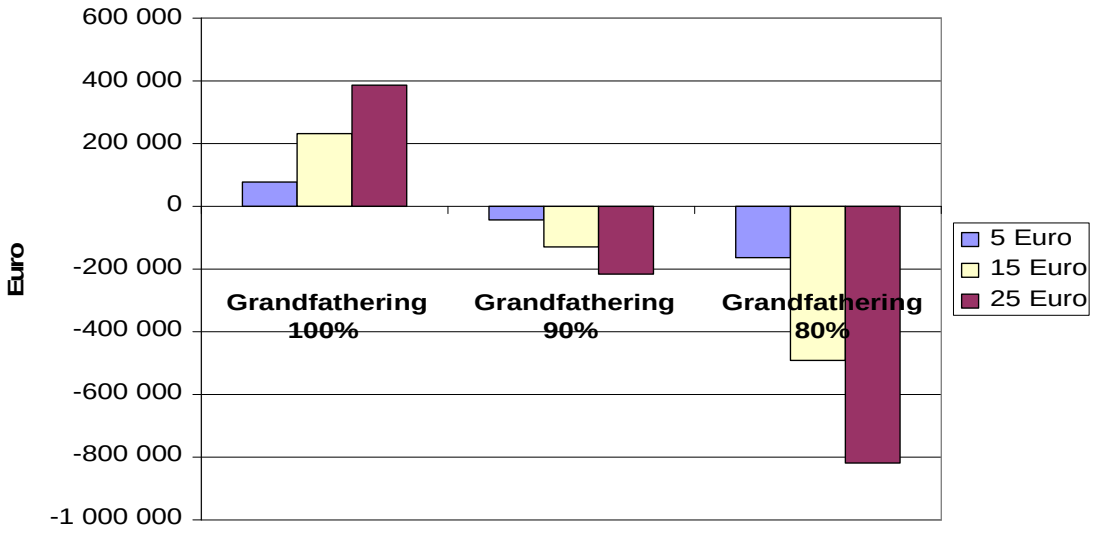


Figure 13: Financial effects of trading with emission allowances if the production is the same as forecasted in 2007 for three possible prices of the allowances in 2008-2012

If the production will be increased approaching a full production in 2010 the situation for the site is different, as can be seen in *Figure 14*. If Akzo Nobel site Stenungsund is considered to be a new entrant also in the trading period 2008-2012 the site will have excess allowances, but in the grandfathering scenarios the company will have a deficit.

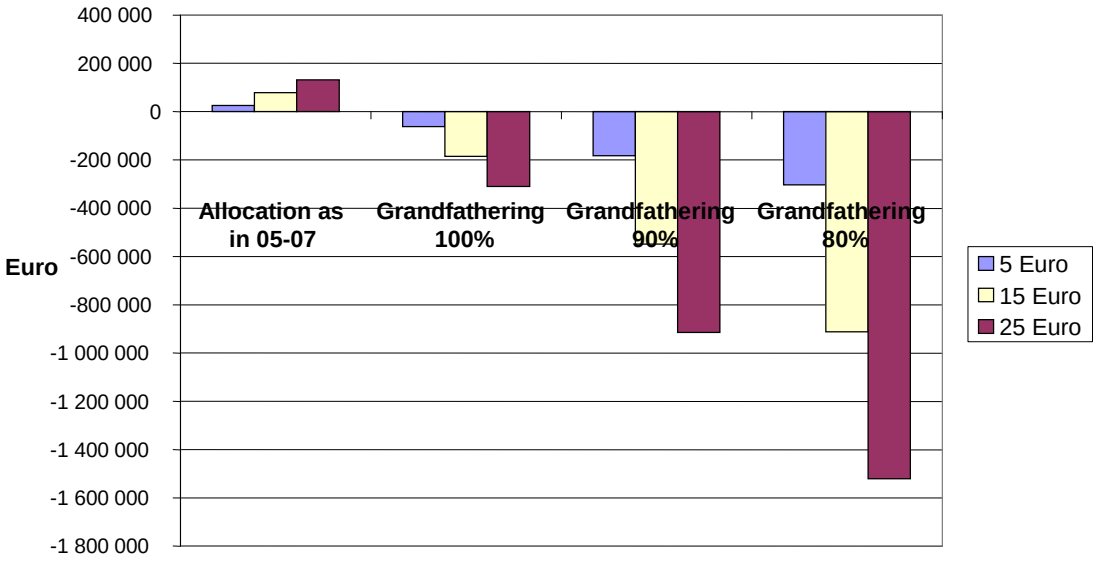


Figure 14: Financial effects of trading with emission allowances if the production is approaching a full production in 2010 for three possible prices of the allowances in 2008-2012

The scenarios are based on a forecasted production, so the real outcome depends on the future production. The factories' steam consumption were based on actual steam consumption figures in 2004, but energy integrated actions can change the situation considerably. Martin Hanson [4 May 2005] suggested a possible energy integrating action at the site. Consider a grandfathering scenario with a reduction factor of 0.9. If this energy integration action is included Akzo Nobel site Stenungsund will have excess allowances corresponding to a value of 380 000 € with a production as forecasted in 2007 and 42 000 € with a production approaching a full production in 2010 considering a price of 15 €/EUA. The fact that the factories become more energy effective with a larger production is not accounted for in any of the scenarios since the extent is hard to predict.

If the emissions from the ethylene oxide processes will be included in the scheme the financial outcome depends on how these emissions will be treated. In trading period 2005-2007 installations with process related emissions received an addition of allowances corresponding to the expected production increase, since the emissions are in direct correlation with the production. Consider a grandfathering scenario with a reduction factor of 0.9, if the production is increased to approach a full production in 2010. If the process related emissions is included and there is no exception for these emissions, Akzo Nobel site Stenungsund will have a deficit corresponding to a value of 3,3 million € (15 €/EUA). In this scenario the transferred CO_2 to AGA is not included in the site's emissions in accordance with the regulations today concerning transferred emissions.

