Impact of the EU emission trading scheme and its effectiveness in reducing CO_2 emissions: the Finnish experience

Heli Jutila

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Swansea Metropolitan University

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Abstract

Human-induced climate change is the greatest environmental, social and economic threat facing the planet. The European Union designed Emission Trading Scheme (EU ETS) as its key instrument to achieve the binding greenhouse gas reduction targets assigned in the Kyoto Protocol 1997. The aim of this research was to study the opinions of Finnish companies and other actors about EU ETS and to evaluate the success of emission trading (ET) in climate change policy. The research methodology combined both positivist and phenomenological approaches, being triangulation. A web-based questionnaire was directed to the installations in the Finnish EU ETS (n=457, received n=69) and the response period was three months (9.11.2007-31.1.2008). Seven semi-structured interviews were conducted with three researchers, two politicians, one NGO consultant, one administrator and one representative of an industry organisation. Carbon dioxide (CO_2) emissions were assessed using statistics from the first ET period 2005–2007. Quantitative variables were analysed with statistical packages: Statistix and SPSS, whilst a content analysis was used for qualitative variables.

Oil refining, steel and forest industries had on average high annual CO_2 emissions per installation and they represented 7%, 16% and 11% respectively of the total Finnish ETS emissions. The energy sector characterized by many small installations with rather low CO_2 emissions, accounted for 61% of the total CO_2 emissions of Finnish ETS. Half of the companies had a defined compliance EU ETS strategy and trading EUAs was the main compliance measure. Many energy companies have been able both to price-in and to sell allowances, obtained free-of-charge, and to make a profit. Internal abatement, the second most important compliance measure, included more energy and material efficient production processes, increased use of biomass energy, other renewables and fuel changes. Clean Development Mechanism, Joint Implementation and carbon funds were used particularly by the bigger companies with large CO_2 emissions. Threats to EU ETS included increased energy costs, high cost levels, reducing ability to compete in global markets, carbon leakage and windfall profits.

Most Finnish EU ETS companies (75%) had environmental management systems, but many need to work further with research and development, carbon foot prints and supplying climate change information to clients. Company EU ETS strategies were mainly based on economics, but quite often included aspects such as environmental issues. EU ETS was also seen as a means of encouraging corporate social responsibility (CSR).

Theoretically EU ETS is a fairly cost-effective system, but in practice it means that the emission caps have to be tightly controlled. Questionnaire results showed that 37% of respondents did not believe that EU ETS leads to targeted emission reductions, 37% believed that is does and 26% did not know. However, interviewees were more positive on this issue. The loose caps during the first period and short term provide reasons for the poor results, but the Commission expects that during the Kyoto period, cuts into national allocation plans will reduce EU-15 emissions by 3.4%. A mixture of measures is certainly needed to achieve the Kyoto targets. The EU Commission's climate change and energy package sends out a quite clear message: CO_2 emissions have to reduce. There are targeted reductions on 2005 emissions as follows: 2020 20%, 2030 30%, 2040 40% and 2050 50% while EU ETS sector and non-EU ETS sector caps will be 21% and 10% respectively. Aviation, aluminium production and chemical industries were new sectors which received most support for inclusion in the EU ETS. Auctioning of emission allowances, although not supported by the companies concerned, is theoretically effective in removing some distortions of the system and provides revenue, which can then be used to cover costs and develop green technology. The work concludes with recommendations to develop the EU ETS and these further support EU initiatives.

Abbreviations

AAU "Assigned amount units", tradable emissions rights associated with national Kyoto targets.
Annex I countries 41 industrialized countries, western countries and countries in transition
C carbon
CDM clean development mechanism.
CER Certified emission reductions generated in CDM and usable in EU ETS.
CF_4 perfluoromethane
CFC chlorofluorocarbon
CH_4 methane
CHP heat and power production
CO_2 carbon dioxide
CO_2eq carbon dioxide equivalent (= emissions multiplied by the GWP value of the gas)
COM Commission of the European Communities
EIT economies in transition
EMAS eco-management and audit scheme
EMS environmental management system
ERU emission reduction units obtained from JI and usable in EU ETS.
ET Emissions Trading
ETA Finnish Emission Trading Authority
EU the European Union
EU-15 member states of the European Union before May, 2004
EU-25 member states of the European Union since May, 2004
EU-27 current number of member states in the European Union
EU ETS emissions trading scheme of the EU (2005-2007, 2008-2012, 2013-)
EUA the European union allowance of CO_2
F-gas fluorinated gas (HFCs, PFCs and SF_6)
GDP gross domestic product
GHG greenhouse gas
GWP global warming potential
H_2O water, di-hydrogen oxide
HCFC hydro-chlorofluorocarbon
HFC hydro-fluorocarbon
IPCC Intergovernmental Panel on Climate Change
ISO14001 an environmental standard of the International Organization for Standardization
JI joint implementation
M million
MIPS material input per service unit
MS member state of EU
NAP national allocation plan
N_2O di-nitrogen oxide
NO_X nitrogen oxide
opt-in installation a small power plants in the same net with at least one plant with over 20 MW capacity, and thus, included in the EU ETS.
PFC perfluorocarbon
RES renewable energy sources
RF radiative forcing
SF_6 sulphur hexafluoride
SO_2 sulphur dioxide
UNFCCC United Nations Framework Convention on Climate Change

1 Introduction

Human-induced climate change and its impacts are currently the greatest environmental, social and economic threats facing the planet. The warming of the climate system is unequivocal and evidenced by observations of increases in global average air and ocean temperatures, widespread melting of snow and ice, and rising global mean sea level. The Earth's average surface temperature has risen by 0.76°C since 1850 and without action to reduce greenhouse gas emissions, is forecast to rise by a further 1.8-4.0°C this century (IPCC 2007a, Vernon 2006).

To prevent, mitigate and adapt to the climate change are great challenges. Two major international efforts to combat climate change are the 1992 United Nations Framework Convention on Climate Change (UNFCCC, agreed in Rio de Janeiro), which limits the emissions of Annex I countries to non-harmful levels, and the Kyoto Protocol agreed on 1997, which came to force February 2005 and set binding emission reduction targets to Annex I countries. GHGs covered by the Kyoto Protocol are CO_2, CH_4, N_2O, HFCs, PFCs and SF_6. Some industrial countries, including the USA, did not ratify the Kyoto Protocol and therefore did not commit to emission reductions (UNFCCC 2002).

In the Kyoto Protocol, three mechanisms, emissions trading (ET), joint implementation (JI) and clean development mechanism (CDM), are available for the Annex I Parties to cut the cost of meeting emission reduction targets. In Europe (EU-15) the Kyoto Protocol requires emissions in 2008–2012 to be 8% below 1990 levels. Under the EU burden sharing, Finland's target was set at 0%, i.e. freezing of CO_2 emission to the 1990 level. Thus, in the EU, a wide range of new policies and measures have been adopted and among them the cornerstone effort, the European Union Greenhouse Gas Emission Trading Scheme (EU ETS).

An “emission trading” system was initially proposed by an American economist Dales in 1968 and was initially adapted by the EPA to control atmospheric and water pollution. It gained unprecedented success with great economic and social benefits. ET can be based on three major theories: the externality theory, the economic transaction cost theory and the property theory for environmental capacity resources (Cao 2005). The idea of ET is that the competitiveness of emission-less and emission-poor fuels improves. It enhances investments and increases the utilization rate. The effect on demand is caused by price changes of products and fuels. Even though the EU ETS program clearly builds upon many of the lessons learned from earlier experiences with ET programs in USA

and Australia (Environmental Law Institute 2002, Farhana 2005, Tietenberg 2006), there are many potential pitfalls, e.g. the heterogeneous, multi-jurisdictional nature of the European Union, the CDM Executive Board, the NAPs (national allocation plans) etc. (Kruger & Pizer 2004).

1.1 Aims and objectives

The research aim was to study the understanding and opinions of the Finnish companies and other actors (researchers, politicians, administrators, lobbyists) about EU ETS and to evaluate the success and role of ET in climate change policy in EU.

The research objectives were:

- To analyse with an interview, how politicians, administrators, lobbyists and scientists think about EU ETS and climate change policy and how it differs from the opinions of company representatives in a questionnaire.
- To analyse with a questionnaire the motives, compliance strategies and measures companies have adapted in response to EU ETS in Finland and make relevant comparisons between sectors and other company characteristics.
- To analyse CO_2 emission trends, patterns and influencing factors in Finnish EU ETS sectors.
- To analyse the links between environmental management and EU ETS. Is the EU ETS encouraging or discouraging the companies to corporate social responsibility and better environmental management?
- To evaluate, whether EU ETS is an effective and efficient system and whether it really leads to CO_2 reductions and is it able to do it more efficiently than other systems.
- To make recommendations to improve EU ETS.

2 Literature review

This chapter reviews the literature concerning the basic facts, causes, effects and measures taken in relation to climate change. The theory and applications of ET in some countries are presented. The EU ETS is described in general and in detail in Finland. Finnish greenhouse gas (GHG) emissions are also reviewed. Then the focus turns to companies and the literature available about the impacts of the EU ETS particularly on Finnish companies is reviewed. Finally, corporate social responsibility (CSR), and particularly environmental management (EMS), in companies are reviewed, because it is one lens through which the results are looked at.

2.1 Climate change

Scientific evidence of the warming of the climate system is abundant and most governments have agreed that the cause of climate change is man made[1]. The Earth's average surface temperature has risen by 0.76°C since 1850 and without action to reduce greenhouse gas emissions, is forecast to rise by a further 1.8-4.0°C this century (IPCC 2007a, Vernon 2006). The natural greenhouse effect, which is caused mainly by atmospheric H_2O and CO_2, is a vital requirement for life on Earth as we know it. Human activities, for instance combustion of fossil fuels, certain farming and forestry practices (e.g. burning, deforestation, over-grazing) and waste management, result in greenhouse gas emissions, which cause an abnormal acceleration of the greenhouse effect and increased temperatures. Climate change is a global phenomenon, because greenhouse gases are dispersed in the atmosphere and because ocean currents and atmospheric flows globally transfer energy (IPCC 2007a, Monni 2005).

The main cause of human-induced global warming is CO_2, resulting from fossil fuel combustion, i.e. coal, oil and natural gas while other industrial processes, e.g. manufacturing of cement and lime, also cause CO_2 emissions. Land use activities, e.g. forestry management, soil cultivation and peatland management, can cause carbon sources, while growing forests act as carbon sinks (IPCC 2007a).

Methane (CH_4) has several natural sources, of which wetlands are the most important. However, 60% of annual global CH_4 emissions are caused by human activity. The most important anthropogenic emission sources are waste management (landfills), enteric fermentation of ruminants, rice cultivation and fuel combustion. Soils can act both as sinks and sources of methane (IPCC 2007a).

Most anthropogenic nitrous oxide (N_2O) emissions come from agricultural soils, due to, e.g. nitrogen fertilisation. In addition, some industrial sources (e.g. nitric acid and adipic acid production), manure management and fuel combustion cause N_2O emissions (IPCC 2001a).

F-gases, HFCs, PFCs and SF_6, are mainly of anthropogenic origin and are released by various industrial processes. Furthermore, the use of these gases in different products and processes, such as in refrigeration and air conditioning equipment, increase their impact (IPCC 2007a).

[1] First signs of climate change were recorded in 1960's and it became a significant research target already in the 1980's. In 1987 Brundtland Commission's report raised it to public knowledge and United Nations established IPCC.

Atmospheric lifetimes of GHGs vary from around 1.4 years for HFC_{-152a} to over 50 000 years for perfluoromethane (CF_4). Global warming effects of greenhouse gases depend, in addition to lifetimes, on their radiative properties. A warming effect can be measured by radiative forcing (Fig. 1), which is defined as the perturbation to the net irradiance at the tropopause after allowing the stratospheric temperature to re-adjust to radiative equilibrium (IPCC 2001a, Monni 2005). In addition, emissions of direct greenhouse gases CFCs and HCFCs, controlled by the Montreal Protocol, have large global warming potentials (IPCC 2007a; Rypdal et al. 2005).

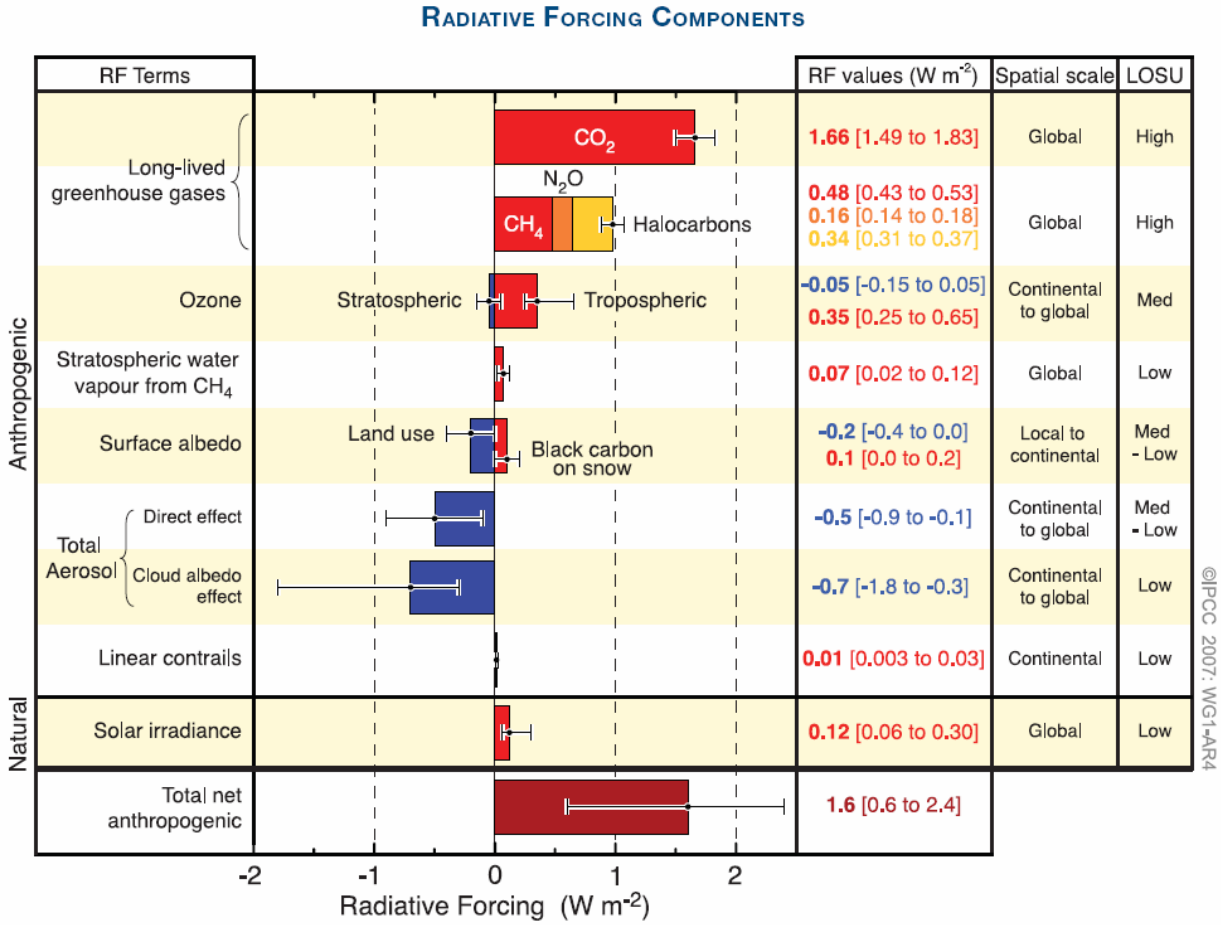


Figure 1. Global average radiative forcing (RF) estimates [net anthropogenic RF] and ranges in 2005 for anthropogenic carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O) and other important agents, together with the typical geographical extent of the forcing and the assessed level of scientific understanding. Volcanic aerosols contribute episodic natural forcing, which is not included. Possible effects of aviation on cloudiness are excluded. (Figure borrowed from IPCC 2007a).

2.1.1 Impacts of climate change

According to the IPCC (4th Assessment Working Group II 2007b) over 89% of about 29 000 observations of physical and biological phenomena show changes, which are in line with the observed temperature change. These observations are from 75 different studies, which fulfil the

following criteria: (1) They end in year 1990 or later; (2) their length is at least 20 years; and (3) a significant change to one or the other direction was confirmed. Big changes are anticipated in Arctic and Antarctic areas, where the annual temperature increase can reach 10^{o}C in a century. Glaciers in these areas and on mountains have started melting and temperatures of seas and fresh waters have increased. There are changes in salinity, pH and oxygen content of the sea water. The coral reefs with narrow temperature optimums are already suffering (IPCC 2007b).

Rising sea level causes floods and several million people will suffer by 2080. Particularly threatened are low-lying areas, which already now have other challenges, such as tropical storms and sinking land levels. Most vulnerable are small islands, but most inhabitants suffer on the deltas of Asia and Africa. Strong tropical storms are also likely to become more common. Fresh water floods have increased and occur earlier in the northern latitudes (IPCC 2007b).

Plant and animal species have moved towards the poles and mountain peaks. Parmesan & Yohe (2003) showed that 279 of 677 species had responded to climate change by moving 6 km to the north or 6 m higher on the mountains in a decade. Spring patterns have come earlier in the northern latitudes and IPCC climate scenarios forecast droughts in some areas and heavy rains in others. The Thomas et al. (2004) review study concluded that if the global increase of average temperature exceeds 1.5-2.5°C, big changes will occur in the structure and function of ecosystems; in species ecological interaction and their geographical distribution. Furthermore, approximately 20–30% of all known plant and animal species will have an increased extinction risk, and cold-blooded amphibians and reptiles are particularly vulnerable. Effects on birds are quite well known and several changes in their distribution, nesting and migration periods have already been detected. Butterflies are also at risk. Invasive exotic species are likely to disperse towards poles, with generalists out-competing locally adapted species (Henson 2006; IPCC 2007b).

Climate change will cause both positive and negative effects on world's food production. Some agricultural areas are forecast to suffer droughts and others floods although northern areas may benefit from longer growing seasons. Millions of people will become exposed to health effects of climate change such as disease, while buildings, roads and other constructions will suffer damage in floods, from melting permafrost or storm winds (Henson 2006; IPCC 2007b)

2.2 Emission trading

2.2.1 Theoretical background of emission trading

There are three major theories on “emission trading”: the externality theory, the economic transaction cost theory and the property theory for environmental capacity resources. Professors Marshall and Pigu at Cambridge University have proposed the externality theory, which also is called Pigu Theory. It refers to the by-products or side effects of economic activities beyond the regulation of market mechanism. Pollution is external diseconomy of economic activity, i.e. business activities produce negative effects on others and the surrounding environment. To avoid this, enterprises’ external diseconomy should be internalized. Indeed, in “emission trading” system the enterprises come to internalize their external diseconomy produced by their operating activities (Cao 2005). From the economic perspective, environmental resources have the nature of public property, which can easily lead to “tragedy of commons” or in other words “free ride”. The essence of pursuing the ET system is the specific device of paying for the use of environmental resources and affirming the property nature of this right (Cao 2005). The third theory linked to ET system is the property right theory of environmental capacity resources. It is believed that the environmental capacity is limited, and thus a scarce “resource”, which possesses value (Cao 2005).

