Emission trading north – benefits for the economy and the environment

A pilot project of the Energy Foundation Schleswig-Holstein in co-operation with the Association of the Chambers of Industry and Commerce in Schleswig-Holstein and the Union of Employers' Associations in Hamburg and Schleswig-Holstein

Dr. Katja Barzantny
Energiestiftung Schleswig-Holstein, Daenische Str. 3-9, D-24103 Kiel
k.barzantny@essh.de

Michael Hahn
ERM Lahmeyer Int. GmbH, Konrad-Adenauer-Str. 3, D-63263 Neu-Isenburg
michael.k.hahn@erm.com

Dr. Martin Kruska
EUtech Energie + Umwelt, Technik + Management, Dennewartstr. 25-27, D-52068 Aachen
kruska@eutech.de

Michael Klein
500 PPM Gesellschaft für Emissionshandel und Beratung mbH, Kriegerstr. 44, D-30161 Hannover
mklein@500ppm.com

Keywords

Regional pilot project, emission trading (ET), EU-draft directive, capacity building, energy efficiency incentives and potentials, system boundaries, allocation of emission allowances, emission trading simulation, www.emissionshandel-nord.de

Abstract

In co-operation with the Association of the Chambers of Industry and Commerce in Schleswig-Holstein and the Union of Employers' Associations in Hamburg and Schleswig-Holstein the Energy Foundation Schleswig-Holstein is carrying out the pilot project Emission Trading North. Its primary target is the regional application of the flexible mechanisms (ET, JI, CDM) together with the industry of Schleswig-Holstein. In detail, it focuses on capacity building on behalf of the different parties involved, a smooth transition to real ET and the positioning of the Energy Foundation in a future ET system.

The project cycle consists of 3 phases (Phase 0: preparatory work; Phase 1: development of emission inventories, identification and evaluation of emission reduction measures; Phase 2: simulation of ET). Participating companies located in Schleswig-Holstein and Hamburg, representing the power sector, cement production, paper and pulp production, non-ferrous metals as well as the renewable energy sector, dealt with the central question of allocation of emission allowances. During in-depth energy analyses emission reduction measures were identified and evaluated with respect to their volume of emission reductions and related costs. Participating companies developed mid and long-term trading strategies taking into account investment cycles, project risks and market prices. The strategy was tested during a multi-period trading simulation.

With respect to the national allocation plan, a central element of the future European emission trading system, the pilot project proposes consistent solutions relating to CHP, capacity limits, process emissions, fuel substitutes, new entrants and shut-down of installations.

Introduction

With the announced ratification of the Kyoto-Protocol by Russia emission trading is no longer just a theoretical concept but will soon become a central element of the environmental policy mix. On December 9th, 2002 the Council of the European Union agreed on an amended proposal for a Directive to establish an Emission Trading Scheme in the EU (Council of the European Union 2002). The Parliament is expected to adopt the Directive during the second half of 2003. The EU member states are now asked for setting up their national allocation plans until March 2004 and for deciding on the different design options. After extensive preparatory work the pilot project "Emission Trading North – Benefits for the Economy and the Environment" which is carried out by the Energy Foundation Schleswig-Holstein in co-operation with the Association of the Chambers of Industry and Commerce in Schleswig-Holstein and the Union of Employers' Associations in Hamburg and Schleswig-Holstein started in May 2002.

The pilot project

TARGETS AND PARTICIPANTS

Primary target is the regional application of an instrument developed in an international context together with the industry of Schleswig-Holstein and Hamburg. Specific targets include:

1. Capacity building of the different stakeholders involved to realise first mover advantages;
2. Communication of important findings (based on detailed company focused case studies) into the national political decision making process;
3. Positioning of the Energy Foundation as a regional promoter of renewable energy, energy efficiency and energy saving measures.

The opportunity to prepare for EU emission trading at an early stage was used by nine companies: three from the power sector, three from the pulp and paper sector, one from the cement industry and non ferrous metal sector each and one from the renewable energy sector.

THE PROJECT CYCLE

The project cycle consists of 3 phases (Phase 0: preparatory work; Phase 1: development of emission inventories, identification and evaluation of emission reduction measures; Phase 2: simulation of emission trading).

The preparatory work of phase 0 included the acquisition of the companies mentioned above, the constitution of an expert advisory board with a regional focus but also including members of the European Commission and the German Environment Ministry, the revision of an already existing and publicly available project manual and, finally, the definition of realistic framework conditions for the pilot project based on the current discussions in Germany and in the EU.

During phase 1 the internal requirements concerning the participation in an emission trading system were set up. Under the guidance of the project team, the companies defined the system boundaries with respect to two installations that are likely to be covered by the EU Directive and established corresponding emission inventories for direct CO_2-emissions within these system boundaries. Subsequently, emission and cost reduction potentials were analysed in detail for each selected installation, including direct measures (e.g. plant and process optimisation) as well as indirect measures (such that lead to a reduced activity level of the installation, e.g. thermal insulation of steam consumers). Finally, each participating company developed annual emission forecasts up to the year 2012, based on its expected (or presumed) economical and technical development. Phase 1 was therefore characterised by "learning by doing" and capacity building. As one main result, the detailed knowledge of the companies' specific abatement costs will allow to develop a profit driven strategy in a future emission trading system.