Another important issue is that the ethylene process generates steam. The competing reaction that generates CO_2 is more exothermic. With a more effective catalyst the process will generate less CO_2, but also less steam which the furnaces have to compensate for. Even though this leads to a decrease in total emissions from the site (the boilers generate less CO_2 per energy produced) this will give excess emissions under the trading scheme as long as the emissions from the processes are not included.

If the allowances are auctioned instead of allocated free of charge the costs for Akzo Nobel can increase considerably. But by the Trading directive today only 10 % can be auctioned in trading period 2008-2012. [Trading directive Article 10]

Conclusively there are many factors concerning the site and regulatory issues that have an influence on the financial outcome of trading period 2008-2012. By working with scenarios the site can foresee the possible financial effect.

4.4 Coordination within Akzo Nobel

There are no corporate approach concerning emissions trading within Akzo Nobel. Akzo Nobel Energy has though a coordinating responsibility concerning emissions trading and advice the site's included when questions are raised. Akzo Nobel is aiming on further coordination in the future, says Gert van Ingen [30 June 2005].

The Corporate Social Responsibility Council within Akzo Nobel is working with a Climate Strategy with policies and targets concerning energy efficiency and greenhouse

gases. The sites have annually reported energy consumption to a central level. Beginning in 2004 the reporting will also include direct fuel based CO_2 emissions from processes [Feenstra, 18 April 2005].

Borealis, a leading producer of plastic products, operates in several countries within Europe and has some 4 500 employees. In 2004 the sales revenues summed up to 4 600 million €. The company's annual emissions of CO_2 included 700 000 ton. Borealis started to work with the issue on a central level in 2003 and have set up three issue groups concerning the progress of legislation; data management to develop a system for a harmonized treatment of data, calculations and reporting; and a group investigating abatement actions. On a central level one person is responsible for all the administrative work concerning the Borealis's accounts in the registries. The persons responsible for purchase of raw material will trade with allowances for all the sites [Andersson, 21 April 2005].

Stora Enso is a producer of publication and fine papers, packaging board and wood products. The group has 45 000 employees in more than 40 countries and in 2004 the sales revenues were 12.4 billion €. In the first trading period Stora Enso was issued a total amount of 6.7 million allowances each year. Being a large company in an energy intense industry, Stora Enso has followed the development of emissions trading since the writing of the Kyoto Protocol. The mills will report the emissions to a central level where the trading for the whole group will be handled. Examples of coordination actions within Stora Enso are calculation tool for estimating the costs of emissions trading, analysis of how the emissions trading will influence the electricity price and CDM projects [Bresky, 21 April 2005].

The writer's opinion is that some issues concerning emissions trading are more suitable to handle at a central level to use the company's resources in an efficient way. There has been no coordination concerning issues as monitoring, reporting and data management within Akzo Nobel. It is recommended to keep updated with the political development of the emissions trading scheme and future reduction targets. By following the development at a corporate level the company can adjust to future reduction costs, higher electricity and fuel prices, and have a chance to influence the political decisions. It is also advised to examine the possible financial consequences of an inclusion of the chemical sector.

4.5 Flexible mechanisms CDM and JI

This thesis project has only looked into the possibility of project-based mechanism to a small extent, with the purpose to inform the company about the option and its potential. The possibility for CDM and JI projects within Akzo Nobel on corporate level has not yet been investigated, but Hans Feenstra [8 April 2005] says that the issue will be looked into in a near future.

There are three main possibilities for a company to benefit from JI and CDM projects according to Christian Sommer [9 March 2005]:

1. Invest in funds
2. Sell your products, i.e. new technology which is more climate-friendly
3. Invest in factories within the company in developing countries

Akzo Nobel Functional Chemical's Mono Chloro Acetic Acid (MCA) factory in Taixing China has been contacted to constitute as an example of a possible CDM project within Akzo Nobel. The MCA-factory in Taixing is a modern factory that is built with the latest technology, but even though the energy consumption figures look good they are working on improvements, says Linhua Yang [21 April 2005]. At the site a project that aims to reduce the steam consumption is in process today.

Power is bought from the power grid with the fuel base of about 80 % coal, 15 % hydro power and 3 % nuclear power. Steam is bought from a neighbor plant that is fueled with coal [Yang, 30 April 2005]. Linhua Yang [21 April 2005] thinks that the possibility to get investments from a CDM is interesting and that the factory aims to become more environmental friendly. According to some analysts China is expected to stand for around 50 % of the reduction potential for the cost-effective CDM-project [STEM 2005].

Akzo Nobel can decrease compliance costs of possible future stricter allocation by investing in funds or proceed with projects within the company. The credits can constitute as finance to projects within Akzo Nobel, but the projects have to give reductions above and beyond "business as usual". Projects can also be seen as a step in the company's corporate social responsibility approach. An advantage with the CERs and ERUs is that they are valid in the whole "Kyoto world" and can be saved between the first two trading periods in contrast to EUAs. The use of credits from the project-based mechanisms will though probably be limited in 2008 by a cap set in the NAP by the member state [STEM 2005].

A limiting factor for CDM and JI projects up to now has been long starting times, and high initial transaction costs [STEM 2005]. But both these costs can be decreased by realizing a project within the company. Though there are always risks associated with project-based mechanisms, as the risk that the project will not work as planned or will be approved. The average transactions of reductions for projects are large, approximately 2 million tCO_2e in 2003-2004. The reason for this is according to Franck Lecocq [2004] that large scale projects generally have lower costs per CO_2e reductions.