2.2.1.1 A principle of ET

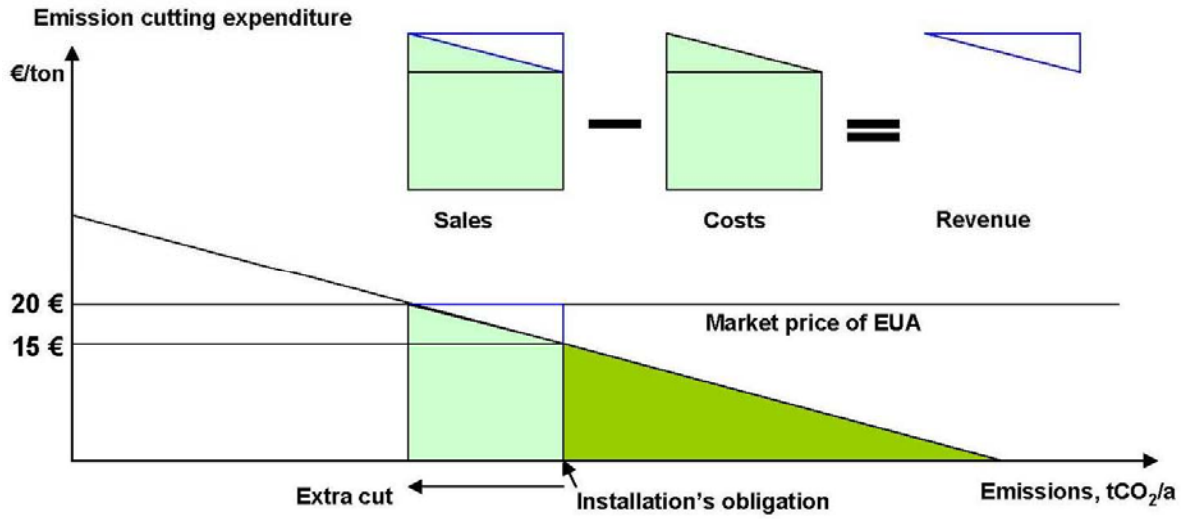
The idea of ET is that the competitiveness of emission-less and emission-poor fuels improves and the energy use of production processes decreases. It enhances investments and increases the utilisation rate. The effect on demand is caused by price changes of products and fuels. Competition in a perfect market would keep the cost at minimum. For a Figure 2a company it is cost-efficient to reduce emissions more than its own obligation is, because it will get the investment back in selling EUAs. For another company (Fig. 2b) it is more cost-efficient to buy a part of EUAs from the market than to reduce emissions whole on its own.

According to Tietenberg *et al.* (1999), the criteria of a functional and cost-effective emission trading system are

- exhaustiveness (emissions trading covers all the emission sources and greenhouse gases)
- competitive markets (enough actors and individual actors do not have a significant market power)

- administrative effectiveness (administrative routines are lean and the trading does not cause significant transaction costs)
- credibility (monitoring systems and non-compliance consequences are enough to ensure compliance)
- continuity (the system is guaranteed for a relevant period for long-term investments)
- time flexibility (banking emission allowances and possibly also borrowing within and between trading periods is allowed for optimal location of long-term investments).

a)



b)

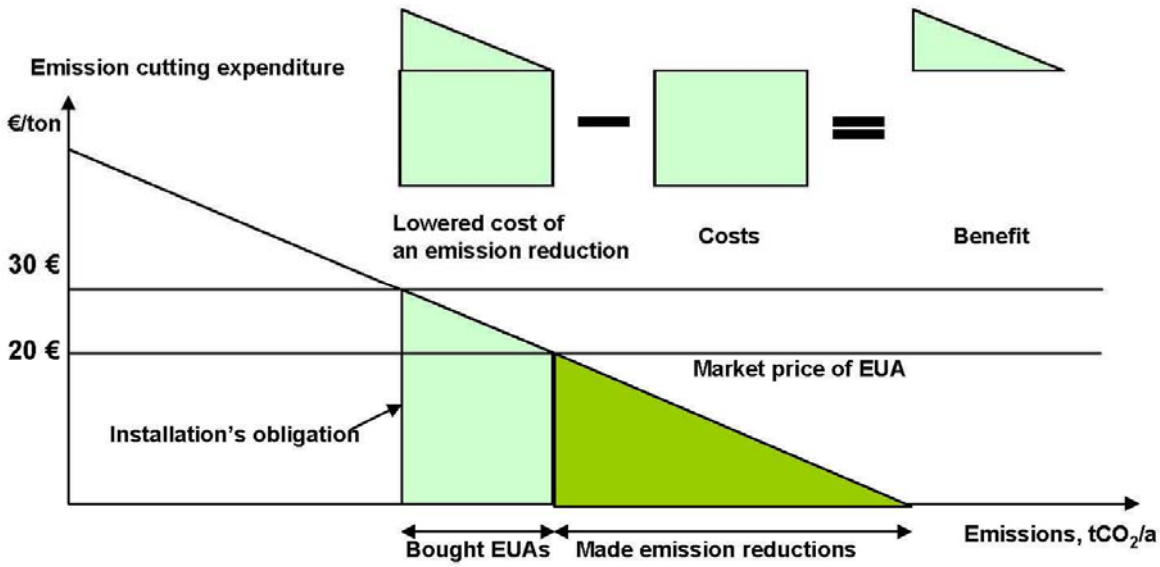


Figure 2. The principle of ET on installation level in the case of a) cost-efficient emission reduction for the installation, b) expensive emission reduction investment for the installation (Redrawn from Leskelä 2005).

2.2.2 Previous experiences from the USA

An “emission trading” system was initially proposed by Dales, an American economist in 1968 and it was initially adapted by the EPA to control atmospheric and water pollution. It gained unprecedented success with great economic and social benefits (Cao 2005). The USA sulphur dioxide (SO_2) cap-and-trade program has been studied extensively and has become the benchmark for evaluating subsequent ET proposals (Kruger & Pizer 2004). However, the U.S. NO_x Budget Trading Program is even more analogous to EU ETS than the SO_2 programme. Regional Clean Air Incentives Market (RECLAIM) program was designed as a market-based approach to help bring the Los Angeles basin into compliance with U.S. air quality standards, but this trading based program has illustrated the potential volatility that may arise in emission markets. Even though the EU ETS program clearly builds upon many of the lessons learned from earlier experiences with ET programmes in USA and Australia (Environmental Law Institute 2002, Farhana 2005, Tietenberg 2006), there are many potential pitfalls, e.g. the heterogeneous, multi-jurisdictional nature of the European Union, the CDM Executive Board, the NAPs etc. (Kruger & Pizer 2004).

2.2.3 Kyoto Protocol

Two major international efforts to combat climate change are the 1992 United Nations Framework Convention on Climate Change (UNFCCC, agreed upon in Rio de Janeiro), which limits the emissions of Annex I countries to non-harmful levels, and the Kyoto Protocol agreed on 1997[2], which set binding emission reduction targets to Annex I countries. According the Kyoto Protocol, which came into force in February 2005, industrial countries are obliged to reduce GHG emissions an average by 5% from the 1990 level during the first commitment period 2008–2012. GHGs covered by the Kyoto Protocol are CO_2, CH_4, N_2O, HFCs, PFCs and SF_6. The current emission reduction target is not enough to stabilise atmospheric GHG concentrations, but signals the beginning of an emission reduction process. Some industrial countries, including the USA, did not ratify the Kyoto Protocol and therefore did not commit to emission reductions. UNFCCC and the Kyoto Protocol cover energy, industrial processes, product use, agriculture, and waste sectors. Furthermore, greenhouse gas emissions and removals from land-use, land-use change and forestry categories are to be reported (UNFCCC 2002).

[2] Came into force 15.2.2005 90 days after Russia had ratified it and the cumulative emissions of the ratified countries passed over 55% of the world’s CO_2 emissions.

In the Kyoto Protocol, three mechanisms are implemented, with which the Annex I Parties can cut the cost of meeting emission reduction targets by reducing emissions or increasing removals in other countries, where it is more cost-efficient. The three available mechanisms are: Emissions Trading (ET), Joint Implementation (JI) and Clean Development Mechanism (CDM), the rules of which are defined in the Marrakesh Accords (UNFCCC 2002). Under ET, emissions are traded between Annex I Parties and the basic unit for CO_2 emissions is Assigned Amount Unit (AAU)[3]. During the Kyoto period the aim is to open at least three stock exchanges around the world.

In Europe (EU-15) the Kyoto Protocol requires emissions in 2008–2012 to be 8% below 1990 levels. Under the EU burden sharing, Finland's target was set at 0%, i.e. freezing of CO_2 emission to the 1990 level. Thus, in the EU, a wide range of new policies and measures have been adopted and among them the cornerstone efforts, the European Union Greenhouse Gas Emission Trading Scheme (EU ETS).

Under the Kyoto Protocol, emissions of different gases are weighed according to their 100-year GWP values that represent warming effects of different gases compared with the warming effect of CO_2. However, this approach does not cover historical emissions and it does not explicitly take into account the slow removal of greenhouse gases from the atmosphere leading to accumulation of gases. The radiative forcing approach gives an index that takes also these effects into account (Monni 2005). The introduction of ‘hot air’ in the emission quotas of Russia and Ukraine in the Kyoto Protocol (Mortensen 2004) has been interpreted as a drawback jeopardizing the Protocol’s effect on the overall emission reductions, but Bohm (1999) sees it as a necessary action to get more reductions to be included in the system.

According to the Kyoto Protocol, at the end of a commitment period, trader countries will be accountable for having an emissions quota sufficient for covering the carbon emissions made during the entire period. An advantage with tradable quotas as an international climate change policy, in comparison to others such as international carbon taxes or harmonized domestic carbon taxes, is that individual countries can adopt policies which comply with their Kyoto Protocol commitments. Thus, they could use either a domestic tradable permit (TP) system, domestic carbon taxes or direct regulation of carbon emitting activities. According to Bohm (1999) the most efficient domestic

[3] The Law on Kyoto Mechanisms (109/2007) implemented the Kyoto mechanisms in Finland 2.2.2007.

policy to support international emission quota trade is a system of tradable permits, although perhaps not much more so than carbon taxes.

To ensure that the emission trading is undertaken successfully, its implementation is based on total emission control, certain market mechanism, and laws & regulations system (Cao 2005). The original intention of ET is to reduce emissions and achieve a coordinated development of economy, society and environment. Sceptics think that ET can reduce the polluter's motive to control pollution. Therefore, an emission permit should be a kind of private right with strong public right emphasis. A government should strengthen the macro-regulation and supervision of ET and expand the channels of public participation (Cao 2005).

Vital for the ET to be successful and effective is that has to be able to reduce CO_2 emissions. As long as large parts of the world are outside the system there are carbon leakage risks to countries which are not in the system (Fig. 3).

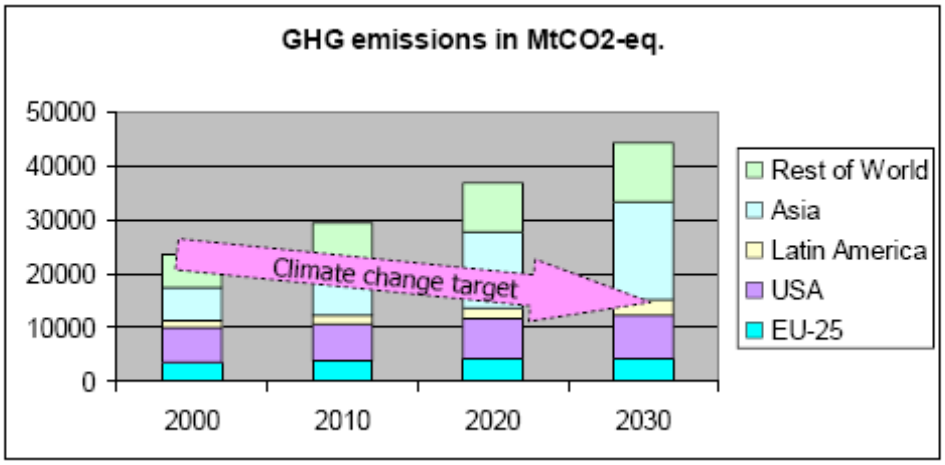


Figure 3. The trend of GHG emissions in the world in $MtCO_2$-eq. From Leskelä 2005 where referred to the EU Commission.

2.2.4 Clean development mechanism (CDM)

Under CDM, Annex I Party may conduct an emission reduction project in a non-Annex I Party[4], and use emission reductions achieved when meeting its own target. The aim of the CDM is

1. to help developing countries to reach sustainable development and the climate agreement's basic targets and

[4] Approximately 120 countries, among them Cyprus and Malta of EU countries, which have ratified Kyoto protocol.

2. to increase the flexibility and cost-effectiveness of the Annex 1 countries national obligations (Ahonen 2006).

While the Kyoto protocol bases on a cap-and-trade model for the Annex I countries, the CDM bases on a baseline-and-credit model, in which the emission allowance units are defined according to the measure and in relation to a baseline defined in advance and the upper limit of the emission allowances is not defined as in cap-and-trade system. In a CDM project the emissions have to be lower than the baseline, and the difference between the baseline and the realized emissions delivers Certified Emission Reductions (CERs)(UNFCCC 2002). One CER corresponds to the emission reduction of one tonne of CO_2. CERs can be used in EU ETS thanks to the link directive (Linnainmaa et al. 2005). Programmatic CDM has enabled the implementer to be public or private and the target to be a certain sector or some other target group. In the future, maybe also sector CDM and policy-based CDM will broaden the possibilities of CDM. In Finland a new technology programme, Climbus, aims to find and promote technological options to mitigate climate change and offers new possibilities for companies to do business (Alakangas & Jussila 2006, http://akseli.tekes.fi).

Even though the CDM has fulfilled many expectations, the mechanism has also been criticized. To define the baseline and to show the effects of the measures cause typically high transaction costs and thus, the system that is strongly dependent on regulatory framework, is not as cost-effective as a cap-and-trade system (Tietenberg *et al.* 1999). According to Environmental Law Institute (2002) credit trading programs by themselves have inherently weak environmental integrity, for example, credits can be gained from measures, which would have been made anyway. A special concern has been that the cost-effectiveness is emphasized at the cost of sustainable development (Ahonen 2006).

2.2.5 Joint implementation (JI)

Joint Implementation (JI) is also a baseline-and-credit type emission trading system in Annex I countries. It is estimated that JI projects will mainly be implemented in EIT countries (economies in transition) where cost-effective emission reduction projects are likely to be available. Emission Reduction Units (ERU) correspond to emission reduction of one tonne of CO_2. The participation criteria are tighter than in CDM. JI is not worthwhile for the installations which are in EU ETS, because EU ETS is much simpler. JI remains a possibility for such companies which fulfil the criteria and are not in the EU or for sectors outside EU ETS in the EU (Ahonen 2006, UNFCCC 2002).

2.2.6 EU emission trading system (EU ETS)

The European Union designed ETS as its key instrument to achieve the reduction target in GHG emissions requested by the Kyoto Protocol. EU ETS commenced operation in January 2005[5], based on Directive 2003/87/EC and is the largest multi-country, multi-sector transferable permit market world-wide. It is based on the cap-and-trade model with a binding upper limit for the emissions. Initially, it covered only CO_2 emissions from four sectors: production and processing of iron and steel; minerals (such as cement, lime, glass, fibre glass, or ceramic production); energy (such as electric power and direct emissions from oil refineries); and pulp and paper, but it may also include multiple greenhouse gases in the second phase of the program. The ET Directive is applied to 11,500 CO_2 emitting installations in Europe (Linnainmaa et al. 2005).

The first period of the EU ETS in 2005–2007 was an implementation and learning period of the trading mechanisms and the ongoing second period is the Kyoto compliance period 2008–2012. EU ETS intends to be a continuing process, but composed of periods (Fig. 4). A common level of penalty for non-compliance was €40/tCO_2eq for the first EU ETS period and €100/tCO_2eq for the second period (2008-2012). These penalties aim to be well above the allowance prices. In addition, there is a requirement to offset, i.e. pay for the excess emissions in the following year (EU COM 2003). Member states can optionally auction up to 5% (during period 2005–2007) or 10% (during period 2008–2012) of allowances. Banking and some degree of borrowing are possible within any phase. Banking between the first two phases is allowed in principle, but it is up to each member state to decide, whether and how this will occur[6]. Member states must allow banking from the second phase (2008–2012) and thereafter to any subsequent phase (EU COM 2003).

In the EU's National Allocation Plan (NAP) process, there are three decisions that must be made more or less simultaneously by each member state:

1. How much of a member state's Kyoto target will be given to the sectors participating in the ET program ("cap within a cap"). This also determines how much the non-capped sectors will contribute in meeting the national target (Harrison & Radov 2002).
2. How to set allocations for each of the sectors involved in the trading system.

[5] Some EU countries had difficulties in getting the legislation and registries ready for the 1st ET period. The ET market started before the EU ETS (www.pointcarbon.com). NordPool was one of the first stock exchanges to be opened 2005.

[6] No member states proposed banking between the first and second phases.

3. How to distribute allowances to firms.

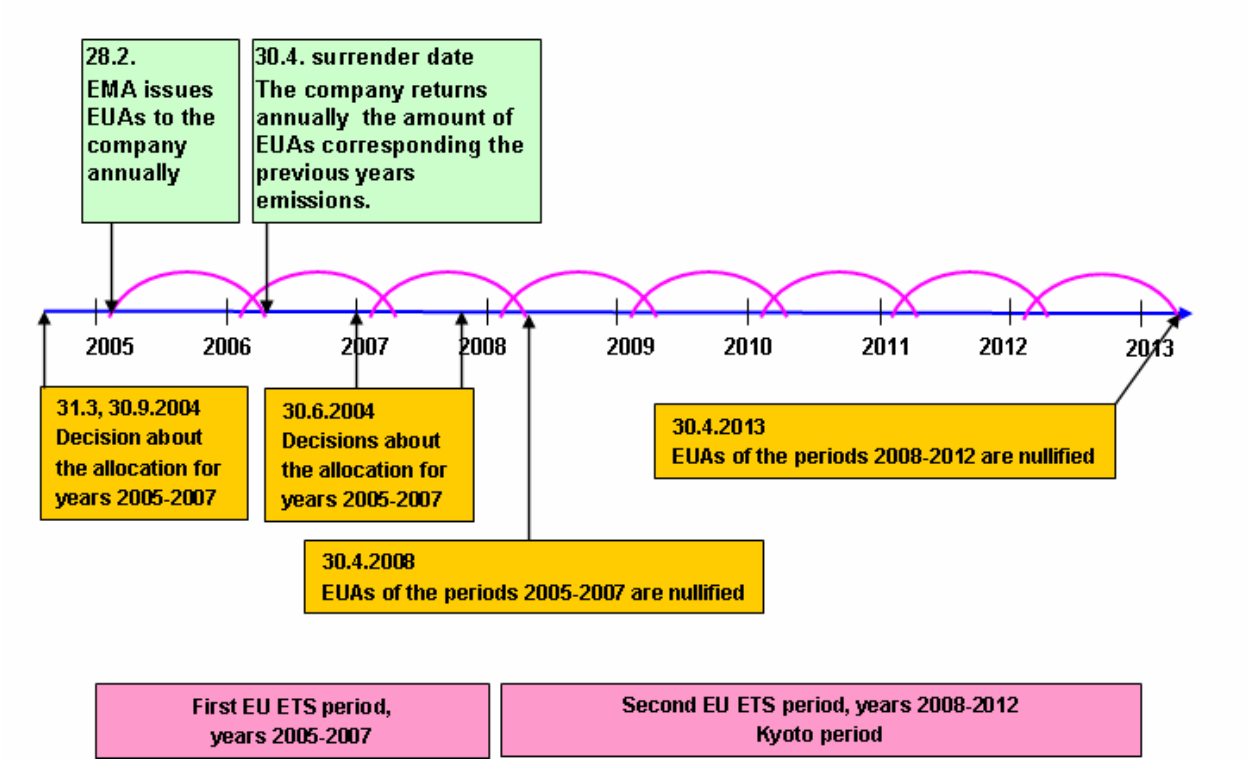


Figure 4. Schedule of EU ETS operations in Finland. Redrawn from Leskelä 2005.