Phase 2 started with a workshop to define the rules of the trading system and to develop the major elements for a company specific trading strategy. Finally, trading of emission allowances was simulated based on the individual emission forecasts of each participant and taking into account the strategy mentioned above as well as the emission reduction measures identified in phase 1. The multi-period-trading simulation was realised online on a commercially available simulation platform.

Results

Important results have been obtained in capacity building. The participating companies started to prepare for real emission trading and all of them consider to have reduced possible restraints for a successful participation in the forthcoming EU system. During the project, especial attention was paid to questions relating the allocation of emission allowances, the identification and evaluation of emission reduction measures and the development of an emissions trading strategy.

ALLOCATION OF ALLOWANCES

General method

The allocation of allowances for Emission Trading North is based on the voluntary agreements between the German industry and the German government of 9th November, 2000 (BDI et al. 2000) and 25th June, 2001 (BDI et al. 2001). The German industry and the energy conversion sector declared to reduce 45 Mt CO_2 between 1998 and 2010. Considering that these sectors have already achieved an emission reduction of approximately 22% between 1990 and 2000, an achievement factor for the year 2010 (α^{2010}) of 91,3% can be deduced. This achievement factor applies for any installation albeit it takes part in the emission trading scheme or not and implies that the trading systems emissions of the year 2000 will have to be cut by 8,7% until 2010.

According to the industries' most important claims the allowances to be allocated shall at least cover the actual emissions of an installation plus the emission reductions which were already realised in the 1990s as early action. The allowances hypothetically to be allocated to a single installation in 2000 (Z_i^{2000}) can be expressed by the formula:

$$Z_i^{2000} = E_i^{2000} + Z_i^{early\,action}$$

where E_i^{2000} means an installation's emissions in 2000 and $Z_i^{early\ action}$ means verifiable early action since 1990. These claims result in an excess allocation of allowances meaning that at the start of the emission trading scheme more allowances will be allocated than emissions have actually occurred. In Emission Trading North this excess allocation amounts to 10,8% of the real emissions in 2000. As the achievement factor α does not consider the excess allocation a correction factor β is introduced. Consequently, the allowances to be allocated in 2010 can be expressed by:

$$Z_i^{2010} = Z_i^{2000} * \alpha * \beta$$

The allocations for the years 2005 to 2012 are calculated through linear inter-/extrapolation through Z_i^{2000} and Z_i^{2010} resulting in an annual reduction rate for the allocated allowances of 1,9%.

Table 1. Special cases.

Issue	Problem	Solution Proposed
I. CHP		
a) build up / enlargement of municipal and industrial CHP	Avoidance of indirect emissions (power from the public grid) leads to an increase of direct emissions of the operator while at the same time the overall emissions in the emissions trading system decrease (prices decrease/power becomes less expensive)	Introduction of a CHP bonus system to compensate for this incentive reduction; choice of a reference technique (e.g. CHP based on gas); emission allowances obtained from a national reserve
b) operation of municipal and industrial CHP	A reduction of the combined production of heat and power leads to a reduction of emissions at the site and to a surplus of emissions allowances	Introduction of a bonus system based on a required minimum gross efficiency of CHP-installations
II. Capacity limit of 20 MW	Combustion installations > 20 MW compete against installations < 20 MW even though they might serve the same purpose (implying competition distortions)	Possibility of an opt-in for installations < 20 MW while making arrangements for equivalent environmental policies for installations that stay out of an ET system; emission allowances obtained from a national reserve
II. Fuel substitutes	Exclusion of municipal waste installations in the EU Directive; no specific rules for fuels with a fossil or biomass component; voluntary agreement of the German industry: all fuel substitutes are regarded as CO_2 neutral; contra-diction to regular fuel switches (e.g. coal to gas)	No general emission neutrality; use of standards/benchmarks; municipal waste installations should be included in the ET system as soon as possible
IV. Process emissions	Especially in the cement, lime and steel industry some production processes cause CO_2 emissions of a large scale which are very difficult to avoid	Inclusion of process emissions because: - process emissions contribute to climate change - incentives for process or product innovations have to be maintained but: granting of allowances on the potential including the technological potential of activities (see Annex III (3) EU Directive)
V. Shut-down of installations / increase of production	Replacement of installations; problem of "cold reserve"; problem of ownership of emission allowances; need for new emission allowances	Shut-downs: emission allowances can be kept by the former operator until the end of the commitment period; increase of production: emission allowances have to be bought on the market
VI. New entrants	Dynamic change of emissions in the course of new investments in installations	Emission allowances have to be bought on the market

Special cases

The pilot project revealed a number of methodical problems which are outlined in Table 1.