There is an absent clarification of the validity of project-based emission reductions beyond 2012. According to Franck Lecocq [2004] the opportunity to initiate project-based transactions is short given the long time, 3-7 years, between the preparations and the first issuing of credits. Projects have to become operational by 2006 or 2007 to allow the credits to become a meaningful contribution to project finance before 2012 [Lecocq, 2004].

4.6 Future emissions trading periods

There is a genuine uncertainty concerning the future development of the trading scheme. Being a political instrument the future development of the emissions trading is due to the political progress in the EU and the rest of the world.

The possibility to reach a harmonized agreement within the EU for changes of the Trading directive until trading period 2008-2012 is very limited, and the Swedish FlexMex2 delegation does not recommend a unilateral addition of sectors or greenhouse gases. Therefore, it is highly unlikely that the chemical sector or consequently the production related emissions at site Stenungsund will be included in 2008. However, the chemical sector is one of the sectors mostly discussed within the EU for an inclusion in 2013, according to Madeleine Infeldt [11 April 2005].

If an inclusion of the emissions from the Chemical sector is good or bad for Akzo Nobel financially is hard to predict. To be able to understand the effect of being included versus excluded in trading period 2008-2012 three essential questions need to be answered:

1. **Which will be the future cap on Sweden's emissions?** Will the national target for 2008-2012 be -4 % of the base year or will it be even lower? Will Sweden use sinks or flexible mechanisms to reach the national target?
2. **Will the tax on CO_2-emissions be removed from the trading sector?**[16]
3. **How will the cap be divided between the trading and the non-trading sector?** If the allocation to the trading sector is generous the reductions must be made in the non-trading sector, which could make it disadvantageous to be excluded from the trading scheme.

The non-trading sector will also be influenced by the future reduction targets through for example increased CO_2 taxes, transportation costs and energy prices.

In 2005-2007 the allowances were allocated free of charge based on past emissions. There are big uncertainties concerning the allocation method for 2008-2012. Both the Swedish government, institution and the FlexMex 2 delegation are positive to benchmarking [SOU 2005:10, 2005]. In 2005-2007 the benchmark used to issue allowances for the future production at the site was 83 ton CO_2/GWh compared to 200 ton CO_2/GWh the actual figure for the site. A benchmark based on emissions per energy production does not promote energy efficiency actions that lower the energy consumption per ton product. Therefore a fair benchmark must be based on CO_2 emissions per ton product and it is highly unlikely that this will be developed to trading period 2008-2012.

There is an increased interest for the option to auction the allowances. No time-consuming allocation method has to be developed and the participants buy what they need. This could of course increase the financial effect of emissions trading. By the Trading directive today only 10 % of the allowances can be auctioned in 2008 [Trading directive Article 10].

[16] If the CO_2 tax will be taken away from the trading sector is being discussed at the moment. According to Jan Karlsson [1 April 2005] this will probably be appointed in the budget proposal in October/November.

Sweden is well on the way to reaching the Kyoto commitment, but to be able to reach the national target of -4 % further reductions of about 2.2 Mt CO_2e must be achieved. [IVL 2004] This is if Sweden chooses not to use flexible mechanisms or sinks[17] to reach the national target.[18] In the Government bill concerning climate that is due autumn 2005 these issues will be decided [Karlsson, 1 April 2004]. The Swedish Environmental party requires a larger reduction in 2008-2012 of at least 10 % in order to take a bigger step to avoid climate change. The party criticizes the Government for adopting a national target that can be reached with already carried through actions. So the political development in Sweden can influence the cap in 2008-2012 [http://www.mp.se/ 5 May 2005].

The lack of regulatory certainty concerning emissions trading is a weakness of the scheme. A clear approach would increase the incentives for companies to plan long-range strategies to decrease their emissions. The political statements today, within the EU and some individual countries, indicate that the greenhouse gas emissions have to be reduced considerably in the future. To reach the EU's goal of a maximum increase in temperature of 2°C with the same emissions per capita, the emission have to be reduced with 80 % in the industrialized countries and with 65 % in Sweden according to calculations by Swedish EPA [Naturvårdsverket 2004:2].

[17] Besides the flexible mechanisms the countries can also use so called sinks to achieve their targets. The sink provides for an increase in the uptake of greenhouse gases from the atmosphere through land use, land-use change and forestry (LULUCF) [http://unfccc.int, 5 April 2005].

[18] Sweden's existing CDM and JI projects will generate reductions of about 0.9 million tons/year during 2008-2012 [Naturvårdsverket 2004]. Sweden can emit additional 2.13 million ton CO_2e for growing forests and forest land [Swedish NAP 2004].

4.7 SWOT analysis

To sum up Akzo Nobel site Stenungsund's conditions to handle the challenges of emissions trading have been evaluated in a SWOT analysis. The company's Strengths and Weaknesses, and the external Opportunities and Threats of emissions trading were examined leading to possible strategies.

		INTERNAL	
		Strengths • Successfully worked with energy integration • Monitored CO_2 emission in more than 10 years	**Weaknesses** • Staff need to learn more about the emissions trading • No coordination within Akzo Nobel
EXTERNAL	**Opportunities** • Sell excess EUA • CDM/JI	**SO Alternatives** • Excess EUA increases the incentives for energy integrating actions	**WO Alternatives** • Implement routines and increase knowledge about the emissions trading
	Threats • Authorities not familiar with the trading system • Large costs if the production is increased • Inclusion of additional sectors	**ST Alternatives** • Continue working with energy integrating actions	**WT Alternatives** • Learn more about the development of the scheme • Coordination within Akzo Nobel if more sites are included

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Annexes

Annex 1. Quantitative and qualitative limits on CDM and JI projects

The Linking directive sets quantitative and qualitative limits for the companies' use of CERs and ERUs. Credits from CDM can be used during the first trading period 2005-2007, in contrast to the credits from JI that can't be used until 2008. [Linking directive Article 11a] Assigned amount units under the Kyoto protocol (AAUs) can not be used by the installation in the EU ETS by the linking directive [STEM 2005].