Because different allocation approaches (e.g. based on historic data or updated over time; based on emissions, production, or fuel use; take into account early reductions etc.) create winners and losers, allocation is a political as well as a technical decision (Kruger & Pizer 2004). The EU Commission accepts or rejects the NAPs and the member states (MS) make the final decision. Almost all the MS had to make changes to their initial suggestions of the NAP for 2008–2012. Finland had to reduce the total emission limit with 5.2% (to 37.6 $MtCO_2$/year; for the whole period 187.8 $MtCO_2$; www.tem.fi) and make some other changes. The United Kingdom's own plan was closest to the Commission's suggestion.

EU ETS has been mentioned as an effective steering mechanism with the following advantages:

- cost-effectiveness
- flexibility
- effectiveness in reducing emissions
- a clear incentive for the companies to act
- gives a longer term security for the companies

- inexpensive for the governments and demands only little administrative resources (Leskelä 2005).

The European Commission has conducted a web survey on stakeholders' views about the EU emission trading scheme from June to September 2005 (EU Commission 2005). The risk management practises used have mainly concentrated on minimizing the impact of the EU ETS on companies, and on following a few of the basic compliance strategies – EU allowances (EUA) trading, internal abatement, and investments in emission reduction projects or carbon funds – available (Lappalainen 2006). In a real option analysis for GHG trading Sarkis and Tamarkin (2005) implied that the policy makers may need to set more stringent regulations to bring about the desired result.

2.2.7 EU ETS in Finland

In Finland, there are two EU ETS authorities; The county government of Ahvenanmaa being responsible for 5 installations and the Energy Market Authority (EMA) being responsible for about 600 installations (<2% of all the installations in EU ETS). The issuance of permits lies with the Energy Market Authority, which is also an emission registry authority. The monitoring and reporting of emission data are essential parts of the permit process and the control of ET, which is based on the Commission Decision 2004/156/EC. The third function of EMA is to control emission reporting, verification and certification of international verifiers in EU ETS (www.energiamarkkinavirasto.fi).

During the periods 2005–2007 and 2008–2012, EU ETS naturally covers in Finland, all sectors defined in the ET directive (2003/87/EY). Main sectors are energy production, ferrous metal production and processing, oil refineries, mineral industries and pulp and paper production. Opt-in power plants, which are in the same net with at least one plant with over 20 MW capacity, are also included in the ET. The directive does not cover installations burning hazardous or municipal wastes. In Finland about 60% of the economy's CO_2 emissions are in EU ETS. When issuing permits the computational emission allowances are multiplied with boosting factors[7] for industrial processes (0.91), fuel using plants producing heat and steam for industrial processes (0.86) and electricity producing peak and stand-by power plants (0.86) or with cutting factors for fuel using plants producing heat and steam for district heating or combined electricity and heat production (0.77) and power plants, which submit steam for electricity production at the same production site and the

[7] Boosting and cutting factors are shown is parenthesis.

condensing power in combined production (0.31) (www.finlex.fi). The ET directive has been enforced with Law on ET (683/2004; changed with laws 108/2007 and 1468/2007). Finland's NAP for 2005–2007 was 136.2 $MtCO_2$ making about 45.4 $MtCO_2$/year and for 2008–2012 it is 187.8 $MtCO_2$ making 37.56 $MtCO_2$/year (17.3% reduction from the previous period; www.energiamarkkinavirasto.fi, www.tem.fi).

The GHG emission permit demands the companies to return in the end of year the same amount of emission allowances (EUA) as they have CO_2 emissions. One EUA equals one tonne CO_2. The installations have also an obligation to monitor, report and validate the emissions. The permit does not set any limits to GHG emissions.

Among the instruments which Finnish government uses to steer citizens and companies to act environmentally friendly and to reach the Kyoto target are environmental taxes on fuels, energy taxes for electricity and fuel production and subsidies for investments in environmentally friendly energy[8].

2.2.8 Finnish greenhouse gas emissions

According to Statistics Finland[9] in 2007 GHG emissions in Finland totalled approximately 80 Mt CO_2eq, which is 13% more than in the base year of the Kyoto Protocol. Under the Kyoto Protocol, the base year for Finland is 1990, with the exception of so-called F-gases (HFCs, PFCs and SF6) for which the base year is 1995. In the base year, GHG emissions in Finland totalled 71 Mt CO_2eq. The Kyoto Protocol obliges Finland to keep emissions at the base year level over the 2008–2012 period making altogether allowable 355 Mt CO_2eq (Statistics Finland 2007).

In 2006, emissions increased by 16% from the year before when they were lower than in the base year. The largest amount, or approximately 80%, of all emissions in Finland is generated by the energy sector. Emissions from this sector have varied considerably from one year to the next due, among other things, to the availability of hydro power and fluctuations in net imports of electricity (Statistics Finland 2007).

[8] In UK there is a Climate Change Levy package, which includes a tax on energy use for business accompanied by a 0.3 % cut in employers' national insurance (Havard 2007).

[9] Statistics Finland acts as national inventory authority under UNFCCC.

Emissions have shown a rising trend of approximately 0.4 Mt CO_2 growth per year. For the past five years, emissions have exceeded the Kyoto commitment by an average of 10%. The main contributors to the excess are the energy industries with approximately 74% growth and transport with around 13% growth in emissions relative to the base year level. Emissions from industrial processes (up by 6%) and emissions of F-gases - eight-fold compared to the base year - have also grown but their impact on the growth of total emissions is smaller (Fig. 5). Emissions from agriculture (-22%) and waste management (-38%) have decreased significantly from the base year (Statistics Finland 2007).

The aforementioned total emissions and the assigned amount under the Kyoto Protocol exclude the emissions and sinks of the land use, land-use change and forestry sector. In Finland, this sector has been a net sink throughout the period 1990–2006 amounting to approximately -33 Mt CO_2, which is over 40% of Finland's total emissions. Furthermore, wood products have been a small carbon sink in Finland with an average of 0.8 Mt CO_2eq per annum (Statistics Finland 2007).

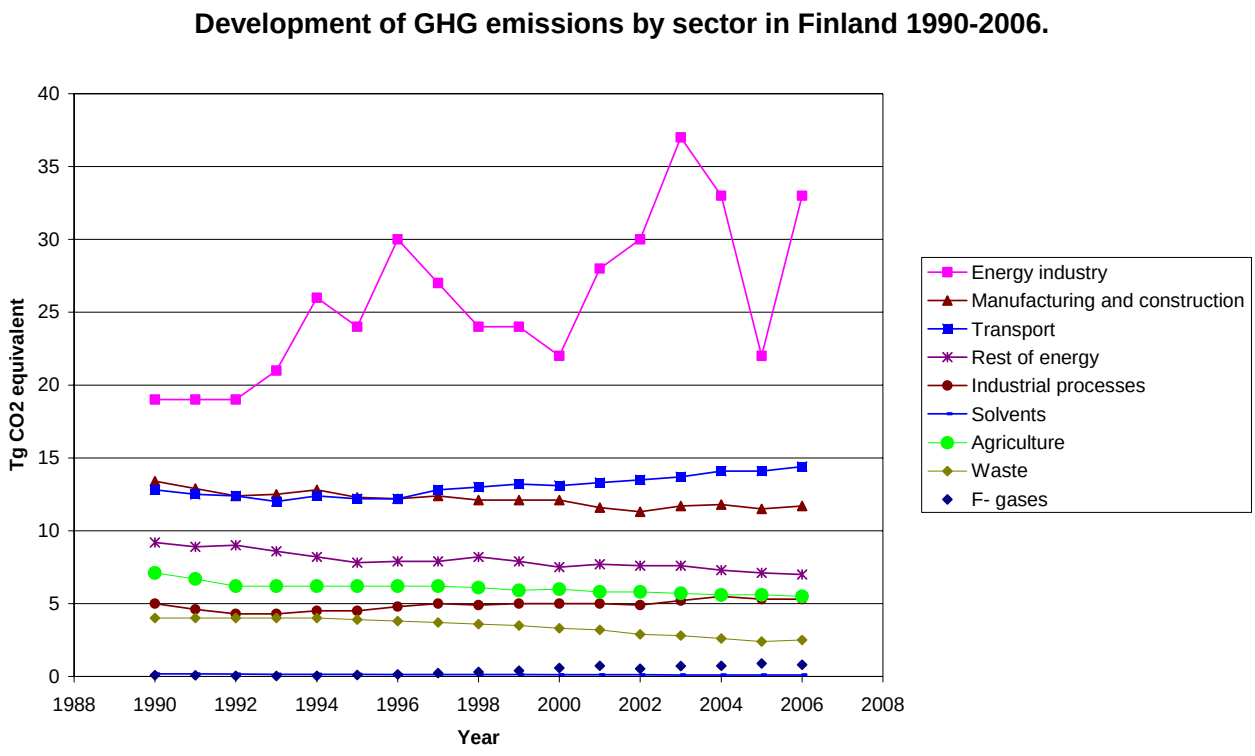


Figure 5. Development of GHG emissions in Tg CO_2eq by sector in Finland 1990-2006. Drawn based on a table of Statistics Finland 2007.

Finland's share of global greenhouse gas (GHG) emissions was assessed for the period 1990–2003 in Monni's Doctoral dissertation (2005). Finnish GHG emissions in 2003 were 86 Tg CO_2eq (95% confidence interval 82 – 92 Tg CO2eq), which represents a 0.2-0.3% share of global emissions. In

the same year, Finland's share of global population was 0.1% and share of global GDP 0.4%. The warming effect caused by Finnish emissions from 1900 to 2100 was also assessed. The radiative forcing caused by Finland will increase from 3 mWm^{-2} in 1990 to 6-11 mWm^{-2} by 2100, depending on emission reduction strategies applied, and technological development. In 1990 Finland's share of global radiative forcing was estimated at 0.18% and by 2100 it will decrease to 0.13%, due to increase in global emissions. The results revealed that Finland's share of radiative forcing was smaller than the share of emissions. This was due to Finland's relatively short emission history (Monni 2005).

2.3 The effects of EU ETS on companies

ET impacts many actors in companies, the acting management, line organisation, owners of the company, customers and competitors. ET effects even such enterprises, which are not directly under the EU ETS. When firms start to operate in new ET markets, they require knowledge and anticipation of future developments of trading markets and especially emission allowance prices.

According to Leskelä (2005) ET is not primarily an environmental issue for the company, but a matter of profitability, risk management, ability to utilize new business opportunities and a new positioning in the market. The strategy of the company has to be re-evaluated in the light of a new business environment. The challenge for a company is to find out the own position in respect to emissions and emission allowances. What are the possibilities to reduce emissions? How will the production costs increase and what are the alternative choices? The company’s new position in the markets in relation to competitors and a new product range, pricing, strategic choices have to be defined. Risk management of ET includes the fluency in arranging the emission permit, allowances and trading, monitoring, reporting, validation and also considering protection and current commitments. It also reflects the changes in asset management. ET has to be included in the investment plans of the company (Leskelä 2005).

2.3.1 Impacts of EU ETS on Finnish companies

Koljonen et al. (2004) estimated the impact of the ET on the energy sector and steel industries in Finland. The effect of the emission allowances price level of €5–30/tCO_2 increases the average price of electricity in the Nordic electricity market during 2006–2010 by €5–20/MWh, when examined using a model created at the Technical Research Centre of Finland. The real market prices may even

be higher than the calculated ones, because of long dry seasons or other consequences. The results indicated that the market price of electricity correlated with the allowance price nearly linearly, even though the EUAs were allocated without cost for the companies during the first ET periods. A similar kind of an increase in electricity price was found already 2003 by Eletrowatt-Ekono in a report ordered by the Ministry of Trade and Industry. A simulation model of the ET market predicted the paths of emissions of the electricity market and compared resulting demand with the amount of allocated allowances. Ollikka et al (POMAR/MARMET 2007) could predict a significant surplus of allowances in the first trading period and the consequent drop of the price of the first phase EUA towards zero during 2007. The predicted price collapse took place in spring 2007.

Koljonen et al. (2004) estimated that reducing GHG emissions to the Kyoto target level with ET would cause direct additional costs of €150–380M for the years 2008–2012 depending on the allowance price level and the hydrological year (and with a remarkable uncertainty). Purchasing of allowances will be changed to selling at the allowance price level of €15/tCO_2 starting from separate electricity production. The results also indicated that there would not be remarkable changes in fuel consumptions at the allowance price level of €15-20/tCO_2. However, the replacement of peat with wood starts to be cost-effective already with the allowance price of €5/tCO_2. At somewhat higher allowance prices coal is replaceable by natural gas. Furthermore, recycled fuels are cost-effective choices at quite low allowance prices. The scenarios showed that the reductions of emissions were gradual through the whole scenario period and based on fuel switching, energy saving and increased combined heat and power (CHP) and wind power (similar results also in Eletrowatt-Ekono 2002). In the scenario with the allowance price of €30/tCO_2, it seemed profitable to build one condensing natural gas power plant in Finland before the year 2010. Otherwise, a significant increase in the capacity of electricity production does not seem likely, if the price level of electricity remains low. In general, early emission reduction actions reduce the need for buying EAUs. In a longer term Koljonen and colleagues (2004) suggest that low carbon materials, the effects of carbon sinks and recycleability of the materials and new technologies and services are issues, which would provide possibilities for reducing GHG emissions. Eletrowatt-Ekono forecasted (2002) that the EUA prices around ten euros would be able to lead to CO_2 emission reductions, but prices over €20/tCO_2 would be needed to the national commitments to be fulfilled. Similarly, Ruokonen (2004) anticipated that allowance prices less than ten euros would lead to increasing use of coal and only prices higher than €10 would encourage to use renewables in the case of auctioning of allowances. In the heating of households the demand of biomass, geothermal power and solar energy is likely to increase.

A company is prepared for various situations and acts in such a manner according to ET strategy, that the liability costs caused by ET would be manageable and minimized. Abatement strategies could prove economical, if the market prices of allowances are at higher levels than the marginal costs of emission reductions. How the ET impacts on the companies' total profitability, is a question, for which there is no simple answer, but it depends on various issues, such as allowance allocation for the installations and competitors, the market prices of fuels, taxation, the evolution of ET in the near future and the companies' measures and investments to reduce emissions and their actions on the ET markets (Koljonen et al. 2004).

Ollikka et al. (POMAR/MARMET 2007) used a Cournot approach to model the Nordic electricity market. The results implied that a potential for market power does indeed exist in the Nordic electricity market, particularly during situations of scarce capacity in winter time (very low price elasticity), when the dominant firms may raise the price of electricity significantly above competitive levels. Thus, the concern over an imperfect electricity market combined with emission trading is justified. However, it must be born in mind that the results depict the extreme case of market distortion and do not consider all factors, e.g. the reservoir role of hydro power.

2.4 Carbon funds as companies' and governments' joint ventures

Governments and companies have invested funds in carbon finance facilities which purchase AAUs, ERUs and CERs and enable countries to respond to the Kyoto commitments. Finland has invested funds in the World Bank's Prototype Carbon Fund (PCF), the EBRD's (European Bank for Reconstruction and Development) Multilateral Carbon Credit Fund (MCCF), the Asia Pacific Carbon Fund (APCF) and the NEFCO's the Baltic Sea Region Testing Ground Facility (TGF).

Of the Finnish companies at least Fortum Ltd. and Rautaruukki Ltd. have invested in World Bank's PCF. Several Finnish companies (e.g. Fortum Power and Heat Oy, Gasum Oy, Keravan Energia Oy, Kymppivoima Tuotanto Oy, Outokumpu Oy, Vapo Oy) have invested in the Baltic Sea Region TGF. As a fund manager acts the Nordic Environment Finance Corporation (NEFCO), an international financial institution with wide experience of financing environment and energy projects in the region. The aim of this carbon fund is to stimulate an early follow-up of the Kyoto Protocol and to help the countries of the Baltic Sea Region to position themselves favourably in respect of fulfilling their own commitments under the Kyoto Protocol. (http://www.nefco.org).

The Finnish Carbon Procurement Programme (Finnder) is searching for eligible CDM and JI projects and aims to purchase carbon credits (CER or ERU) generated by these projects on behalf of Finland. Overall, Finland aims to acquire 12 Mt CO_2eq via the Kyoto mechanisms for the Kyoto Protocol's first commitment period 2008–2012. Finnder is administered by the Finnish Ministry of Employment and the Economy in collaboration with the Ministry for Foreign Affairs and the Ministry of the Environment. The Finnish Environment Institute (SYKE) acts as a consultant in providing support services, such as project identification and project cycle management, to the Ministries. Finnder is the successor to the pioneering Finnish CDM/JI Pilot Programme, which was launched in 1999 and ended in early 2006 when Finnder took over as the new Finnish Carbon Procurement Programme. Nine contracted bilateral projects together with investments in two multilateral carbon funds (PCF and TGF) will deliver approximately 2 Mt of carbon credits for Finland (www.ymparisto.fi).

2.5 Corporate social responsibility

The CSR is a multi-layered concept, which can be differentiated into four interrelated aspects – economic, legal, ethical and philanthropic responsibilities as presented in a model by Carroll (initially 1979, modified 1991; referred from 1999; Fig. 6). The economic and legal responsibilities are required by society and properly functioning business is seen as a basis for subsequent responsibilities. Ethical responsibilities mean that a firm does what is right, just or fair. Philanthropic responsibilities include a corporation’s discretion to improve the life of employees, local community, e.g. charity donations. Corporate social responsiveness refers to the capacity of a corporation to respond to social pressures and the outcomes of business commitment are seen as corporate social performance (Crane & Matten 2004, Carrol & Näsi 1997).

Outcomes of CSR are social or environmental policies, social programmes, quality assurance standards and auditing systems. They are ways for companies to communicate good corporate citizenship to the stakeholders. According to the stakeholder theory (Freeman 1984) a stakeholder is any group or individual, who can affect, or is affected by, the achievement of the organisation’s objectives. Stakeholders matter because of legal reasons and also because of economic reasons. Normative (why to take account), descriptive (how to take account) and instrumental (is it beneficial to consider) aspects can be taken to study stakeholders (Crane & Matten 2004).

Figure 6. Carroll's four-part model of corporate social responsibility (from Crane & Matten 2004).

2.5.1 CSR of energy companies in Finland

Energy companies have a crucial role in influencing the climate change and mitigating the effects. There is a lot of legislation in different countries and regulation on the EU and even at global level in the form of the Kyoto agreement. What ethical standards would be applicable to energy producers and the energy marketing companies? One starting point could be that the information given should be true. Energy sold as 'green' must really be produced in a sustainable way. Thus, the energy companies should tell, how the energy they are selling is produced and what are CO_2 emissions and other possible harmful factors. One way of doing this is producing standardised reports.