EMISSION REDUCTION MEASURES

The detailed plant analyses showed that even within the small sample of participating enterprises a broad range of energy saving and emission reduction potentials could be realized on an economic basis, i.e. at negative or zero specific abatement costs ("no-regret potentials"). A large majority of emission reduction potentials was found to have specific abatement costs between zero and one hundred Euro per tonne of CO_2 avoided annually. Up to 15% of the overall emissions of all participating enterprises could be avoided at these costs. Figure 1 shows the abatement cost curve of the emission reduction potentials identified within the project. Table 2 shows the corresponding clusters of potential emission reduction measures.

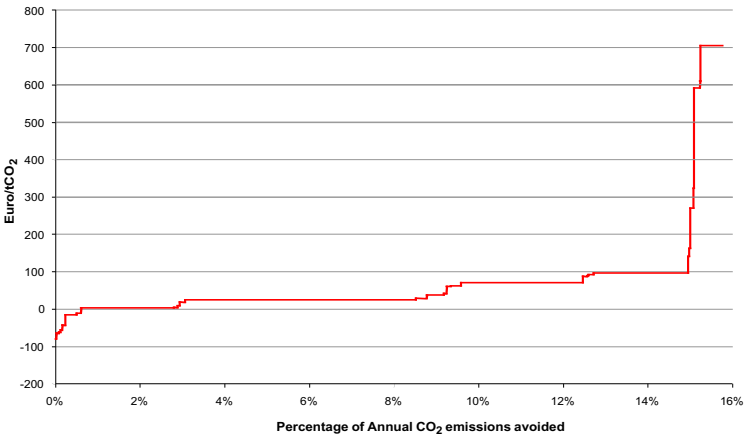

Figure 1. *Specific abatement cost curve of the potential emission reduction measures.*

TRADING STRATEGY AND SIMULATION

For each installation, emission forecasts for the years 2005 to 2012 were made, based on projected activity levels, planned

Table 2. Potential emission reduction measures

I. Increase in efficiency of combustion plants		II. Fuel Switch
• replacement of old block-type thermal power station modules (increase in efficiency) • replacement of block-type thermal power station modules by boilers • replacement of block-type thermal power station modules by fuel cells • expansion of block-type thermal power station modules • modification of CHP through reduction of back pressure	• replacement of a power plant through a gas and vapour turbine power station or Cheng-Cycle-turbine • optimised mode of operation of combustion plants with respect to emissions • reduction of heat losses of heavy fuel heating • reduced combustion of light heating oil by change of gas subscriber agreement • use of fluidised bed combustion	• partial fuel switch to biomass and biogas • use of renewable energy • generation and use of biogas by application of anaerobic sewage treatment • increased us of fuel substitutes
		III. Optimised operating characteristics for production plants
		• waste heat recovery • decrease in clinker factor • use of thermal oil for air preheating • replacement of butterfly valves through frequency converters • improved heat insulation

implementations of reduction measures and investments. By opposing these emission forecasts to the predefined allocation scheme, emission balances where drawn to determine each company's compliance shortfall or surplus for each year. Companies where then invited to develop a compliance strategy, taking into account investment cycles, legal, financial and technological framework and their marginal abatement costs compared to market price forecasts. The possible strategies included make or buy decisions, forward transactions, banking according to the allocation scheme, and the choice between three types of compliance instruments (emission allowances, JI credits, CDM credits).

These strategies were tested in an internet based trading simulation. To provide for a liquid market, emissions of the participating companies where scaled to comparable sizes. Due to the constraints concerning market conditions abatement prices within the simulation were not representative for a real carbon market at all. However, the participants reportedly experienced a good capacity building in reference to compliance strategies. The notions of trading, shortfall risk management, anticipated or forward transactions were especially new to non-power sector companies. Participants also related a deepened understanding of the nature and specific advantages of different compliance instruments, and all declared to have got a better feeling how to assess market situations and price development.

Final remarks

The pilot project "Emission Trading North" revealed a number of findings important to guarantee an optimal effectiveness of this new instrument Based on individual case studies of the participating companies representing the power sector, cement production, paper and pulp production and non-ferrous metals, it proposes consistent solutions with respect to the definition of system boundaries and the related allocation of emission allowances in the context of the national allocation plan. Typical emission reduction measures have been identified and evaluated in terms of costs and emission reduction volumes. By means of emission and allocation forecasts and emission balances, companies have been trained to develop efficient compliance strategies, by taking advantage of the possibilities of emissions trading and assessing market risks of non-compliance situations. To cope with these risks, especially decision makers with a technical background need a deepened understanding of the instruments and rules of the carbon markets.

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Acknowledgements

We would like to thank the participating companies and the expert advisory board for their commitment and their helpful comments. It has been a pleasure to work together in this project.