Quantitative limits:
During the first trading period there is no cap on how much CERs a company can use to cover their emissions in the end of a trading year. The following trading periods the operators will only be allowed to use CER and ERU up to a certain percentage of the issued allowances to each installation. The actual percentage will be decided by each Member State in the NAP [Linking Directive 11 a (1)]. Before the proposal for the Trading directive was adopted by the Commission there were proposals of a cap on 6% [STEM 2005].

Qualitative limits:
In accordance with the convention and the Kyoto Protocol CDM and JI projects involving nuclear power plants will not be allowed during the first trading periods (2005-2012). CERs and ERUs from projects creating sinks through land-use, land-use change and forestry activities will not be accepted in the EU ETS from 2005. [Linking directive 11a (3)] These activities are though likely to be included in 2008 [STEM 2005].

To approve hydroelectric power projects exceeding a production capacity of 20 MW international criteria and guidelines must be respected [Linking directive 11a (3b)].

The JI and CDM projects can be carried through within the EU, but to avoid double counting the Linking directive establish some restricting rules. Projects that directly decreases emissions from an installations covered by the trading scheme will be given credits if the same amount of EUA is cancelled by the operator of the installation. If a project indirectly decreases the emissions from an installation covered by the scheme the same amount of EUA will be cancelled in the national register in the host country [Linking directive 11 b].

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Annex 2. Closer look at the CDM and JI projects

CDM and JI projects can reduce one of the six greenhouse gases under the Kyoto Protocol. Fuel switching, renewable energy technology, more energy efficient technology, methane recovery and waste incinerators are examples of projects that can be implemented [Rosales, J.; Provone, G; 2003]. CERs and ERUs from projects creating sinks through land-use, land-use change and forestry activities will not be accepted in the EU ETS from 2005 even if they are approved under the Kyoto Protocol [Linking directive 11a (3b)].

Regulations

By the Marrakech Accords projects that began before November 2001 can be validated and be registered as CDM projects before 31 December 2005 [UNDP 2003]. This prompt start made it possible to start forming the institutions under the UN Climate Convention that will administrate the projects and the detailed rules. This has been a long process though. In September 2004 the first project was given in for registration. Before the CERs can be issued, a registry for CERs has to be in operation [STEM 2005].

The corresponding detailed rules for JI and the appointment of a supervisory committee for JI did not start until the Kyoto Protocol came into force. Although the credits from JI can't be used until 2008, sales contracts have been established between project owners in the host countries and the buyers in investing countries for several JI projects [STEM 2005].

The project cycle for CDM-projects

A CDM project can only take place in non-Annex I countries that have ratified the Kyoto Protocol. Jon Rosales and Gao Provone (2003) summed up the following important characteristics of a CDM project. The project must:

- Be voluntary and have an approval from the host country;
- Meet the sustainable development goals defined by the host country;
- Give a reduction of emissions above and beyond "business as usual";
- Account for emissions that occur outside the project boundary that are given by the project;
- Include participation of stakeholders;
- Not contribute to environmental decline;
- Not divert from official development assistance (ODA) (i.e. the CDM ca not come from existing investment activities); and
- Have strict physical boundaries within which the emissions will be reduced or sequestered.

The project cycle can be divided into four steps project design, validation and registration, monitoring, verification and certification and issuance of credits.

When you have decided to proceed with a possible CDM project the project's design has to be developed. The Project design document is a key document in the process, where

the baseline methodology, monitoring methodology and monitoring plan are given [UNFCCC, Executive Board, 2004]. An emission baseline can be "continuing purchasing electricity from a public grid that is fossil fuel intensive". The difference between the baseline emissions in the scenario and project emissions will be the emission reductions given by the project [UNDP 2003].

The participants can choose to use a baseline and a monitoring methodology that have already been approved by the Executive Board[19]. The possibility to use already approved methodologies simplifies the project cycle and therefore lowers the costs [http://cdm.unfccc.int/, 5 April 2005].

The designed document will be presented to the Designated Operational Entity (DOE)[20] for validation. The relevant document (the project design document and the letter of the approval from the host country) for the suggested CDM will be evaluated. When the DOE has validated the project it passes the validation report to the Executive Board for registration which is the formal acceptance of the project [UNDP 2003].

Verification is the periodic review and the determination by the DOE that emission reductions have occurred. Certification is the written assurance that the project has generated emission reductions [http://cdm.unfccc.int/, 5 April 2005]. The certification report includes a request to the Executive Board to issue the amount of CERs achieved by the project. [Rosales, J.; Provone, G; 2003] A crediting period that can be renewable at the most 2 times can be 7 years. If the project participants choose to have a fixed crediting period the period are at the most 10 years [UNFCCC, Executive Board, 2004].

There is also a possibility to do a small scale CDM project which can have simplified baseline determination and monitoring plans [http://cdm.unfccc.int/, 6 April 2005].

The market

The demand of CDM projects are influenced by the rules for CDM, transactions costs of the projects, and the marginal costs of hosts' and investors' emission reductions. [Rosales, J.; Provone, G; 2003] The largest buyers of emission reductions in 2004, accounting for 90 % of the demand, were Japanese companies, Word Bank Carbon Finance Business and the Government of the Netherlands. The dominating suppliers were Asia, Latin America, developed economies and Eastern Europe. EU actors are thought to be more active in the near future. The transactions are often big and range from around 500 000 ton of CO_2e and to about 5 million tCO_2e. [Lecocq, F., 2004]

HCF_{23} destruction projects represented the largest share of the emission reductions in 2004 (35 %), since its extremely high global warming potential gives a cheap reduction

[19] The Executive Board is appointed by the UNFCCC to oversee the CDM projects. Their assignment is to work with the rules and procedures for the projects and issue the CERs that will be entered in the official CDM registry [Rosales, J.; Provone, G; 2003].