CSR reporting has been quite popular among the energy companies in Finland and a guide for companies about the Corporate Social Responsibility has been published (Aho et al. 2001). One basis for this had been the European Commission's report Promoting a European framework on Corporate Social Responsibility (ECOM 2001), which has after that evolved to two Communications from the Commission about CSR (ECOM 2002 and COM 2006).

Jutila (2007) studied whether the internet marketing of energy companies in Finland is socially responsible using content analysis (Weber 1990). She analysed internet pages of 13 Finnish energy companies, of which 12 had participated in the Finnish competition on CSR reporting during years 2004 and 2005. The internet page information of these companies was evaluated using ten categories: CSR reporting, environmental auditing, environmental policy, the method of energy

production clearly stated, mitigation measures, climate change information, energy saving instructions, energy education and energy safety considerations. The trustworthiness of the information was evaluated on the company basis in general.

All the studied companies had reported about their CSR or environmental issues and all, except two companies, had an environmental policy. One electricity retailer (E.ON. Finland) did not provide information about fuels and ways of producing energy, even though there is a law on the securing and informing the origin of electricity (1129/2003; www.finlex.fi). Some regional energy companies (Jyväskylän Energia, Turun Energia) used CSR and environmental issues in marketing very modestly, while others used them more. Eight out of 13 companies reported having an EMS. The companies usually mentioned district heating as environmentally friendly energy, if they used it. Renewable energy sources and bioenergy were marketed as not causing CO_2 emissions, but one company did not tell much about using peat (slowly renewable). Helsinki Energia focused on energy efficiency and green energy (energy penny users), but did not mention too much about producing only 6% with renewables[10]. Seven companies had conducted mitigation measures to reduce the harmful effects of energy production. All companies had energy saving tips on their net pages, except Pohjolan Voima and Teollisuuden Voima, which are mainly business to business (B-B) providers.

Fortum advertised being the most responsible electricity company in the world according to the Norwegian Bank Concern Storebrand (44 evaluated companies). Fortum PLC was indexed in 2006 in the global Dow Jones Sustainability Indexes (DJSI) -evaluation, where only two other Finnish companies were indexed. Also, in the Jutila's internet page analysis Fortum scored the most points. In conclusion, the internet pages of energy companies were quite traditional and mainly followed a responsible way of marketing. The data online appeared to be mainly accurate and reliable. The energy sector has been very active in Finland to build guidance in CSR issues. There is still need for more transparency and common standards for CRS reporting (COM(2002) 347) and particularly a need for "green products".

[10] At the beginning of 2007 the City of Helsinki made decisions to increase the proportion of energy produced with renewables.

3 Research methodology

3.1 Research rationale

The aim of the research was to study the understanding and opinions of the Finnish companies, lobbyist, politicians, administrators, scientists about EU ETS and to evaluate the success and role of ET in climate change policy. For this to be achieved, there were six objectives that were met.

The first objective was to analyse with interviews how politicians, administrators, lobbyists and scientists think about EU ETS and climate change policy and how it differs from the opinions of company representatives in the questionnaire. The second objective aimed to analyse with a questionnaire the motives, compliance strategies and measures companies have adapted in response to EU ETS in Finland and to make relevant comparisons between sectors and other company characteristics. The third objective was to analyse CO_2 emission trends, patterns and factors influencing companies. The fourth objective analysed the links between environmental management and EU ETS. The fifth objective evaluated whether EU ETS is an effective and efficient system and whether it really leads to CO_2 reductions and is it able to do it more efficiently than other systems. The sixth objective aimed to make recommendations to improve EU ETS. These six objectives being met allowed for a conclusion to be made on the understanding and opinions of Finnish actors about EU ETS and its general success and role in climate change policy.

3.2 Research method

The research methodology bases on both positivist and phenomenological approaches, being so called triangulation, which combines both qualitative and quantitative methods (Collis & Hussey 2003). The questionnaire survey based more on a positivist and quantitative approach, while the interviews were largely phenomenolocigal and qualitative in nature. A quantitative method was suitable for the questionnaire, because it aimed to provide a picture of the whole Finnish EU ETS sector. A qualitative approach was adopted in interviews and in the string questions of the questionnaire, because it can reveal attitudes and motives, which are often important when companies make decisions about practices and future investments. This applies to the environmental management of the company and its EU ETS compliance. The qualitative data revealed insights which the literature review may not have highlighted or yet raised.

Interviews and the web-based questionnaire included both quantitative and qualitative questions, and due to a small sample size of interviews the nature of data handling was simple quantification like tabulation. However, the web-based survey (with Webropol program) produced partly quantitative data for statistical analysis. The qualitative research allows observation, real behaviour identification and open-ended sensitive topics to be explored. The findings are often relevant and applicable, but the method is very time-consuming. Disadvantages in qualitative research may be the problems of data interpretation and validity (no random sampling, very small survey samples and only little statistical testing possible). It is difficult to replicate and open to bias. The quantitative research is in many respects opposite to qualitative research. It enables random sampling, large samples, statistical analysis and rather rapid data collection. A quantitative method is unbiased and can be replicated. Cons are that it needs a good prior understanding of the topic, it is possible to miss important topics due to pre-selected questions, which may lead to limited information (Jones 2007). Combining both qualitative and quantitative methods enables both valid and reliable findings.

3.3 Research survey techniques, sampling framework and data analysis

Because there was already plenty of literature available on the topic, first, an exhaustive insight into tradable emission permit markets, their regulatory power, EU ETS compliance techniques, and the impact on corporate behaviour was produced. Then, a qualitative pilot survey was conducted by contacting about 30 persons (politicians, administrators, NGO and company representatives) with email to find out the focus areas for the research. 10 responses were received.

Carbon dioxide production and allowances of the EU ETS sector was studied using all the installations in the Energy Market Agency's data register for years 2005–2007[11]. The collection of the data from the internet page was cheap and quick. This quantitative data was analysed with Statistix (Analytical Software 2003) and SPSS and in connection to other variables (environmental management, industries sector, size of company etc.).

[11] The data for year 2007 were only available from 1.4.2008 and thus, the statistical runs and figures were first made for the data of years 2005 and 2006.

3.3.1 Questionnaire

A web-based questionnaire survey method was selected, because it is cost-effective, cheap to administer, allows a wide geographical area and quick response. The disadvantages of the technique are patchy reply, bias[12] in sample, cost of equipment and technical knowledge needed.

The questionnaire was planned to yield information about the research topic, particularly considering the objectives of the study. It was regarded important to allow for anonymity to ensure a high response rate. To enable anonymous answering exact questions about the answerer and the company were avoided, e.g. the net sales, size of the personnel and emitted CO_2s were not asked in exact numbers, but providing classes to choose. Of course this had some bearing on the analysis. Furthermore, demanding exact numbers might well have ended in unfilled questions and loss of data. Drafts of the questionnaire were sent out to 17 persons for comments and testing. Detailed comments were received from 5 persons and some general input from two. Among the test persons were an Inspector in the Ministry of Environment (Magnus Cederlöf) and the Department Head in the Energy Market Authority (Jarno Ilme). Four persons used Webropol to test answering the nearly final version of the questionnaire and recommended minor improvements, which were made.

The web-based questionnaire (Appendix 1) was planned to be directed to all the companies and installations in the Finnish Energy Market Agency's emission trading register (about 100 companies and 550 installations altogether; www.paastokaupparekisteri.fi), but because the Authority was not allowed to give out the contact information of the installations, it was searched from the European Commission's internet registry on EU ETS (ec.europa.eu/environment/ets), where the name of a permit holder (often the CEO of the company) and in addition, two names of responsible persons were given. Unfortunately, in most cases the EU Commission's registry did not provide email addresses, but in some cases it did, conveniently for me. Information was sought also on the companies' internet home pages. However, there were some installations, for which email addresses were not available. Altogether 457 questionnaires were sent out (excluding those addresses for which emails failed). To guarantee obtaining answers to the questionnaire several questionnaires were particularly sent to such companies, which had many installations in EU ETS.

[12] One issue causing bias is the fact that the answers of people can sometimes differ from the truth due to various reasons: lack of knowledge, insufficient time to check the asked information or intentional delivery of incorrect information. Thus, in addition to normal measurement bias questionnaires have an extra respondent bias. Same phenomena influences also in interviews, but to a lesser extent (cf., e.g., Groves 2005).

The questionnaire was first prepared on Excel, but then moved to the Webropol program, where some specialities like the ability to bypass such questions, which were unnecessary[13] were added. It was published both in Finnish and English and provided with explanatory attachment (Appendices 1A and B). The respondents received a personalized link, through which they could answer the questionnaire either at one sitting or using several times. In the beginning of the questionnaire period there were some difficulties and I allowed some respondents to answer through an open link (eight respondents, who could not later be linked to a company). Two respondents answered in English and 67 in Finnish. Based on the information given, answers came from at least 49 and maybe even 57 companies. Among the companies was one, wherefrom six answers were received, one wherefrom two answers came and three wherefrom two answers were gotten. Thus, it has to be remembered that a company is not represented by one answer, but due to making the language more fluent the answer and the company are still often used synonymously.

The response period was extended several times so that ultimately, it was almost three months (English version period 9.11.2007-31.1.2008; Finnish version 11.11.2007-31.1.2008.). At the end of November 38 persons had answered and five more answers came by 14.12.2007. This encouraged to keep the questionnaire open and to remind about it again at the end of December. Indeed, in January 26 answers more were received. The active public discussion about the issue from the end of 2007 up till this day may have influenced in such a manner that the general knowledge of the issue has increased during the questionnaire period, but on the other hand, considering the high knowledge of the respondents about the issue, it may not have any significant influence.

With Webropol it was possible to combine the results of English and Finnish questionnaires and produce a draft report (Appendix 2) with frequency graphs and tables for many variables. The analysis of open string variables had to be done separately and the results of numerical variables had to be checked and in some case corrected based on expert evaluation. Webropol produced an Excel results file, which was further modified, analysed and prepared for the use of statistical tests.

The numerical variables gained from the web-based questionnaire were analysed with statistical package Statistix (Analytical Software 2003) and SPSS. The used tests were Kruskal-Wallis test, two

[13] If the answer would be “no” for a question, then the next question, defining the “yes” answer would be unnecessary.

sample t-test, pairwise t-test and Spearman correlation. The string variables were analysed using content analysis (Weber 1990).

3.3.2 Interviews

Fifteen candidates for interview were contacted, and seven personal face to face semi-structured interviews were conducted. Three of the interviewees were researchers, two were politicians, both Ministers, one was an environmental agent or consultant, who had been actively working with NGOs and companies, one was an administrator in the Finnish Energy Market Authority and one was a representative of a forest industries organisation (Table 1). Several other persons and particularly industries managers were contacted, but they did not seem to consider the interview necessary after finding out that a questionnaire had already been answered by their employee. The Minister of Environment was interviewed first on 16.11.2007 and the Director of Energy and Infrastructure in Finnish Forest Industries Federation was interviewed last on 28.1.2008 (Table 1). The interviews took from 35 minutes to one and a half hours[14] and they all occurred in Helsinki on various premises suggested by interviewees[15].

The interview questions were sent beforehand to the interviewee (Appendix 3). The basic structure of the interview was the same in all interviews, but emphasis of the interview and some questions were adapted to the person's scope to the topic, the time available and the timing of interview, because a lot happened in the climate policy between the first and the last interview. This was regarded as a reasonable and rich way of collecting data[16]. The aim of the interviews was to synthesize opinions and to get insights of different stakeholders about the topic. The researcher interviews attempted to get educated and broad-viewed attitudes of what is happening in the EU ETS field. Interviews allow for exploring, explaining, rich and efficient data collection, flexibility and control. However, this technique is time consuming, limited to a certain geographical area and maybe influenced by personalities and bias. All the interviewees allowed to record the interviews and none demanded anonymity. The interview questions and answers were typed and translated to English[17]. All the interviewees had a good knowledge about ET.

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[14] The time the interviewees were able to provide.

[15] It was regarded that interviewee's own surroundings were more comfortable and more efficient to them.

[16] Based on Silverman (2001) this is a positivist approach added with some freedom and common sense.

[17] All these data are available from the author both in Finnish and English.

Table 1. Background information about interviewed persons and the date of interviews. Age= age group: 1:<30 years, 2: 30-50 years, 3: >50 years. Primtype: 1= authority, 2= politician, 3= environmental agent, 4= researcher, 5= industries representative. EThisty= ET history in years.

Date	Name	Position	Genger	Age	Prim type	ET histy
16.11.2007	Kimmo Tiilikainen	Minister of Environment	male	2	2	5
27.12.2007	Jarno Ilme	Head of ET Unit	male	2	1	4
27.12.2007	Mauri Pekkarinen	Minister of the Economy	male	3	2	1
23.1.2008	Tuuli Kaskinen	Consultant	female	1	3	8
28.1.2008	Stefan Sundman	Director of Energy and Infrastructure	male	2	5	6
28.1.2008	Kimmo Ollikka	Researcher	male	2	4	3
28.1.2008	Tuula Pohjola	Docent	female	3	4	7

The qualitative parts of in-depth interviews were analysed with content analysis (Weber 1990). The quantitative and structured parts of interviews were shown in numbers, but no statistical analysis was conducted due to small sample size. The results of the questionnaire and the interviews were mirrored to each other.

3.4 Resource implications and limitations

The research demanded resources such as a computer (enough computing power), email, phone, Webropol, Statistix (Analytical Software 2003) and SPSS. All the interviews occurred in Helsinki, which meant travelling and some costs. The researcher had to be able to use library sources and use statistical program. Also intellectual and language skills and hard work were needed. The time table of the research was presented in the research proposal and during the research a diary was kept.

In-depth interviews gave rich information, but it was not possible to interview the company managers. The recipient group of the web-based questionnaire was initially known to be somewhat small for quantitative sampling, and the difficulties in obtaining email addresses made it even smaller. Furthermore, the response rate ended up quite low. In the short time frame it was not possible to include companies from other countries, even though the questionnaire would have been appropriate. Instead the survey setting would have become more difficult due to different legislation and application of EU ETS in different countries (even though based on the same directive).

It is difficult to separate other influencing factors from the impacts of emission trading. There is a lot happening in the climate policy and it is not possible to know the situation in conditions without EU ETS. The time span of the CO_2 trading is fairly short (about 3 years) and thus, the true functioning of the system may not be apparent yet.

3.5 Research ethics

Ethical principles were adopted during planning and the process of research. Commercial aspects of some questions were considered to influence the answering of the questionnaire and for this reason it was regarded necessary to keep questionnaire anonymous, which was also communicated to the respondents in the introductory letter of the questionnaire (Appendix 1). When presenting the questionnaire results no person or company was named. Instead when using the ETA's CO_2 emission statistics which are publicly available, in the analysis some names of companies were mentioned like also in the literature review. Each interviewee agreed to the interview voluntarily and each was asked whether they wanted the interview to be anonymous and whether recording was possible during the interview. None of the interviewees wanted anonymity and allowed recording. The draft of the final dissertation was sent to the interviewees for comments. It was also sent to such questionnaire respondents, who had requested it.

4 Results

4.1 Carbon dioxide and emission allowance statistics

When studying the Finnish ETS sector CO_2 emissions, it appeared that the greatest total emissions come from heat and power production and smallest from opt-in installations. The second greatest CO_2 emitting sector is iron and steel industries and the biggest individual emitter being Rautaruukki Raahe steel factory, which emitted on average 4.8tonne CO_2/year. The next greatest emitting branches (total CO_2) are forest industries, petroleum refining, and manufacturing of cement and lime. In petroleum refining there are two installations in Finland, of which the refineries of Porvoo emit even 2.7 Mt/year.

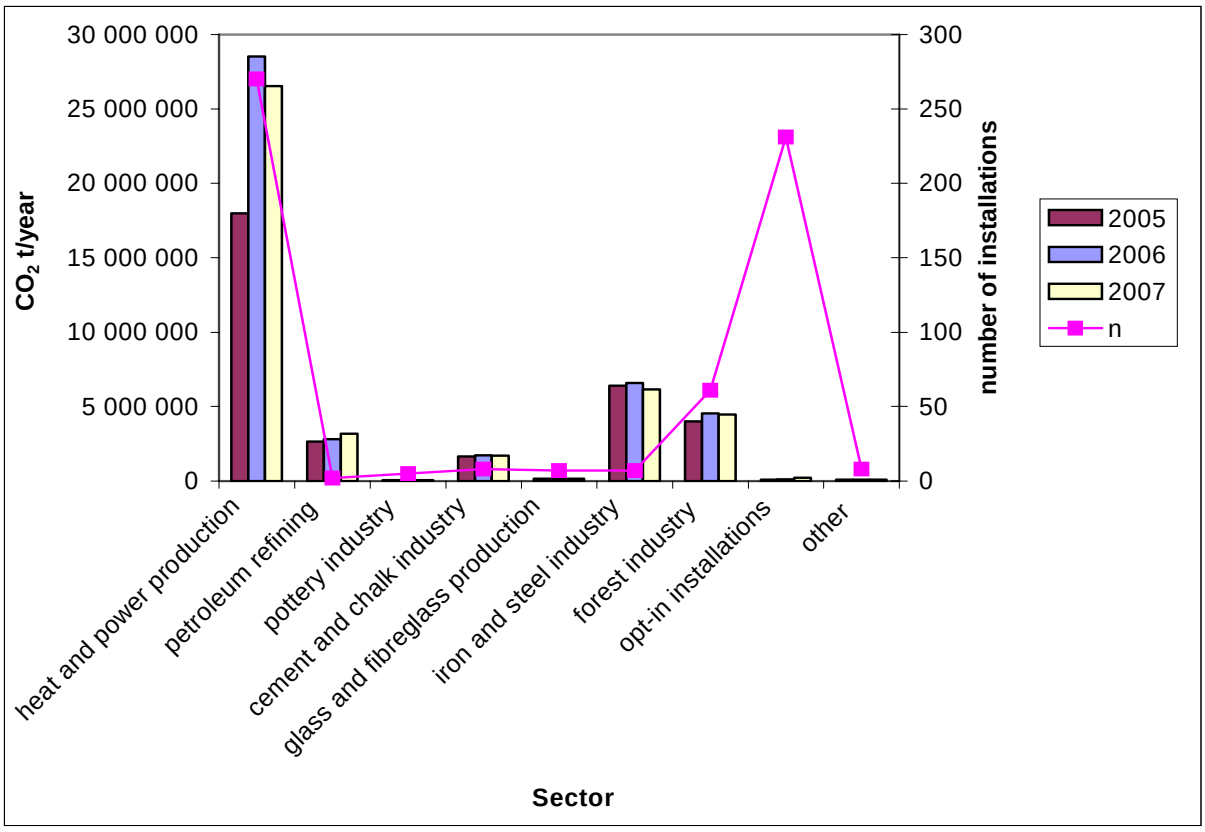


Figure 7. Annual total CO_2 emissions (t/year) and number of Finnish EU ETS installations in 2005–2007 by sector according to the EMA's statistics. Sectors are defined by the author. The number of installations is defined based on the whole period.