[20] A DOE is either a domestic legal entity or an international organization accredited or designated by the Executive Board. Its main functions are to validate and thereafter request a registration of a CDM project activity; and verify and certify emission reductions and request the Executive Board to issue Certified Emission Reductions [http://cdm.unfccc.int/, 7 April 2005].

cost per ton of CO_2e. Other projects that are dominating are projects that capture methane, such as landfill gas to energy or biomass waste recovery; and hydropower projects. The past distribution of project technology does not have to be consistent considering the absence of large scale fuel switching projects that is only possible with large investments [Lecocq, F., 2004].

Funds

The World Bank provide with finance to CMD and JI projects by linking buyers of carbon credits with projects seeking finance. Participants who invest money in return for emission reductions are both companies and governments. Examples of funds started by the World are the Prototype Carbon Fund (PCF), the Netherlands Clean Development Mechanism Facility (NCDMF), Community Development Carbon Fund (CDCF) and the BioCarbon fund [http://www.ieta.org/; 12 April 2005].

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Annex 3. Interpretations of laws and regulations

Contents

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1. Rules and regulations and authorities involved

In addition to the Trading directive the Commission has issued guidelines for the monitoring and reporting of greenhouse gas emissions and issued regulations for a system of registries, the Registry Regulation. The Linking directive is an amendment of the Trading directive that links the emissions trading in EU to the flexible mechanism in the Kyoto Protocol.

In Sweden a law (SFS 2004:1199) and ordinance (SFS 2004:1205) concerning emissions trading have been implemented. Regulations have also been given out by the Swedish EPA (NFS 2005:6) concerning monitoring and reporting and by the Energy Agency (STEMFS 2004:8) which constitutes the Swedish complementary addition to the Commission regulations concerning the registry [Asplind, 21 January 2005].

In the table beneath the authorities and their responsibilities concerning the issue of emissions trading in Sweden can be seen [SFS 2004:1205, 2§].

Responsibility	Authority
Licensing authority	County administrative board
Issues concerning the allocation of allowances	Swedish EPA
Supervisory authority	Swedish EPA
Registry administrator	Swedish Energy Agency

2. Monitoring of emissions and quality control

In the regulations from the Swedish EPA (NFS 2005:6) the procedures of monitoring, treatment of uncertainties, calibration and quality assurance are given. The monitoring can be done either through calculations or continuous measurements. A source shall only

be monitored through measurements if this gives a smaller uncertainty than through calculations applying a combination of the highest tiers [NFS 2005:6, 18§].

The calculations of the CO_2 emissions from the site are based on the fuel consumption, the net caloric value, the emission factor and the oxidation factor (se formula 1). The methodologies for determining the variables are divided into different tiers, where the accuracy increases with the increasing number of tier [Monitoring guidelines]. The monitoring by calculations should be done according to the highest numbered tier if it is technically practicable and not connected to unreasonable costs [NFS 2005:6, 20§].

CO_2 emissions [ton CO_2] = consumed fueled [ton fuel] * net caloric value of fuel [TJ/ton fuel] * emission factor [ton CO_2/TJ] * oxidation factor [1]

It was decided by the County administrative board that the monitoring of the steam boiler 3 at Site Stenungsund must fulfill the accuracy of the highest appropriate tier. This means that the variables consumed fuel; net caloric value and emission factor shall be measured for each batch.[21] The net caloric value and the emission factor will be measured by Borealis [Lindqvist, 17 Feb 2005].

Since the emissions from steam boiler 2, the two oil furnaces for heating and the back-up units are below a given limit the monitoring level can be lower by 21§ NFS 2004:9. The consumed fuels can therefore be calculated through mass balance according to the permit. The net caloric value for these installations' fuel have to be measured for each batch, which is also true for the determination of the emission factor for the fuel in boiler 2 [Application for CO_2 permit, 2004].

The procedures applied to sample and determine the activity specific emission factors and the net calorific values shall be based on relevant CEN standards if they are available, otherwise other standards should be used. If the operator entrusts someone else to perform the measurements the test laboratories shall be accredited against the EN ISO 17025:2000 ("General requirements for the competence of testing and calibration laboratories"). The operator must be able to present that the values are representative and without systematic errors [NFS 2005:6 Annex 1].

The operator shall have knowledge about the uncertainty of the emission data that is reported, which should not exceed what is given in the permit. The operator shall ensure that the metering equipment is calibrated, regularly maintained and used in an appropriate manner, and checked against measurement standards [NFS 2005:6 Annex 1].

3. Emission registry

Each member state that is included in the emissions trading has to establish a national registry. The Commission has given out detailed information on how these registries shall be designed, function, operate and be maintained in the Registry regulations

[21] "Batch" means an amount of fuel or material transferred as one shipment or continuously over a specific period of time. The sample shall be representatively for the batch [NFS 2004:9 3§].

[http://www.stem.se/, 1 March 2005]. In the registry the allowances will be issued and the transaction between accounts will be registered. The company or person that wants to trade with allowances is obliged to have an account in the national registry [STEMS manual, 2005].

The national registries will be interlinked with a central registry the Community independent transaction log (CITL), where the issue, transfer and cancellation of allowances will be recorded [Trading directive Article 20]. After 2008 all transfers of allowances between companies in different countries will involve corresponding adjustments of AAU under the Kyoto protocol. This will be provided by a communication link between the CITL and the UNFCC independent transaction log [Registry Regulation, Article (7)].

The Swedish national registry is called "SUS - Svenskt Utsläppsrätts System" and is established by the Swedish Energy Agency. SUS consists of a national registry and a registry for the installations [http://www.stem.se/, 1 March 2005]. The registry of installations is meant to be means in the supervision and contains information about the companies and the installations covered by the law of emissions trading [Prop. 2004/05:18].

Every emission allowance will be given a unique unit code so that the authorities can keep track of the allowances. The trading with allowance is based on the possibility to track and account the units so that a member states total number of allowances can be decided in the end of a trading period [SOU 2005:10, 2005].

3.1 How to get access to the account

For each account in the registry at least two authorized representatives chosen by the owner of the account shall be registered in the registry. The representatives shall agree to the requested transactions from the account before the Energy Agency carries them out [SFS 2004:1205, 39§].

An application of an account or an application for a transaction shall preferably be signed electronically with an electronic identification [STEMS 2004:8, 2 chap, 6§]. Each person that has access to the account and that are not the person authorized to sign for the company has to send in a power of the attorney to the Energy Agency [STEMS 2004:8, 2chap, 7§]. Consequently the operator has to do the following to get access to the account:

1. Apply for a user's account for at least 2 persons;
2. Issue power of attorney for persons that shall handle the accounts; and
3. Apply for an electronically identification [http://www.stem.se, 24 March 2005].

The easiest way to learn about how to activate the account and learn how to make transactions is to follow the guiding in the Energy Agency's manual available at:

https://www1.stem.se/SSO/dokument/Extern%20manual%20för%20registerhantering

To be given an account the competent authority or the operator must provide information given in Annex III in the Registry Regulations [STEMS 2004:8 3 chap 1§]. The Swedish Energy Agency has entered most of this information based on the information from the permits. Usually the company only has to enter the data concerning the representatives, but if some other information is missing an error message will appear [Drott, 29 March 2005]. If any of the information is changed the operator has to change this within 10 days in the account [STEMS 2004:8, 3 chap., 2§].

3.2 Processes carried through in the account

Transactions
All requests to carry out a process in the registry shall be sent to the Energy Agency by the owner of the account or the representatives [STEMS 2004:8, 2 chap, 8§]. The information that is sent to the register shall be correct and reliable and all changes of the information must be informed to the Energy Agency without any delay [STEMS 2004:8, 5 chap, 2§]. Every registration will be run through an automated check by the central registry to ensure that there are no irregularities, and a registration will be discharged if it is not compatible with existing registrations in the CITL [SFS 2004:1199, 4 chap. 9§].

The transfer of emission allowances from one account to another shall be done by the company that transfers the allowances, i.e. the seller of EUA. The application shall contain the information given in SFS 2004:1199, 4 chap. 5-6§§.

Verification
When the emission report has been verified the verifier shall enter or approve the entry of the annual verified emissions from the installation in the verified emissions table. [Registry Regulation Article 51] Therefore the operator has to appoint a verifier to the account and information about the verifier must also be entered [STEMS manual, 2005]. Each verifier shall also appoint at least one authorized representative that shall enter or approve the entry of the installations verified yearly emissions in the table of verified emissions [STEMS 2004:8, 2 chap, 10§].

Submission of EUA
The compliance is calculated by subtracting the number of allowances surrendered from the verified emissions and this is entered in a compliance status table. The administrator for the registry will inform the Swedish EPA about the status of the compliance [Registry Regulation, Article 56].

The transaction to surrender EUA shall be requested at the Energy Agency and it shall be expressed that the administrator of the registry shall:

1. Transfer a specified amount of allowances for a specified year from the operator holding account to the Party holding account.
2. Enter the number of transferred allowances into the section of the surrendered allowance table designated for that installation and that year [STEMS 2004:8, 6 chap, 1-2 §§].

The account will be blocked for transfers if the operator fails to send in the verified yearly report by 31 March to the Swedish EPA. [SFS 2004:1199 6 chap. 4§] The Energy Agency shall give the company a new possibility to go through with transactions out of the account when the operator has shown that the verified report has been presented [STEMS 2004:8, 5 chap, 3§]. Also if the installation's annual verified emissions have not been entered in the verified emissions table on 1 April the account will be blocked for any transfers of allowances out of the account until the action is carried through [Registry regulation Article 27]. Notice that the blocking of account means that the company cannot sell allowances, but they are free to buy since it is always the seller of allowances that makes the registration in the registry [Karlsson, 1 April 2004].

An emission allowance shall be cancelled [SFS 2004:1199, 6 chap. 2§]:

1. When it has been surrendered to fulfill the obligations to surrender emission allowances covering the emissions at the end of a year;
2. When it is no longer valid since the trading period for which it has been issued is over (four months after the end of the trading period, 1 May 2008); and
3. When the owner of a emission allowance asks for a cancellation.

The law (SFS 1998:1479) concerning account holding of financial instruments shall be applied on account holding of emission allowances [SFS 2004:1199, 4 chap, 1§]. This means that the emission allowances will be a subject of the rules for protection of investments and the special check that comes with the Swedish legislation. The practical meaning of this according to a government bill is that only companies authorized to handle valuable papers can handle the trading of allowances that is not done directly between companies [Prop. 2004/05:18].

4. Changed conditions

A planned change of an installation or activity in nature or functioning, or an extension of the installation or activity shall be notified immediately to licensing authority i.e. the CAB if it can influence the emission of CO_2 more than slightly. The CAB also must be informed if a new operator will take over the operation of one or several activities at an installation [SFS 2004:1199, 2 chap., 8§]. In each case the CAB shall decide if the above changed circumstances will lead to new monitoring and reporting conditions in a new CO_2 permit [SFS 2004:1199 2 chap; 9§].

The changes that require a notice according to Gunnar Barrefors [29 March 2005] are issues that can influence the conditions in the permit, for example changes of fuel or if a new emission source arise. Barrefors says that some changes can have notification requirements also by the Environmental Code, but it is valuable that a company has routines to understand that the changes can have an effect on the monitoring procedures.