Variance analysis ($P<0.000$, $n=607$) showed that there was a significant difference between the unit CO_2 emissions (=emissions/year/installation) of the EU ETS sectors (Fig. 7). The unit emissions of

petroleum refining and iron and steel industries were the greatest[18], the next greatest were in the manufacturing of cement and lime, then heat and power production (without opt-in installations), and then forest industries (Fig. 9). The smallest unit emissions were from the opt-in installations (not shown in Fig. 9) and the second smallest from pottery industries, glass and fibreglass production and other (Fig. 9). When the heat and power production was combined with the opt-in installations, the unit emissions of the energy sector were smaller than in the other fields of Finnish EU ETS (Two-Sample T Test P<0.0001, n= 1767).

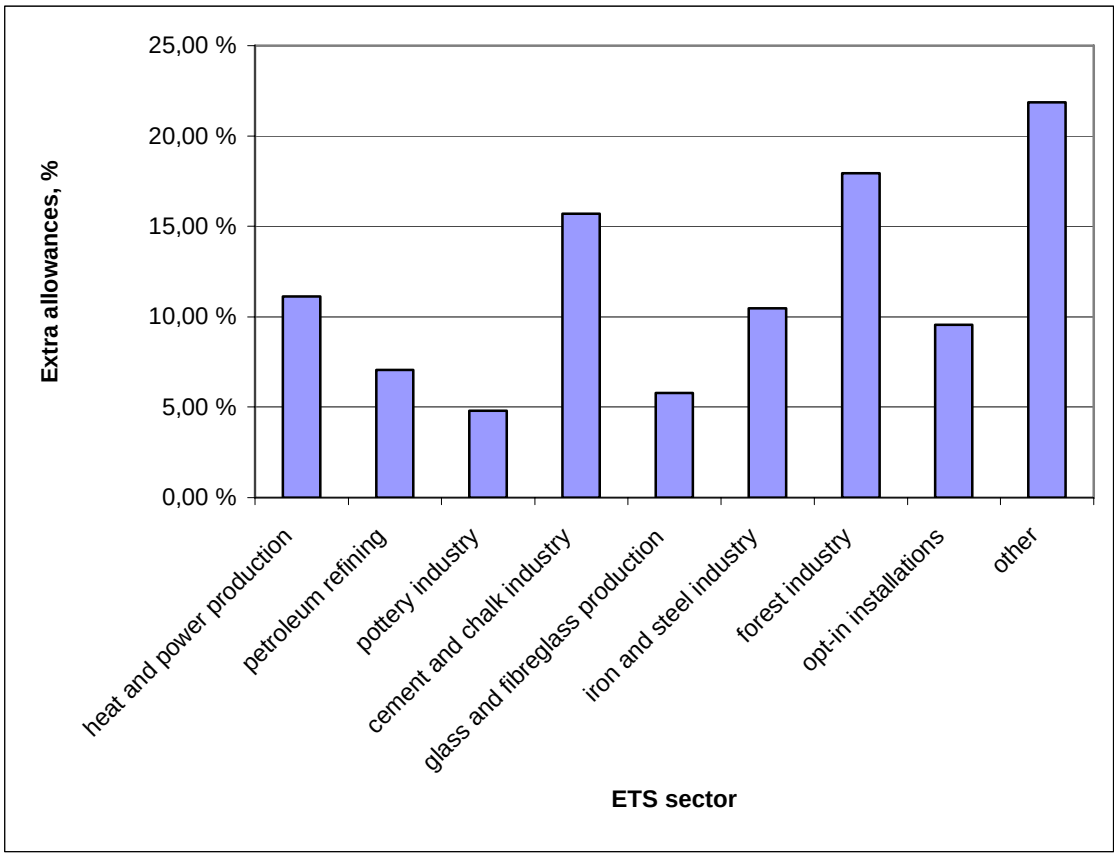


Figure 8. The extra allowances (allocated EUAs–verified emissions) in percents of allocated allowances by Finnish EU ETS sectors for the period 2005–2007 in the April 2008.

During the first EU ETS period Finnish companies were delivered 136.2 million allowances and they used 120.2 million, thus, leaving over 15.9 million allowances, which is 11.7% of the total. The free-of-charge allowances could cover the emissions of all Finnish ET sectors during the period 2005–2007, but during the last year oil refining and opt-in installations were short of some allowances

[18] This order of most to least emitting units is statistically significant and based on two-sample t-tests between different sectors.

(shortages were about 102 000 and 54 000 tCO_2 respectively). Thus, the Finnish companies were able to sell allowances and some allowances may have been left unused. In total amount heat and power production, forest industries and iron and steel industries received the most extra allowances, but in relative figures other, forest industries and manufacturing of cement and lime benefited most (21.9%, 17.9% and 15.7%; Fig. 8).

4.2 Questionnaire

4.2.1 Background information

The Webropol internet questionnaire was answered by 69 persons. The low response level (15%) was maybe due to hectic schedules and due to some other questionnaires and inquiries. Most of the respondents were men (94.0%) and the age class >50 years was most abundant (53.7%), even though the group of 30–50 years was also well represented (41.8%; Appendix 2). Most answers came from the energy sector, i.e. heat and power production (82.1%; Fig. 9), to which most of the Finnish installations in the EU ETS belong to[19]. Based on a paired t-test the number of answers in each sector and the number of installations in Finland in the respective sectors did not significantly differ (P=0.267) from each other indicating that the sampling has been representative. Pearson correlation between these variables was also very high (P=0.9938).

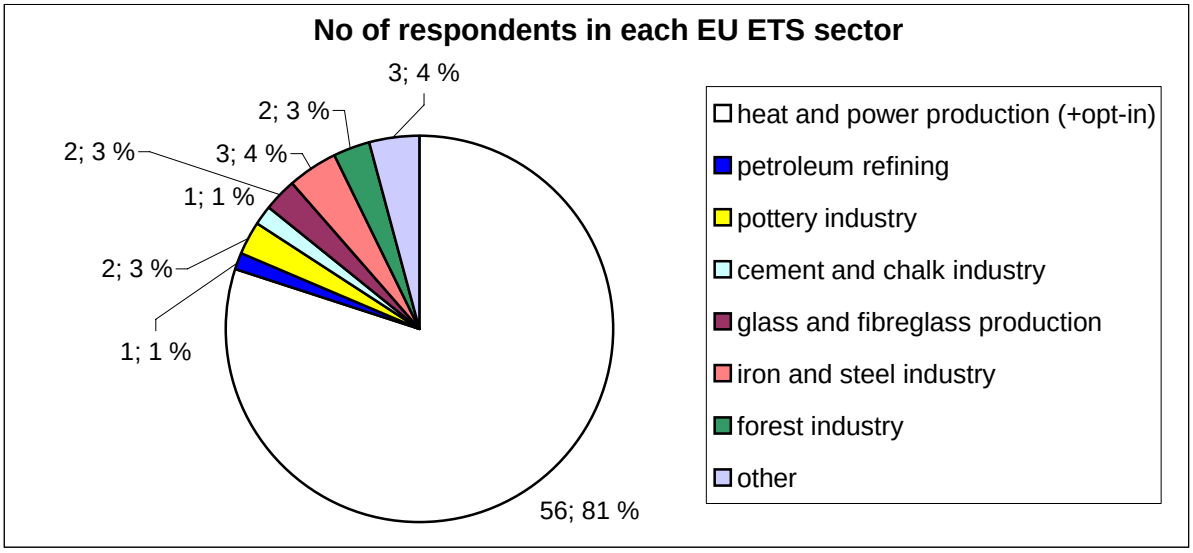


Figure 9. The number of responses in each EU ETS sector.

[19] Three respondents had selected both heat and power production and also opt-in installations. Actually also some other energy companies have opt-in installations, but did not indicate it. Because it is evident that the data of opt-in installations were not valid it was left out of the figure.

Most of the respondents represented an organisation with an annual turnover of less than €500M (82%; Appendix 2). The companies of the energy sector had significantly smaller net sales than other sector companies (two-sample T-test, n= 57, P<0.001). This was also true when the municipally owned energy companies were excluded from the analysis (two-sample T-test, n= 39, P<0.0123). Three companies had a turnover of over €5000M. Most of the organisations had over 100, but less than 5000 employees (53%). Clearly, the biggest group of the organisations were limited companies (45.6%) and the second group were other organisations (29.4%), of which municipalities were prevalent (19 mentioned to be owned by the municipality and among the limited companies there were 9 companies owned by municipalities). Companies were mainly acting on domestic market (62.7%) or in the Northern Europe (16.4 %), but some of them were also global (13.4%).

Carbon dioxide emissions were mainly below 0.5 Mt/year (42.9%) according to the questionnaire and when using EMA's statistics (2005–2007) for the respondent companies the average was 477 014 t/year (n= 57; Md= 44928 t/year)[20]. Four of the companies emitted over 1 Mt/year based on the averages of the first ETS period and they presented iron and steel industries, petroleum refining and heat and power production. The emissions of energy sector were smaller than in the other fields (Two-Sample T Test P<0.0001, n= 57) and this was also true after excluding the municipal companies (Two-Sample T Test P<0.0001, n= 33). In an analysis omitting the energy sector, oil refining, steel and forest industries had significantly greater emissions than other fields (Two-Sample T Test P<0.0001, n=13; Fig. 10).

Most of the companies had 2–5 installations in ET (39.7%), but the next group was the companies, which had only one installation (25%). Five companies had even more than 20 installations. Understandably the number of installations and the annual emissions[21] were correlated on a significant level (Spearman correlation 0.4543; P<0.0001). Many companies (36.8%) anticipated CO_2 emissions either to remain at current level or increase (35.3%) during 2008–2012. Still, 19.1%

[20] Three respondents announced emissions >10 Mt/year, but based on the other information received, this was far too high an amount. After checking the average emissions of CO_2 from the emission registry (average of years 2005–2007) it appeared that in several cases the real emissions were smaller than the respondents gave. Thus, there was a need to rerun the analysis with the corrected data. However, for all the answers the exact numbers can not be found because the persons and the companies are not known. The scale used in the questionnaire showed to be inappropriate.

[21] The emissions collected from the EMA's statistics gave a significant result. The emissions reported in the questionnaire gave a nearly significant result.

anticipated reduction in CO_2 emissions (Appendix 2)[22]. In conclusion, small municipality-owned (altogether 28) heat and power plants with several installations were the biggest group in the responses, which could be anticipated also based on the all installations belonging to the ET. However, in general the companies belonging to ET form quite a heterogeneous group.

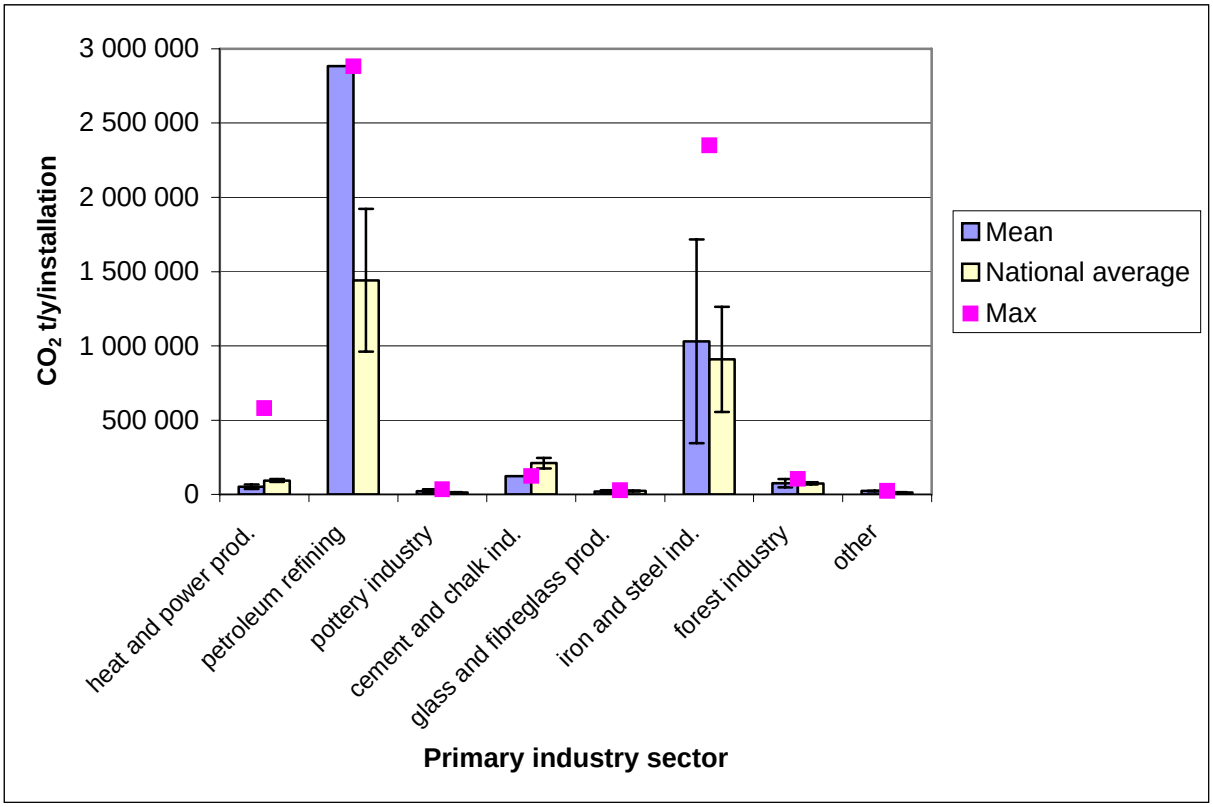


Figure 10. Mean unit CO_2 emissions in t/year/installation of the questionnaire respondent companies (n=58) and for the whole Finnish ETS sectors based on EMA's statistics for years 2005–2007. Standard errors of the means are presented with a bar and max is also shown for the questionnaire data. The letters indicate the significant differences in two-sample tests for the national data. There is no statistical difference between either the mean unit emissions or the number of installations (not shown here) in Finland and the ones in this questionnaire (Paired T-tests with opt-in installations included in the energy sector).

4.2.2 Operations and environmental management

Operations or production unit (32.8%) was most often responsible for the ET. Environmental and risk management departments (both 13.4%) were also in an important role in several organisations. Only in one case the general responsibility was with the consultant, although certainly consultant help is used in the EU ETS functions (Appendix 2). In most companies ET was a part-time task (no

[22] No significant differences were found between the sectors in the Kruskal-Wallis tests with 9 sectors, 2 or 3 sector groups.

full-time ET personnel in 81.2%) and it involved most often 2–4 persons (50.0% of the companies), but could sometimes occupy part-time even over 20 persons (apparently in cases where the company has many installations). At least one full-time employee was involved in EU ETS according to 11.6% of the answers[23] (Fig. 11).

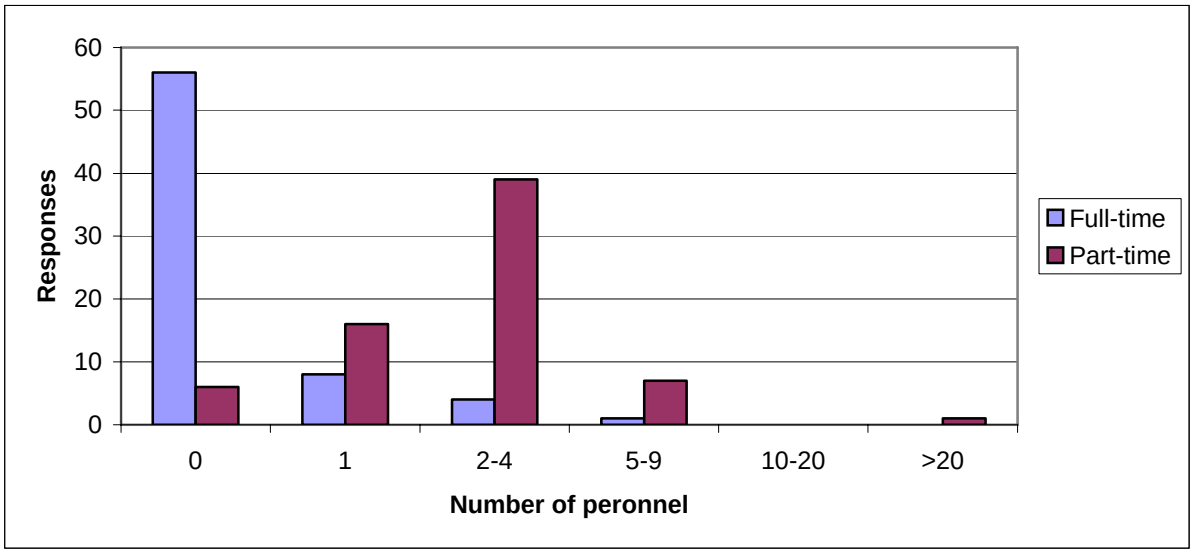


Figure 11. Number of full-time and part-time personnel dealing with EU ETS issues in companies. Modified questionnaire data.

ET was described in various ways (n=43) and the answer contents can be divided to at least to eight types: 1) buying and selling of allowances (44.2%, 24 answers), 2) allowance bureaucracy, e.g. applying for, reporting and verifying the emission allowances (34.9% and 24 answers), 3) no emission trading (1), 4) strategic approach in ET (8), 5) portfolio management (6), 6) investments in energy efficient technology (2), 7) annoyed statements like useless answering of questionnaires (2), 8) projects mechanism and coal funds in use (2).

Most companies priced in the value of CO_2 allowances (46 answers, 67.6%), but still quite many did not (22; 32.4%) and at least two mentioned that they are not able to do that (Appendix 2). Steel and forest industries did not price in at all (Mean= 2) and energy sector (Mean= 1.22) priced in more often than others (Mean= 1.56). There was a significant difference ($P<0.0003$) in Kruskall-Wallis test between these three groups.

[23] In a few smaller companies a surprisingly high amount of full-time persons was reported. The improper answers were modified and missing full-time responses were regarded as indicating 0. The results for this question are only indicative.

Fifty per cent of the responses (34) indicated that companies had an accredited ISO system, which was most often ISO 14001 (29 specified this). One company had an accredited EMAS system. Eight mentioned having an own environmental management system (EMS) and seven responded that it is included in another system (e.g. risk or environmental health management system). The greater the annual CO_2 emissions in the company, the more likely it was to have an EMS (Spearman Rank Correlations 0.5476, $P<0.001$)[24]. Companies lacking EMS (24%) were mainly (9) owned directly or indirectly by municipalities (when excluding municipally owned companies, 17.5% lacked EMS). EU ETS was included in the EMS in over half of the companies (27 yes vs. 24 no; Fig. 12). Most of the companies (55 answers; 80.9%) had not calculated their CO_2 or carbon foot print, but eight mentioned having done it and five were planning it during 2008. The companies with accredited EMSs had more likely than others calculated their carbon foot print (Spearman Rank Correlations 0.2925; $P<0.0174$)[25]. One company had counted a product life cycle already in the middle of the 1990's.

Having an EMS and producing an annual environmental report were strongly correlated (Spearman Rank Correlations 0.5964; $P<0.0001$). Almost as high was the correlation with the annual CO_2 emissions. An annual environmental report was included in company's annual report in 20 cases and in 21 it was separate from that. A few companies (4) reported about environmental issues less often than annually. EU ETS issues were included into the environmental report in 82.2% of the answers (n= 45; Fig. 13).

Many companies reported having delivered climate change and energy saving information to the clients either through net pages (43%) or marketing leaflets (35%). Some had been involved in school projects related to the topic (22%). Unfortunately, even 47% had not delivered such information (Appendix 2). The higher the annual CO_2 emissions, the more likely that the firm had delivered information through net or leaflets (Spearman Rank Correlations 0.42-0.45; $P<0.0011$, $P<0.0005$). Environmental management systems also predicted more informing through leaflets (Spearman Rank Correlations 0.3887; $P<0.0014$).

[24] Data were modified for this test so that no environmental system = 1, own environmental system = 2 and any accredited system =3.

[25] Modified environmental management data like in footnote 7.

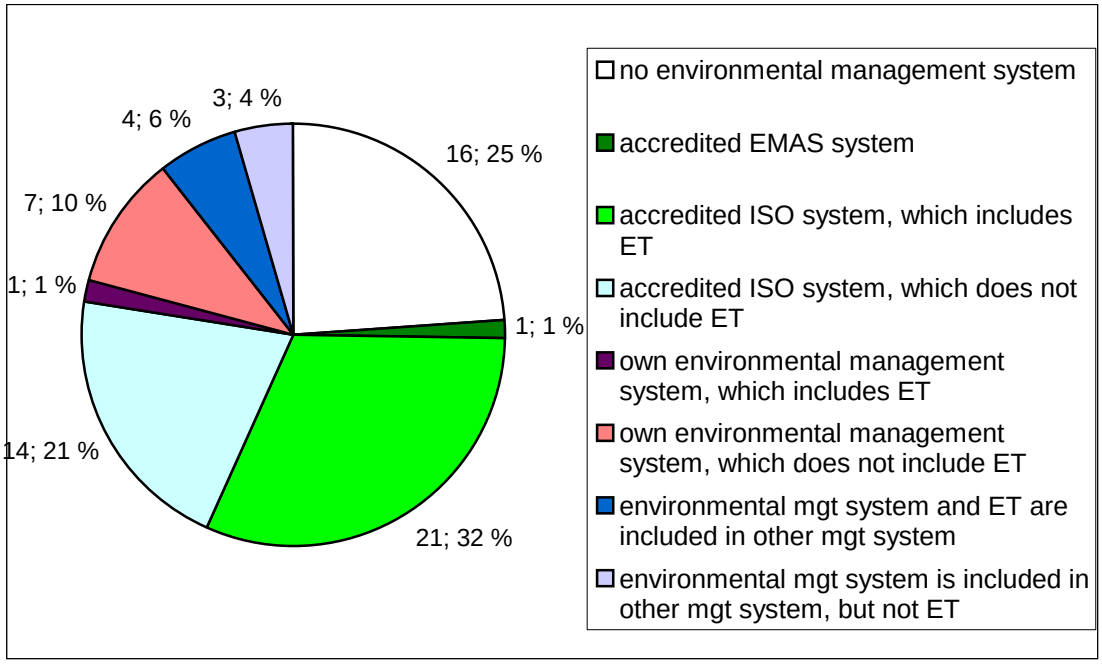


Figure 12. The type of environmental management systems and ET (frequency of responses in percents). Answers of questions 15 and 16 combined.

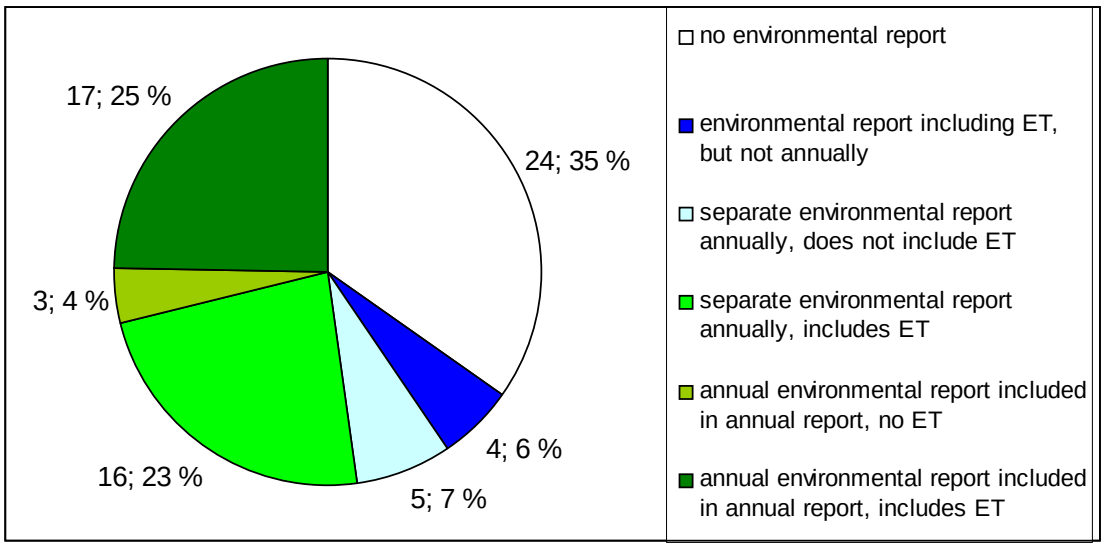


Figure 13. Environmental reporting and ET (no of responses; % of them). Answers of questions 18 and 19 combined.

4.2.3 Compliance and risk management strategies

Almost half of the responses (49.3%; n=69) indicated that companies had defined an EU ETS compliance strategy and 9 more were being prepared. Still, 35.7% mentioned lacking it. Most often the EU ETS strategy was part of a risk management strategy (14 answers) or an acquisition strategy (10), and a little bit less common was that it was part of the company's main strategy (8). Only six respondents mentioned it being part of the EMS. The top management of the company had

understandably been most often (59.1%) involved in planning the strategy. In several cases, the board of the company (25%) had planned it. The rest of the answers split between the choices. Two answers indicated the energy department to be central in the strategy development (Appendix 2).

Only some respondents described their company compliance strategy for EU ETS. The most common strategy was a simple adaptation to regulations (10 responses; e.g. taking care of obligations, following the orders of authorities etc.), which was not further elaborated. Some described the compliance strategy to be part of energy production strategy (4). Often as an aim was mentioned to reduce the use of coal or oil and thus, reduce CO_2 emissions. By this fuel selection the emissions are optimized and the costs minimized (9), and investment strategy was referred in this context (4). As replacement fuel was mentioned wastes, natural gas, wood and bio-fuels. Portfolio and risk management and a diverse electricity acquisition strategy were also mentioned in some answers. Some comments showed annoyances, e.g. “too bureaucratic”, “suffer and die”.

The company’s adopted strategy (n= 39) was totally based on economic issues according to 15 answers (38.5%), mainly based on economic issues and partly on environmental issues according to 15 answers. Six respondents indicated that economic issues and corporate social responsibility (including environmental aspects) have played an equal role in strategy formulation. Three respondents reported that CSR is even more important than economic issues in their company strategy. In 30 questionnaires this open string question was left unanswered. The municipal companies did not, maybe surprisingly, have any higher percentage of stress on CRS than the other companies. Instead, the number of company’s installations in ET and emphasis on environmental issues in strategy were positively correlated (Spearman rank correlations 0.3815, $P<0.0266$). When asked about the factors that lead to the choice of compliance strategy for EU ETS in the company, the most common answers (n=37) were dealing with the requirements of the authorities or the obligation to take part in EU ETS (9), the economic requirements (9) or risk management (5), but in general it seemed that either the respondents did not have deep knowledge on the issue or they did not want to reveal it.

4.2.3.1 Measures of compliance for EU ETS

The most common measure of compliance with the EU ETS was understandably trading EUAs (the most important 63%, the second most important 27%). Only two companies did not use it (n=67), but just adapted to the received EUAs. About 60% of the companies had used internal abatement,

which was most often indicated as the second most important measure. Carbon funds were used by 17 companies[26] and when mentioned, they were mainly regarded as the second most important measure. Twenty four respondents answered using JI or CDM[27] and marked it most often as the third important measure (Fig. 14). In question 31 respondents had to define further their usage: Nine answers reported investing in JI, six in CDM and four in both JI and CDM. Most of the companies had not invested in carbon funds (76.7% of the answers), but 14 reported doing that. In most cases the investments were smaller than €1M, but in one case it was over €10M. Eleven answers reported that the company will gain credits through CDM, JI or carbon funds in question 33[28]. Using CDM was highly correlated with using carbon funds and getting credits from them (Spearman rank correlations 0.7379, $P<0.0001$; 0.7368, $P<0.0001$, respectively). The higher the CO_2 emissions, the more typical to use CDM and carbon funds and to receive credits (Spearman rank correlations 0.3013, $P<0.0559$; 0.4677, $P<0.0023$; 0.4704, $P<0.0021$, respectively). Carbon funds and credits were also significantly positively correlated (Spearman $P<0.0001$), as was the number of installations and gained credits (Spearman $P<0.0126$).

Ten companies marked product halts as a used measure, but based on other answers it seems evident that they have been very short or restricted.

The most common ways of internal abatement were development of more energy and material efficient production processes (30 responses, 48%, n=62) and increasing use of biomass energy (29; 45% of all; Appendix 2). About 36% had also increased the use of other renewable energy sources. Some companies had increased the use of nuclear power (9 responses) and others funding for research, development and innovative technologies (6). The more installations the company had in ET the more likely it was to invest in biomass, other renewables or research (Spearman rank correlations 0.3496, $P<0.0586$; 0.4202, $P<0.0214$; 0.3951, $P<0.0314$). Even 70% (40; n= 57) reported about fuel changes either now or in future (7) in the question 27 (n=57). Energy consumption had been changed according to 12 answers considerably and in 4 answers a little and it

[26] In question 28 17 answered using carbon funds, while in question 32 the investments >€0 were indicated in 14 answers. Maybe some anticipated using carbon funds, but had not yet done it.

[27] In question 28 24 respondents indicated using CDM and JI, while in question 31 the combined amount was 23. Maybe one respondent anticipated using CDM or JI in future, but had not yet done it.

[28] Oddly, in three cases the answerer had reported credits in this question, but not indicated any method in the previous two questions.

was anticipated to change in 6 answers. In one answer the problem of verification was raised and it was claimed to lead to ending of bio-fuel use.

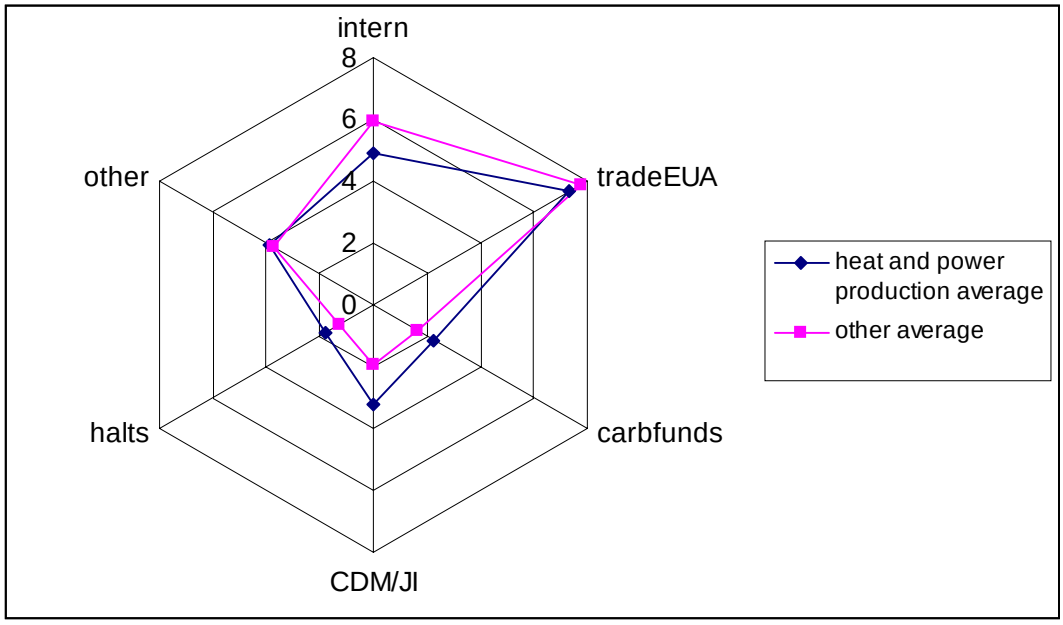


Figure 14. The importance of measures of compliance with the EU ETS divided into energy sector (n= 53) and other industries (n=14). Axes are internal abatement, trading EUAs, carbon funds, corporate internal or external CDM/JI projects, production halts and other. The bigger the value, the more important and used measure. Values were obtained from the answers (in which the numbering was to opposite direction) by subtracting from 9. Two responses with no answers were removed. The differences between energy sector and other fields were not significant according to two-sample t-tests.

Unfortunately, respondents had not answered carefully to the question 30, where it was possible to select several choices. However, it was clear that the companies had sold more allowances than purchased them (in the modified dataset 68.4%). In 18 cases the sales were even higher than €100 000, but only in 4 answers purchases were indicated being that high. 77.6% of the responses indicated only either selling or buying and the rest had done both. It seems that particularly energy companies have been able to sell allowances and big metal industry companies have been forced to buy (but this could not be confirmed with statistical tests). There is a group of firms, which have both sold and bought: 10 out of 13 companies were energy companies.

4.2.3.2 SWOT of the adopted strategy and EU ETS

Various **strengths** in a company's EU ETS strategy were mentioned and they were categorized to 20 types (Appendix 4). In six cases companies emissions were small and received emission allowances covered the need and thus, investments were small. Three mentioned an efficient emission

monitoring as strength. In seven cases the fact that ET creates a price for the carbon was indicated either through ability to move the allowance price to the product price, to make profits or to enable optimizing investments. These are indeed the same issues, which are often in theoretical literature mentioned as crucial strengths of the ET system. Three respondents mentioned as strength process improvements for energy efficiency, for energy conservation and energy use of by-products. The use of local bio-fuels, wood and wastes were seen as strengths in five answers and natural gas in one answer. An ability to use several fuels was mentioned in two answers. Furthermore, know-how, experienced personnel, risk minimization, adaptation and anticipation were mentioned as strengths.

Twenty-one respondents described **weaknesses** (Appendix 4) in the company EU ETS strategy, or actually more or less weaknesses of the system rather than the ones of company strategy, which likewise was the case in the previous question. Four wrote that the system increases the costs, when they have to buy the extra allowances. The system was seen as complicated and resource demanding (2 answers). Some responses indicated price sensitivity of the system, which can lead to losses. Short ET periods were seen as problematic, because large investments would need longer time certainty. One person mentioned the slow-motions of a big organisation, central decision making and restricted local knowledge as weaknesses in the company strategy. This may be true for many international corporations. Several respondents regarded low flexibility in fuel use and lack of innovativeness as weaknesses. Wood use as fuel was pointed out to be competitive with the raw material use and wood prices were anticipated to rise. Interestingly, one respondent wrote that the connection to the authorities was too weak.

Increasing energy costs (12 responses) and too high cost level (7) were mentioned most often as **threats** due to EU ETS (Appendix 5). This leads to a weakening ability to compete in global markets (7), where costs can not be transferred to product prices (3). Further, this can result into carbon leaking (1) and even increasing global CO_2 emission, when companies move the production to other areas (2). One respondent answered: ‘EU emission trading does not consider global competition and the effectiveness of the actors, and thus, encourages carbon leakage and can even increase global CO_2 emissions. Energy prices increase and drive industries out from the EU. This is not a threat, but realism.’ Many answers mentioned production halts and ending the production completely (5), when it becomes economically unfeasible (2). Changes in allocation plans were seen as threat particularly, if they included pricing or auctioning (5). Comments about increasing bureaucracy, speculative markets and energy related topics were also reported in this question 34. One respondent wrote: “The Kyoto period’s NAP allocation took from us a significant part of the money, which we would have

invested in renewables." Comments like this show annoyance with the system, but may also indicate lack of deeper understanding of the system.

Many **opportunities** due to EU ETS were listed (Appendix 5), of which most frequently increasing use and investing in bio-fuels, waste fuels and other renewables (10). Taking advantage of the market mechanisms by making energy saving as business, producing light, recyclable products with small carbon foot print or products suitable for renewable energy production were suggested, (altogether 6 answers). As opportunities were also mentioned the possibility to sell allowances (2) or to improve the company's image by marketing their usage of renewables (2) and developing technology (2). However, four respondents saw no opportunity at all.

4.2.4 Effectiveness and efficiency of EU ETS

ET seems to divide the opinions. There was a tie in the responses concerning whether the EU ETS leads or does not lead to emission reductions (25 vs. 25; Appendix 2). Even 18 respondents did not know how to answer. Thus, it was no surprise that also in the next question 12 many did not know how to answer, what would be the most efficient method to reduce CO_2. A mixture of measure got the most votes (13) as the most efficient method to reduce CO_2, and environmental taxes (9) and ET with national caps (8) equally popular. Even an emission permit policy had some supporters (5). A mixture of measures was explained by one respondent as taxes, global ET and development of clean technology. One answer pointed out that the whole society and not only manufacturing should be included, which idea actually is in the Kyoto commitments. Environmental taxes were considered the best, because the money would remain domestic and would not go to the pockets of speculators and polluters. Taxing would also make investment calculations easier. Many of those who regarded ET with national caps the best method, explained further that the system needs to be global to work properly. It should also be able to consider the previous investments in clean technology. Parenting, in which the biggest polluters get the most allowances, and fee-free allocation, are also problems of the EU ETS system. According to one respondent "The biggest winner on the ET is water power industries – they do not have a genuine need to decrease CO_2 in the world."

In question 39 respondents were asked to number ways to develop the EU ETS to better function in its initial purpose[29] (Fig. 15). The results clearly showed that respondents regarded as a most

[29] Some respondents had marked 1, the most important, for several statements, and this complicated the analysis.

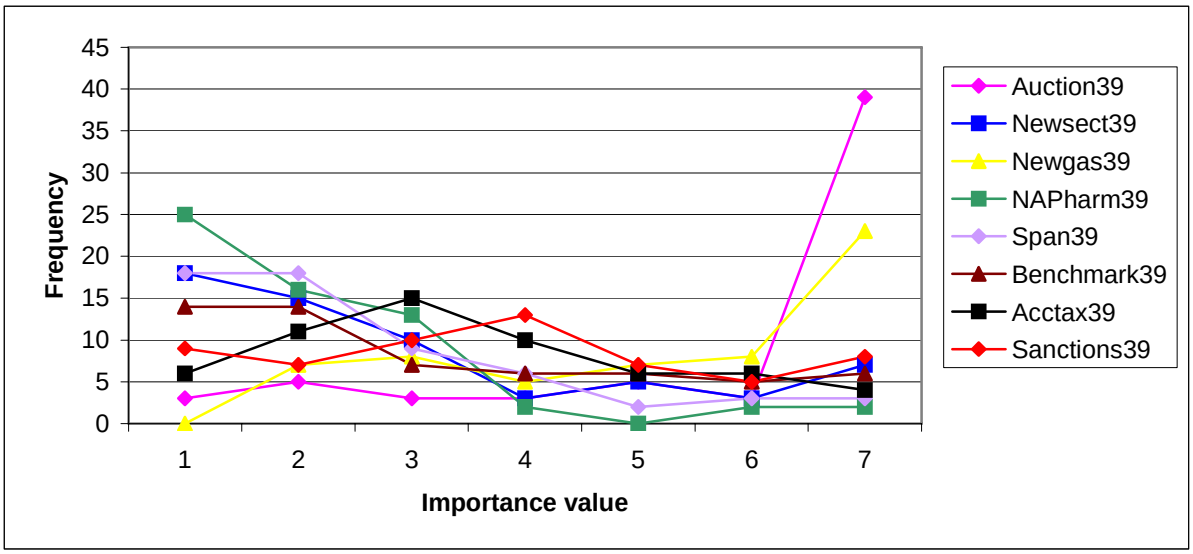
important measure harmonizing the national allocation plans (NAPs) and their basics in the EU countries (25 regarded it as the 1st and 16 2nd measure). Only two respondents would not use this method at all. A lot of support obtained also spanning EU ETS planning system further into the future (1st 19 and 2nd most important 18 answers). New sectors were demanded to be included to the EU ETS by most respondents and community-wide benchmarks were also quite popular. Instead, auctioning of the emission allowances in the beginning of the emission trading period did not get much support (64.5% would not use them) and those who regarded auctioning and also benchmarking important had also reported environmental issues being important in the ET strategy (Spearman $P<0.0193$; $P<0.0209$, respectively). Respondents were not too eager to include new greenhouse gases to the EU ETS (40.7% would not use them). Sanctioning was not among the most important measures, but still got clearly more support than objection (Fig. 15). The effectiveness of EU ETS can be further increased making it global (10 answers). If this is not possible, some answers suggested using protective tariffs. Some answers referred to sector model and benchmarking, which actually was proposed by the EU Commission during the questionnaire response period. One respondent wrote: "International information net about where and how much each installation pollutes is needed to put pressure on emphasising environmental issues."