All changes in monitoring tiers shall be documented [NFS 2005:6, 32§]. An operator shall change to a monitoring methodology of a lower uncertainty if it's technically

practicable and not connected to unreasonable costs. This is also applicable if errors have been found in the monitoring methodology [NFS 2005:6, 25§].

If the conditions of the monitoring given in the permit of technical reasons cannot be achieved the operator can use the highest achievable tier during a shorter time. The operator shall take all necessary measures so that the original monitoring tier can be used as soon as possible. The operator must document the changed conditions of the monitoring method and notify the changes without any delays to the CAB and give information of the temporary method [NFS 2005:6, 30§].

An operator shall notify the CAB of a change of the monitoring methodology or if new emissions have occurred [NFS 2005:6, 26§]. The County administrative board can issue a new permit on account of the above changes [NFS 2005:6, 29§].

5. Supervision, punishments, forfeitures and other sanctions

5.1 Withdrawal of permit

The licensing authority, i.e. the CAB can withdraw a permit to emit carbon dioxide if:

1. The terms in the permit has not been followed by the operator and the negligence is severe;
2. An operator neglects the regulations concerning reporting or submission of allowances;
3. The operator lacks an environmental permit; and
4. A new operator of the installation fails to fulfill the requirements in 5 § SFS 2004:1199 and regulations by this law [SFS 2004:1199, 2 chap. 10§].

Also if it is needed to fulfill the Swedish obligation by the membership in the EU the licensing authority can withdraw a permit or can change or withdraw the conditions in the permit [SFS 2004:1199, 2 chap. 11§].

5.2 Supervision

The supervisory authority has the right to get the information demanded and be noticed of the documents needed to make the supervision. [SFS 2004:1199, 7 chap. 2§] The supervisory authority also has the right to issue injunctions and demand entry to the installations [SFS 2004:1199, 7 chap. 3-4§§].

The Energy Agency shall if requested give information from the emission registry to the supervisory authority [SFS 2004:1199, 4 chap. 17§].

5.3 Punishments

A person can be sentenced to pay a fine or to imprisonment for a maximum of one year if he deliberately or through negligence:

1. Operates an activity that emits carbon dioxide without a permit;
2. Leaves incorrect or misleading information in the application for a permit which can lead to the permit being based on false grounds;

3. Leaves incorrect or misleading information in the yearly report;
4. Fails to report a change of an installation or activity in nature or functioning or an extension of an installation or activity (by SFS 2004:1199, 2 chap, 8§);
5. Fails to report if a new operator takes over the installation (by SFS 2004:1199, 2 chap, 8§); and
6. Leaves incorrect or misleading information in the application for emission allowances which could lead to the operator being issued too many emission allowances.

[SFS 2004:1199, chap.8, 1§]

Point number six is a rule that should be given more consideration by Akzo Nobel site Stenungsund since the company was considered a new participant and was given allowances also based on future production. Johan Norman says that it is almost impossible to predict if and how this paragraph will be used [Norman, Johan; 29 March 2005].

A person who commits a crime by the law concerning emissions trading can make an economical profit. If it is not unreasonable a profit of a crime by SFS 2004:1199 can declared forfeited [SFS 2004:1199, 8 chap., 4§].

5.4 Compensation

If someone suffers damage from a technical error in the registry he can claim compensation by the government. The compensation shall be reduced or be omitted if the person who claims it has partly caused the error [SFS 2004:1199, 8 chap, 9§]. Also a person that is affected by the correction in the registry has the right to compensation by the government. The compensation will not be given if the person should have realized that the error had occurred [SFS 2004:1199, 4 chap. 19§].

6. The handling of secrecy and personal particulars

The Swedish law concerning personal particulars (SFS 1998:204) is used concerning personal particulars in the registry. The Energy Agency is the responsible for the usage of the personal particulars in the emission registry [SFS 2004:1199 15§]. All information including the holdings of the accounts and all transactions made shall be considered confidential for any purpose than the implementation of the requirements of the Registry regulation, the Trading directive and national law. [Registry regulations Article 10)] All information given in the national registry is comprised by the Swedish Secrecy Act [STEMS 2004:8, 7 chap, 2§].

7. Limitations in the right of disposition of emission allowances

If the Energy Agency is informed that an owner of an account is bankrupt a note about this will be entered on the account [SFS 2004:1199, 4 chap. 11§]. Also if the Energy Agency is informed that an emission allowance has been meted out, sequestrated or has become the object of security of payment a note concerning this shall be entered on the account where the allowance is registered [SFS 2004:1199, 4 chap. 12§]. The Energy Agency will deny a request of a registration if it’s not compatible with an existing

registration described above [SFS 2004:1199, 4 chap. 9§]. The notes concerning the above issues shall be removed when they are abolished or finalized [SFS 2004:1199, 4 chap. 13§].

An allowance cannot be used to fulfill the obligation to surrender emission allowance at the end of a year or on the request of the owner if the allowance has been meted out, sequestrated or become the object of security of payment [SFS 2004:1199, 6 chap. 3§].

References

Rules and regulations

Application for CO_2 permit, 2004; Akzo Nobel Surface Chemistry, site Stenungsund

Monitoring guidelines; Commission decision of 29 January 2004 establishing guidelines for the monitoring and reporting of greenhouse gas emissions pursuant to Directive 2003/87/EC of the European Parliament and of the Council

NFS 2005:6; Naturvårdsverkets föreskrifter och allmänna råd om utsläppsrätter för koldioxid; established 20April 2005

Prop. 2004/05:18, Government bill concerning trading with emission allowances, 2004-09-23, 297 pages

Registry regulation; Commission regulation (EC) No 2216/2004 of 21 December 2004 for a standardised and secured system of registries pursuant to Directive 2003/87/EC of the European Parliament and of the Council and Decision No 280/2004/EC of the European Parliament and of the Council

SFS 2004:1199, Lag om handel med utsläppsrätter; issued 2 December 2004.

SFS 2004:1205; Förordning om handel med utsläppsrätter; issued 2 December 2004

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Personal references

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Barrefors, Gunnar; County administrative board, Västra Götalands regionen, 29 March 2005

Karlsson, Jan; Swedish EPA, 1 April 2004

Drott, Daniel; Swedish Energy Agency, 29 March 2005

Norman, Johan; environmental lawyer, Delphi & Co, 29 March 2005

Annex 4. Criteria for the National Allocation plans

1. Kyoto Commitments – The target *must* be reached in 2008-2012 however the effort is distributed between covered and non-covered installations and activities. The quantity of allowances that potentially will be available for installations covered by the trading scheme *should* be consistent with the forecasted increases or decreases in non-covered activities. Countries *can* choose to use flexible mechanisms to reach the targets.
2. Assessment to emission development – The total allocation *shall* be consistent with the Commission's annual assessment of actual and projected emissions of Member States (by 93/389/EEC). Consistency with assessments will be deemed as ensured if the total quantity of allowances to be allocated is not more than actual emissions and projected emissions contained in those assessments.
3. Potential to reduce emissions - Quantities of allowances to be allocated *shall* be consistent with the activities potential to reduce emissions. This criterion has to be applied in the determining of the total quantity by comparing the potential to reduce emissions of activities covered by the scheme and the activities not covered. A country *can* use this criterion for the allocation to activities.
4. Consistency of other legislation - The plan *shall* be consistent with other Community legislative and policy instruments. Account *should* be taken of unavoidable increases in emissions resulting from new legislative requirements.
5. Non-discrimination between companies and sectors – The normal rules for state aid will be applied.
6. New entrants - The plan *shall* contain information on the manner in which new entrants will be able to begin participating in the Community scheme.
7. Early action - The plan *may* take early action into account and *shall* contain information on how this is done. Benchmarks based on the best available technologies *may* be employed in developing the NAP, and these benchmarks can incorporate an element of accommodating early action.
8. Clean technology – A country *can* take account of clean technologies in setting allocations. This criterion can be seen as an extension of number 7, so either the criterion 7 or 8 shall be applied not both.
9. Involvement of the public –The plan *shall* include provisions for comments to be expressed by the public, and contain information on the arrangements by which due account will be taken of these comments before a decision on the allocation of allowances is taken.
10. List of installations - The plan *shall* contain a list of the installations covered by this Directive with the quantities of allowances intended to be allocated to each.
11. Competition from outside the Union - The plan *may* contain information on the manner in which the existence of competition from countries or entities outside the Union will be taken into account.

References

Trading directive; Directive 2003/87/EC of the European Parliament and on the Council of 13 October 2003 establishing a scheme for greenhouse gas emission allowance trading within the Community and amending Council Directive 96/61/EC

The Commission guidance on the implementation of the criteria listed in Annex III to Directive 2003/87/EC, Brussels, 7.1.2004, COM(2003) 830 final, 30 pages

Annex 5. Review and further development of the trading scheme

The European Commission shall review the trading directive after the first trial period and if thought needed give proposals of amendments. The evaluation shall be done "on the basis of experience of the application of the directive and of progress achieved in the monitoring of emissions of greenhouse gases and in the light of developments in the international context". This will result in a report that shall be submitted to the European Parliament and the Council by 30 June 2006, where the Commission shall consider the following issues:

- If other sectors inter alia the chemicals, aluminum and transport sectors or greenhouse emissions should be included (amending of Annex I and Annex II in the directive).
- The relationship of Community emission allowance trading with the international emissions trading that will start in 2008.
- Further harmonization of the method of allocation, including auctioning for the time after 2012, and of the criteria for national allocation plans.
- The use of credits from project mechanisms.
- The relationship of emissions trading with other policies and measures implemented at Member State and Community level, including taxation that pursue the same objectives.
- If it is appropriate to have a single Community registry.
- The level of excess emissions penalties.
- The functioning of the allowance market, covering in particular any possible market disturbances.
- How to adapt the Community scheme to an enlarged European Union.
- Pooling
- The practicality of developing Community-wide benchmarks as a basis for allocation, taking into accounts the best available techniques and cost-benefit analysis.

References

Trading directive; Directive 2003/87/EC of the European Parliament and on the Council of 13 October 2003 establishing a scheme for greenhouse gas emission allowance trading within the Community and amending Council Directive 96/61/EC

Annex 6. Shortening and translations

Translations

AAU	Assigned Amount Units, an Annex I country's target is divided in to AAU's
CAB	County Administrative Board
CDM	Clean Development Mechanism
CER	Certified Emission Reductions
CITL	Community Independent Transaction Log
ERU	Emission Reduction Units
EU ETS	European Union Greenhouse Gas Emissions trading Scheme
JI	Joint Implementation
LULUCF	land use, land-use change and forestry in the Kyoto protocol
NAP	National Allocation Plan
BAU	Business As Usual
UNFCCC	United Nations Framework Convention on Climate Change
CO_2e	CO_2 equivalents
EUA	European Union Allowance (corresponds to 1 ton CO_2)

Translations

a notice	anmälan
conditions	villkor
County administrative board	Länsstyrelsen
Environmental Code	miljöbalken
issue injunctions	meddela föreläggande
licensing authority	tillståndsmyndighet
notification requirements	anmälningsplikt
notify or report	anmäla
ordinance	förordning
permit requirements	tillståndsplikt
regulation	föreskrift
supervision	tillsyn
supervisory authority	tillsynsmyndighet
Swedish Energy Agency	Statens Energimyndighet
Swedish EPA	Naturvårdsverket