There was a fairly high consensus that the prevalent companies should get EUAs initially free of charge (70.1%[30]; Appendix 2). Still, 17.9% would have seen the real value of the EU allowances been paid and 11.9% would like 10% of the value to be paid. One person reasoned this: "The current system bases on the idea that the amount of free-of-charge allowances is reduced constantly and thus, the emissions are also reduced and change is created. If all the emissions are priced, it only causes a fast inflation…" Another wrote that a part of the companies should have emission allowances free-of-charge, not to weaken the global competition position, but that those companies, acting in regional markets and being able to transfer the EUA cost to the consumer price, could pay for the allowances. One respondent wrote about auctioning: "If the rights are auctioned, the windfall profits increase even more and the electricity price and price fluctuation increases and nobody pays to build new maximum or reserve power or even maintain the current…". Those supporting auctioning saw it guiding more quickly to emission reductions and believed it to be fair and transparent in considering the previous actions in a meaningful way and effective in giving a clear

[30] More respondents (70%) claiming EUAs free of charge than opposing auctioning (65%) quite likely relates to the idea that prevalent companies should get the EUAs free-of-charge, but for new companies some could be auctioned.

price message,. Understandably, the support of auctioning (question 39) was negatively, almost significantly correlated (Spearman P<0.0679) with free-of-charge delivery of EUAs (question 41).

a)



b)

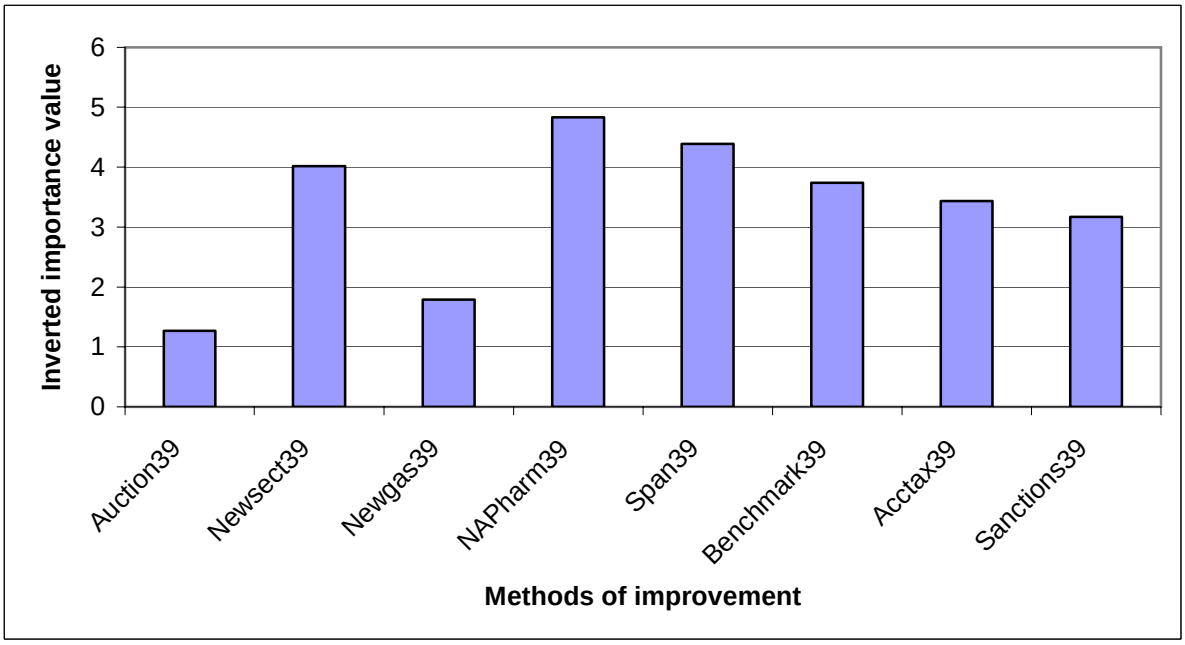


Figure 15. Favoured ways to improve the efficiency of EU ETS.

a) The frequency of importance values for each method. Frequency is the number of respondents and importance value indicates the importance from 1: very important to 6: little importance; 7 if not willing to use.

b) Average inverted importance values (7-importance value) of improvement methods.

The legend for both a and b: Auction39= in the beginning of ET period emission allowances should be auctioned; Newsect39= New sectors should be included in EU ETS; Newgas39= New greenhouse gases should be included in EU ETS; NAPharm39= National allocation plans (NAPs) and their basics in the EU countries should be further harmonized; Span39= EU ETS planning system span should extend further to the future; Benchmark39= Community-wide benchmarks should be used when allocating the emission allowances; Acctax39= Accounting and taxation policy related to ET should be harmonized; Sanctions39= Nations, which will not reach the national caps, should be sanctioned.

The inclusion of chemical industry (74.1%) in the EU ETS was most often suggested. Aviation (68.5%), transportation (64.8%) and aluminium production (66.7%) were not leaf far behind (Appendix 2). Even inclusion of agriculture was suggested by 50% of the respondents. Food industry and some other sectors (e.g. waste management areas, sewage plants, ship traffic, separate heating) got also some support. During response phase the inclusion of aviation and aluminium production for the future EU ETS became evident.

Almost half of the respondents (49.2%) agreed that EU ETS is encouraging corporate social responsibility and better environmental management, while 29.2% thought that it did not encourage. Actually quite a high percentage did not know (21.5%), maybe because the question unfortunately was contradictory[31]. The encouraging effect was mainly explained by the scarcity of allowances and increasing price, which guide to invest in less polluting or CO_2 free production (six responses). Euro is a good consultant. EU ETS encourages companies to have better information about their processes, to look at them from another perspective and to utilize customers' interests in environmental issues. Lack of fairness, manoeuvring, free-of-charge allowances, carbon leakage outside Europe and difficulties for manufacturing were mentioned to discourage. Some pointed out that the ET is just a business tool and not environmental protection. Somewhat more companies (43.9%; n=67) were involved in the creation of future climate change regulation policy than not (36.4%) according to the answers (Appendix 2). Eleven respondents indicated that this involves influencing through interest or industry groups.

When given possibility to comment on the future of different fuels due to the EU ETS, 12 respondents raised the question of peat and wanted it to be included in the renewable fuels. The use of biomass and particularly wood was seen to increase (13) and some respondents were worried about the consequences to forest industry and nature. The use of fossil fuels was anticipated to decrease, at least in Europe. Some claimed that fossil fuels use does not disappear, but they are burnt in countries outside ET. The price of fuels was anticipated to increase and some believed nuclear power to be the solution. One respondent set the following vision: "The use of fossil fuels (oil, natural gas, coal, peat etc.) is decreasing. In large coal plants the recovery of CO_2 is introduced, if there is a suitable previous mine or oil well nearby. The staple production in forest industry will

[31] Based on the next question a few do not know answers could be relocated. Three indicated noticing the contradiction, but did not divulge their opinion. It seems that most have understood it according to the first choice of the question.

decrease in Finland and pulpwood is started to be used in CHP plants for power and heat production. In sewage plants heat of the treated water is taken with pumps and directed to district heating system in a larger degree than currently. Waste burning increases. Wind power will become profitable without subsidies in the future."

Many general comments on the EU ETS or the Kyoto protocol indicated that respondents did not believe in the system: some regarded the system as inappropriate (foolish), some mentioned that it does not reduce CO_2 and many claimed that the system can not work, if it is not global. A group of comments arouse from the worry about the industry in Europe, its compatibility etc. Windfall profits, deficiencies in ET concerning previous actions of companies, parenting, verification and breaks between periods were mentioned as well. Some comments pointed out the importance of actions against climate change.

4.3 Interviews

Seven persons were interviewed, five of them men and two women. The age class 30–50 years was most frequently represented, two were > 50 years and one <30 years. Three researchers, two politicians, one environmental consultant and one administrator had an average of 4.9 years long history with ET issues (Table 1) and their knowledge on ET sector was good. Abbreviated and selected set of results of the interviews are presented in Appendix 6.

4.3.1 EU ETS and CSR

All the interviewees believed that EU ETS encouraged CSR. It was mentioned to "force companies to CSR, to be "an incentive mechanism" and just "Companies try to survive with ET".

> The Minister of Environment, Mr. Tiilikainen said "ET is not an individual target, but only a tool, with which internationally agreed emission reductions can be economically effectively targeted. It is an economically effective steering mechanism, if there are covering and tight enough emission caps: Covering in that sense that the market would be global, and so tight that it really encourages to reduce. If we have more allowances than needed, then it does not guide anywhere. The idea is to allocate scarcity in a cost-efficient manner."
>
> According to Ms. Kaskinen "Companies clearly conceive ET as part of CSR implementation and environmental responsibility. ET tightly connects to other voluntary commitments, which

companies are doing in the field of climate change. Carbon gets a price. At some point this leads to CSR. In my graduate work interview respondents perceived this as part of a long process in the mitigation of climate change."

The interviewees' unanimous view of ET as encouraging mechanism is more optimistic than the questionnaire result (50%). One reason may be that the interviewed persons were more educated about the theoretical grounds of ET and had less negative experience of it.

A half of the interviewees thought that companies have created compliance strategies for EU ETS mainly from economic starting points and a half considered them being created mainly from economic and partly from environmental reasons. The emphasis on economic issues might, thus, be slightly higher with the interviewees than in the questionnaire. Maybe it reflects the power of economy in our society.

Ms Kaskinen put it like this: "I'm not sure, if you can set the question as either from an economic or environmental basis. I see the companies operating in first hand from economic standpoints. How environmental aspects are shown depends on economic impacts. Few companies would claim to get direct economic benefit from writing a CSR report, but undoubtedly it has indirect economic benefits. In that sense, I see ET as very central, when it makes an environmental question as an economic one and creates price for carbon. If I have to choose, I would select the economic grounds. Society has to make sure that economic or legal aspects force companies to CSR. This pressure can also come directly from the consumers and then the environmental reason turns economic."

Ollikka mentioned that "Particularly energy companies, which have good understanding of the mechanism, have since liberation of energy markets prepared portfolio and investment strategies. Other sectors lag behind and it has not shown too much in their operations. I believe that forest and metal industries have tight strategies and they have thought what the ET means. Companies think about their own economic situation. The operation environment has been set up such that it is beneficial to act environmentally right."

The Minister of Environment responded "Surely, they are on economic grounds prepared. The idea of ET is that CO_2 emissions have a price. It is a production guiding cost-factor. We do not need to ask the companies, whether they want to save the world or not, or do they like hedgehogs or flying squirrels. An instrument has been made for the daily decision-making in

companies, which from the standpoints of a company would guide to a better environment, without the company having to make an intentional decision that it wants to act environmentally responsibly. Despite the values or the products of the company, the economic steering should lead to a good situation for the environment."

Some interviewed persons (2) considered companies to deliver enough information, but even they mentioned that it is another issue whether this information is the right kind or whether people are able to use it. Other interviewees (3) would like to see companies delivering more information and also anticipated that more will be available quite soon. The quality of information was pointed out to be crucial. There is not enough information available about what the companies have in concrete terms done, how they save energy, how they mitigate climate change.

Some of the interviewees commented the question of green wash in information delivery: Whether a company is trying to uplift its image or whether it has real ambition to mitigate climate change. Image was considered important.

Ms Kaskinen elaborated this topic in more detail: "Green wash? It is a two-sided issue. A good example is Vattenfall's global initiative to reduce emissions. It is very significant that the companies figure out, how to solve the problem and on what time scale. It shows that the company has invested a lot, people have been discussing, writing papers and formulating ideas and I believe that such processes influence, what the company does. More problematic it is in relation to the individual consumers. We still have a system that a consumer has not enough information, when he buys energy. The electricity provider has only seldom been changed and even more seldom due to environmental reasons. It tells that the companies do not have a real incentive to market products, which are clean and of which they can communicate with sincere eyes. Thus, customers' disbelief. They may have a climate change slogan on the net page, but when you look at the product assortment it is more difficult to select."

4.3.2 Measures of compliance with EU ETS

All the interviewees except one believed that trading EUAs was the most important measure of compliance with the EU ETS. One regarded as the most important measure internal abatement, which was in general regarded as the next important measure. Carbon funds were regarded only a slightly more important than CDM and JI. CDM, JI and carbon funds were seen increasingly important particularly in the future, because in this way the developing countries can be included in

the same system. However, some respondents worried about the rules of projects, which currently are too loose to ensure sustainable development targets. None of the interviewees believed companies having used production halts. The answers of interviewed persons and the questionnaire results, thus, showed a very similar picture about the compliance measures with the EU ETS.

Interviewees considered companies having implemented internal abatement firstly by developing more energy and material efficient production processes and secondly by increasing the use of biomass energy. Increasing the use of other renewable energy and nuclear power were believed to be somewhat less important. Two interviewees regarded R&D funding having some importance. The interview and questionnaire results were mainly similar, except that in interviews nuclear power was regarded more important than other renewables and in the questionnaire the other way around.

> Director of Energy and Infrastructure Sundman explained: "By-flows are utilized. The use of forest logging waste has been increased and investments in combined heat and power (CHP) plants have been made in seven towns. In Finnish forest industry electricity acquisition structure is very low-emitting. There is a lot of nuclear and water power."
>
> And it has to be remembered that it is quite difficult to separate the impact of EU ETS from other factors as Ms Kaskinen mentioned: "…None of these has been done solely because of EU ETS…"

The interviewed persons either believed that companies price in the allowances (3 persons) or try to do it (2 persons), but if they are in a global markets they may have difficulties in doing that. Mr Sundman responded that pulp and paper industries can not price in. Thus, the results of the interview and questionnaire were pretty similar. Interviewees also believed that Finnish companies had sold more allowances than bought during the first EU ETS period. Two of the interviewees saw ET more as an opportunity than threat to Finnish companies.

> Researcher Ollikka said: "It is sure that climate change policy is here to stay. It is something that should be looked at more as a challenge than as a threat. It is a bad strategy if it is taken as a threat." Two persons acknowledged it being both a threat and an opportunity. The Head of Unit Ilme pointed out: "It depends on the company. There have even been such companies, which have wished to be included in EU ETS. They have had an ability to take bio-fuels into use and get emission reductions and in this way, EUAs to be sold. Other companies have seen it as a threat. The readiness to create emission reductions influences whether the company sees it as a threat or as a possibility." One interviewee mentioned that "at least the companies regard it as a huge threat".

4.3.3 Effectiveness and efficiency of EU ETS

Most of the interviewed persons believed that EU ETS leads to CO_2 reductions during the Kyoto period, when tighter emission caps come into force. Thus, there was a clear difference to the answers in the questionnaire, in which only a half believed EU ETS to lead to emission reductions.

> However, Sundman was sceptical whether it mitigates climate changes: "In Asia emissions increase in two years as much as the total emissions of Europe are now. International negotiations are the key. Somebody has to give an example. Hopefully in the long term it could be said that EU ETS has influenced the climate change: Example has lead to others coming on board. ET, in general, as a steering mechanism is efficient: You form a bubble and decrease it and the installations are inside. If the bubble would cover the whole world, then it would work."

> The Minister of Environment pointed out: "ET as such does not lead, but it is a central tool, with which the agreed emission reductions can be targeted. In that sense ET leads to emission reductions, that when there is a measure, it helps in agreeing on binding emission reduction targets…We know that the system is still deficient, but it can be developed. It has not absolute value, but instrumental value."

Three interviewees estimated that the most efficient methods to reduce CO_2 is ET with national caps and two evaluated it to be environmental taxes and two suggested the mixture of measures, which was the most popular method according to the questionnaire. The difference between the interview and questionnaire results might be because the interviewees were more committed to the ET system and saw the other choices as more theoretical.

> According to Ollikka: "The best measure to reduce CO_2 would be a global, at common level set environmental tax, but it has proved to be difficult to apply even in the EU, and it hardly could be managed at a global level. Thus, of the remaining measures, ET is a good steering mechanism. The problem is that industry sectors acting on international markets are involved, but not all countries are included. When USA and developing countries are in the system then ET would work." Environmental taxes were appreciated also because they can be encompassing and take the choice to the consumer. Docent Pohjola said: When ordinary citizens are forced to pay, they start acting…ET is not the most efficient measure, but ET and

> permit policy tames the worst actors. Real change comes only after the customers change their behaviour." Environmental Minister Tiilikainen emphasized the three legs in international climate policy: binding commitments, ET and other market mechanisms and development of technology.

The interviewed persons suggested improving the EU ETS to function better in a similar way as the questionnaire respondents: three most favoured ways were inclusion of new sectors, extending the time span of ET periods and harmonizing the NAPs, even though in a little bit different order than in the questionnaire. For instance, harmonizing NAPs did not get that much support maybe because EU had made a decision about this issue at the end of 2007. Sanctions did not get too much support and auctioning was again dividing the responses. Two interviewees regarded auctioning as the most important measure, two as the second important measure and two would not use it. According to the Commission's proposal auctioning will increase in the future. Other suggested measures to increase the effectiveness of ET was enlarging it to global, communicating it better and other market mechanisms, i.e. CDM and JI.

> Director of Energy and Infrastructure in Finnish Forest Industries Federation, Sundman stated though: "European pulp and paper industry is not interested to pay one billion euros for emission allowances to be divided in a new way in Europe." He referred in that to the possible allocation charge of allowances in the future. Minister of the Economy Pekkarinen mentioned: "Now it is considered that a sector allocation would be applied. Using benchmarking allowances would be delivered to sectors. They would not go to auction and would not be a part of the national emission cap. The Commission publishes a new RES-directive on 23.1.2008."

Two interviewees thought that companies should get allowances free of charge also in the future, two suggested that a part of the allocation would have a price and two would charge for all allowances when allocated and one would demand an allocation price, except in the case of companies on the global market. Thus, the interviewees were much more willing to charge a price in allocation of EUAs than the questionnaire respondents. Interviewees regarded windfall profits at least somewhat problematic. Some would like to see some kind of correction mechanism, but others regarded windfall profits as just minor side effects of the system.

Three respondents would have made it possible to move the saved emission allowances from one emission trading period to another. Two denied this because they saw it to complicate the system too much. The rest would allow some banking, but would limit it though. Currently, banking between ET periods is not possible in EU ETS.

All the interviewees favoured inclusion of aviation in the EU ETS. This is no surprise, because the EU Council of Environmental Ministers had already at the end of 2007 decided to include aviation into the system[32]. Inclusion of aluminium production and chemical industry for the EU ETS got the next most support. Thus, the four most frequently suggested fields by the questionnaire respondents were also supported by the interviewees except in a little bit different order. Two interviewees would have included also transportation and one food industry to the EU ETS. None included agriculture and the most typical reason was that monitoring would be very difficult. Ms Kaskinen would even support personal ET. She emphasized that in non EU ETS sector emission accounting, carbon foot prints or at least carbon contents of the products should be started to be produced.

When inquiring whether the Commission's cuts for the Kyoto period EU ETS NAPs were large enough to ensure climate change mitigation, five interviewees regarded them tight enough, while one doubted that. One mentioned that is not actually possible to know whether the cuts have been large enough. Actions are needed also elsewhere than in the ET sector to fulfil the Kyoto commitments.

Altogether EU ETS was regarded as one among the most important measures to mitigate climate change by four interviewed persons, as the most important measure by two and as a fairly important measure by one.

4.3.4 Other climate change policy

When the measures in sectors outside EU ETS were inquired about, heating and transportation were mentioned as most important and the examples included renewed car tax and vehicle taxation, support to public transportation, integration of community structure, construction instructions with ever tightening energy consumption norms, subsidies for heating system renovation to use renewable energy. Guiding, counselling and informing was claimed to be done much less in Finland than in any

[32] Year 2011 emissions from all domestic and international flights between EU airports will be covered. At the start of 2012 system will be expanded to cover emissions from all international flights that arrive at or depart from an EU airport.

other EU country and particularly compared to Great Britain. Some would suggest mainly voluntary measures while some saw also the need for obligations. For example, it was suggested that the most energy consuming apparatus should not be allowed to be sold.

5 Discussion

A statistical testing suggested that participation in the web questionnaire was representative of the Finnish EU ETS sector. The interviews intended to give a broader view and were directed to persons in administration and research mainly. Intensive following of the discussion in the media and literature provided additional information of the climate change policy and ET. The topic was a very timely issue during the whole research period and the issues developed in a remarkably fast manner.

5.1 The emissions of various companies and sectors

The results showed that companies in the energy sector had significantly smaller net sales and also CO_2 emissions per installation than other sector companies in EU ETS, even though energy sector covers 61% of the total CO_2 emissions in Finnish ETS. The low unit emissions of the energy sector[33] were mainly due to the smallest unit emissions in the opt-in installations based on EMA's statistics. Otherwise, the unit CO_2 emissions of heat and power production (without opt-in installations) were in the third highest category after four industry branches. Typically, energy and power production has been largely regional. The high proportion of municipally owned companies does not completely explain the differences with other EU ETS sectors. For example, stand-by power plants typically have low annual emissions, because they are only used at times of very high energy consumption, i.e. during cold temperatures. From the questionnaire it could be anticipated that particularly in the small companies, where the personnel is small, EU ETS is often seen as nuisance, the system is not fully understood and there are no resources to analyse its impacts. Thus, the Commission's new proposal to exclude the least emitting installations out of EU ETS on condition that measures are in place for equivalent greenhouse reductions (COM 2008b), seems very reasonable also based on this study[34]. Large installations representing only 7% of the total number of installations in EU ETS produce 60% of total emissions, while small installations representing around 14% of total installations only emit 0.14% of total emissions. The cost-effectiveness of including these small

[33] Heat and power production and opt-in installations. This combining was practical and also necessary to make comparisons to the questionnaire.

[34] The implementation of controlling of the norm compliance has to be planned to avoid negligence and extra costs.

installations has been very low. To reduce the administrative burden of the small emitters the Commission proposed to maintain the current applicable threshold of 20 MW for combustion installations, but to combine it with an emission threshold of 10 000 tCO_2/year, as long as they remain below 25 MW (COM 2008b). This would mean over half of the Finnish installations to be removed from the system (444 according to 2005–2006 emission data)

Based on EMA statistics oil refining and iron and steel industries had the highest annual unit CO_2 emissions per installation and they represented respectively, 7% and 17%, of the total Finnish ETS emissions (average of years 2005-2006). The next greatest unit emissions were in the manufacturing of cement and lime, which produces only 4% of the EU ETS emissions though. The emissions per installation were clearly at lower level (70 000 tCO_2/year) in forest industry, which made up 11% of the total Finnish ETS emissions. According to Koljonen et al. (2004), the Finnish steel industry, which acts on the global market, is unlikely to be able to maintain GHG emissions at current or reduced levels and increase production. It will need to buy emission allowances from the markets. However, at least during the 2005–2007 ETS period all the Finnish sectors had received all needed and even extra allowances free-of-charge from the state.

According to EMA statistics Finnish companies had received almost 12% more allowances than they ended up needing during first EU ETS period and thus, they were able to sell more EUAs than purchase. This was the case for all EU ETS sectors during that period. The surplus was also anticipated based on the questionnaire and the interviews. This is in line with the results of Lappalainen (2006), where surplus was anticipated somewhat more than deficit.

According to this survey most companies priced in the value of CO_2 allowances (68%)[35], and energy sector was able to price in more often than others[36]. On the global market acting steel and forest industries were not able to price in at all in this survey, and priced in poorly in the Commissions study[37]. Energy intensive industries have lobbied for free allowances also in the future and the EU Commission has considered the competitiveness issue in the climate change and energy policy proposal (COM 2008b).

[35] EU COM 2005: 48% price in and over 70% intend to do so.

[36] 77% vs. 70% in this survey and EU COM 2005, respectively

[37] 29%, 33% and 25% of steel, pulp and paper and aluminium industries priced in, respectively.

5.2 Compliance strategies and practices

According to the questionnaire results almost half of the companies had defined a compliance strategy for EU ETS. This was less than in the survey of Lappalainen (2006; 70%; Finnish n=14), which sampled larger companies. Typically the strategy was part of a risk management strategy, acquisition strategy or company's main strategy in this survey. The top management had been most often (59%) involved in planning the strategy. The compliance strategy for EU ETS in the company was rarely described and typically it was mentioned to be just adaptation to regulations. Some mentioned energy production or acquisition, fuel selection and investments. According to the Commission (EU COM 2005) for half of the companies EU ETS is one of the key issues in long-term decisions[38], while for the other half it is only one among many issues. In order to manage their risks and profitability, companies need means to estimate future price developments of emission allowances. Ollikka and colleagues have developed a price estimation model for EUAs in the University of Helsinki and Pohjola's group has created a general risk management model for EU ETS that aims at improving competitiveness of companies (POMAR/MARMET 2007).

An operations or production unit was most often responsible for the EU ETS (33%) and ET was mainly a part-time task in companies. The most abundant class of part-time employers, 2–4, was the same as in Lappalainen's study (2006), but in this survey this class was more frequent (50% vs. 46%) and full-time personnel was rarer (some full-time 19% vs. 43%) than in Lappalainen (2006). ET operations included mainly buying and selling of allowances and allowance bureaucracy.

5.2.1 Measures of compliance for EU ETS

In this survey[39] trading EUAs was the most prominent measure of compliance in EU ETS and even to a greater degree than in Lappalainen (2006). Internal abatement was likewise in both studies the second most important measure. Framework conventions on energy efficiency (since 1992, last period 1997-2007) have encouraged companies to invest €360M voluntarily into energy saving and a new convention period has just started (2008-2016).

Approximately a third of the questionnaire respondents answered using JI or CDM and marked them most often as the third important measures. This was more than in the survey of Lappalainen (2006),

[38] Particularly in steel and pulp and paper industries.

[39] Both in the questionnaire and in the interviews.

where one fourth had invested in CDM/JI. A similar increase was apparent in investments in carbon funds[40] (23% in this survey vs. 15% in Lappalainen 2006) maybe indicating increasing interest into these instruments with time. In most cases the investments were smaller than €1M. The bigger companies with many installations and large CO_2 emissions had invested in CDM and carbon funds and gotten credits from them. Also in interviews the role of CDM/JI and carbon funds were anticipated to increase in the near future despite known problems related to the baseline-and-credit mechanism.

In the climate change and energy package the EU Commission (2008b) projected four scenarios and accounted the cost for the 20% GHG reduction target till 2020: 1) cost-efficient reference scenario, 2) redistribution of non EU ETS target, no CDM, 3) redistribution of non EU ETS target, with CDM and 4) redistribution on non EU ETS and renewables targets, no CDM, no RES trade. Under a 20% GHG reduction scenario, where only the EU would be in demand for CDM credits and with limitless access to such credits, carbon prices are projected to be potentially as low as of €4/ton and EU emissions would be reduced only marginally. This would imply that no significant changes in the EU's energy system would be achieved, that oil and gas savings would not materialise and that technological innovation is not spurred within the EU. In addition, the 20% RES target would become much more difficult to achieve, and significantly more support for renewable energy technologies would be required. In case of a carbon price of €30/ton of CO_2, the overall emission reduction efforts with limited CDM by 2020 would be reduced by a third compared to a situation without access to CDM-type mechanisms (-14.5%). At the same time the renewables support needs to be increased to ensure that the RES target can be achieved. Equally, benefits, for instance, related to air quality would diminish (COM 2008b).

Based on this survey production halts have been rare due to EU ETS. It seems that the costs of the system for companies at least during the first period have been quite minor and other issues are more defining when decisions like this are made. Leskelä (2005) assumed that in general the effects of ET are left behind other impacts at least in the beginning of the period 2005–2007.

The most common ways of internal abatement in this survey were development of more energy and material efficient production processes and increasing use of biomass energy. Even 70% reported about fuel changes either now or in future and over 31% had also increased the use of other

[40] Interviewees regarded carbon funds more important than CDM/JI.

renewable energy sources according to the questionnaire. The interview and questionnaire results were mainly similar, but interviewees emphasised nuclear power more. The more installations the company had in EU ETS the more likely it was to invest in biomass, other renewables or research. Questionnaire respondents raised the question of peat and wanted it to be included in the renewable fuels. Certainly, it can not be defined what part of internal abatement is solely due to EU ETS and which part due to some other reasons, e.g. renewable energy subsidy systems. EU's renewable energy target for Finland is 38%, which is 10% higher than the current level of renewable use.

5.2.2 SWOT of the adopted strategy and EU ETS

As the **strengths** of a company's EU ETS strategy was mentioned on one hand that the received emission allowances covered the need and on the other hand that company was able to move the allowance price to the product price. Some mentioned the efficient emission monitoring as strength. As strengths were seen local bio-fuels, energy efficiency and by-products. As the **weaknesses** of a company strategy were mentioned slow-motions of a large organisation, low flexibility in fuel use and lack of innovativeness, but most weaknesses described, increasing costs, price sensitivity and short ET periods, were actually more weaknesses of the system than the ones of a company strategy. As **opportunities,** in the questionnaire were seen an increasing use and investments in bio-fuels, waste fuels and other renewables, making energy saving business and the ability of companies to improve their image by using renewables and cleaner technology.

Increasing energy costs, a high cost level and weakening ability to compete in global markets, when costs can not be transferred to product prices, production halts and ending the production completely, carbon leakage and increasing global CO_2 emission were mentioned in the questionnaire most often as **threats** due to EU ETS. The same issues were raised in interviews. Some comments indicated lack of vision and deeper understanding of the system. When a company is worried about the fact that EUAs cost more during the Kyoto period and they are not able to invest because of that, it has not understood that actually the investments in cleaner technology are in many cases more important now than ever before, because the price of carbon is going to increase in long-term anyway and if price-in is possible that is made by most of the companies. Lappalainen (2006) reported that Finnish companies have used less internal abatement and more trading of EUAs than companies in other countries. Maybe the energy sector in Finland is larger than elsewhere due to the climate and in this sector it means a little bit more vision to understand the value of investments in clean technology than in heavy industries which acts on the global market and can not miss the point cost-efficiency.

In the energy sector it is maybe too easy just to buy the EUAs and put the price on the customer. In has been proven that the consumers are very lazy to change the energy distributor and the change rarely occurs due to environmental reasons. Maybe energy companies have relied on that. This topic was raised also in the interviews, where it was mentioned that the R&D funding in the energy sector has been lower than in other fields even though at least the bigger companies have received huge windfall profits during the first EU ETS period. During last year the massive discussion about climate change and also the ET system has activated both consumers and industries to find out ways of producing and using greener energy and technology. Maybe the political actors influencing municipal and state owned energy companies are just starting to realize the importance of these companies in GHG emission reductions and including more CSR in their management.

5.3 CSR and EU ETS

Based on the questionnaire 75% of the companies in EU ETS had an environmental management system (EMS) and the likelihood increased with increasing CO_2 emissions. Only a fifth of companies had calculated their carbon foot print and this was most likely in companies with accredited environmental management systems. Annual environmental reporting and an EMS were strongly correlated, which was also the case for environmental reporting and the annual CO_2 emissions. EU ETS issues were often included into the environmental report (82% of the answers).

About 50% of the companies had delivered climate change and energy saving information in one form or another and the likelihood increased with annual CO_2 emissions and having an EMS. On the other hand, almost half of the companies denied delivering any information about these issues, and thus, it is not a surprise that interviewees would like to see companies delivering more honest information particularly related to their products. Green washing is probably less a problem than complete lack of information and lack of choices in many fields. Furthermore, even though there is a lot of general information and newspapers have articles almost every day about climate change issues, practical information helping the consumers in their every-day decisions to consider climate change and make a less emitting choice is still rare, even though the emphasis of media on the possibilities of individual citizens or companies to act has increased clearly [compared for example to the study of Lamminmäki (2006) during 2004–2005].

Based on this survey company EU ETS strategies base most often either solely on economic issues, or mainly on economic and partly on environmental issues. The more a company had installations

the more likely it was to emphasise CSR. The interviewees expected the strategies to base slightly more on economic issues than the questionnaire respondents. Certainly, this question setting was very simplistic, but maybe also revealing. Most companies operate in the first place from economic standpoints, but many have also accepted other limiting provisions such as CSR. ET makes an environmental question an economic question and creates the price for carbon. The operation environment has been set up so that it is beneficial to act environmentally right. An instrument has been made for the daily decision-making in companies, in which economic steering leads to better environment.

Almost a half of the questionnaire respondents and all interviewees thought that EU ETS is encouraging CSR and better environmental management, but a third of the questionnaire respondents did not see it encouraging. The encouraging effect was suggested to come through saved euros, better knowledge of environmental impacts and marketing opportunities. Discouraging were lack of fairness, manoeuvring, free-of-charge allowances, carbon leakage out of Europe. Interestingly, some persons both in interviews and in the questionnaire had a need to emphasise ET as a pure business tool and not environmental protection. Actually this interestingly is related to several speeches of politicians, in which climate change mitigation is regarded not to be environmental protection, but business or something else. It is peculiar in a way that even today this kind of a distinction needs to be made. Many companies were involved in the creation of future climate change regulation policy, which can be regarded as a positive sign.

5.4 The efficiency and effectiveness of the EU ETS reaching the environmental targets

5.4.1 The efficiency of EU ETS

When estimating the efficiency of EU ETS it can be compared to the criteria of a functional and cost-effective ET system set by Tietenberg *et al.* (1999). The exhaustiveness criterion is not met: emissions trading is not global and in EU does not cover all the emission sources and greenhouse gases. Indeed, new gases (CH_4, N_2O, HFCs, PFCs, SF_6) are planned to be included in EU ETS in the third period (COM 2008a). In that sense EU ETS has been flexible[41] that the directive of 2003 was planned to enable new sectors and gases to be included in the future.

[41] In the EU's new climate change and renewable energy package flexibility refers to different ex-ante national circumstances and sufficient flexibility in the manner the targets are achieved (COM 2008b).

The competitiveness criterion is mainly met due to fairly large EU markets, but there are still sectors, for which this is not true, particularly the global trading fields may suffer. Administrative effectiveness can be judged to be quite lean at least in Finland. A credibility criterion is likely to be quite OK, even though there have been comments on too loose monitoring and directing it instead of CO_2 emissions to the carbon content of the used fuels. This pragmatic approach is not likely to cause any bigger distortions to the system. However, a bigger problem is the lack of credibility related to the ability of the system to lead to global or European CO_2 reductions. The political decisions about the continuity of the EU ETS have been made, but still due to the fairly short ET periods the companies have criticised the continuity in the light of long-term investments. Time flexibility including banking and borrowing of allowances is defined in directives and applies also to between trading periods 2008–2012 and 2013–2017. Based on my judgement the criteria are met on 60–70% level, which can be expected to be sufficient for the system to work.

Thus, EU ETS can be regarded as a fairly cost-effective system. However, it is not maybe the most cost-effective system theoretically available, but the environmental taxes could be more efficient as mentioned by Ollikka in the interview. On the other hand, Bohm (1999) has regarded ET somewhat more efficient than carbon taxes. Ala-Nissilä (2008) suggested world-wide carbon tax, which would be based on the CO_2 emissions per unit of energy and in which revenues would be used for reducing the employer's social security taxes. The problem is that it is difficult to count all the costs and benefits of each system. Furthermore, the systems do not operate in vacuum, but there are many policies, systems and national regulations, which may even work into opposite direction and thus, a definite answer is not obtainable. A theoretical discussion may be regarded as pointless, because decisions in favour of ET have already been made and it is maybe more reasonable to invest in stabilizing and developing the system than to try to find out alternative options. According to the impact assessment of the EU's package for implementation measures on climate change and renewable energy for 2020, cost-effectiveness has been one of the key principles[42] for implementation (COM 2008b). One cost-effectiveness basis has been that it is inexpensive for the governments and demands only little administrative resources, but maybe it is more costly for the companies.

[42] Other key principles are flexibility, internal market and fair competition, subsidiarity, fairness, competitiveness and innovation.

It can be said that the first three years of EU ETS has fulfilled the task of "learning by-doing" and the years may be regarded as a slight success despite of some critical voices. Trading has been active and the volumes traded have been increasing since the beginning of the scheme. The focus of this study seems to be correct, at least based on what the POMAR/MARMET (2007) research group has concluded: “The discussion of true carbon emission reductions as a result of emission trading has been a hot debate, but the most important thing is that carbon now has a price, creating an incentive for cleaner production and emission reductions.“

5.4.2 The effectiveness of EU ETS

It is critical, whether the system really reaches the targets and reduces GHGs. It is pointless if the system is inexpensive, but it does not achieve the target. The effectiveness of EU ETS in reducing CO_2 emissions can really be questioned based on the first three years period. The caps were set on too high a level and because the companies received the allowances mainly free of charge, a clear incentive for action to reduce emissions was lacking at least on a short-term. It can be judged from this study that the bigger companies, which have better strategies and longer visions have acted in this issue. Instead smaller installations with fewer resources have maybe not understood the system at all and have continued as usual and only been annoyed about the system bureaucracy. On the other hand energy companies seem to have wasted money on options even though they should have invested in research and development in the field. Quite likely there still is a lot of disbelief about the system and this has prevented many companies from making strategic decisions, which would be beneficial in the long term. The media has quite often approached the EU ETS topic from the point of view of industrial lobbyists and challenged the fairness of the reduction obligations set for the Finnish industries (also in Lamminmäki 2006). On the other hand, media has not raised at all the issue of too many emission allowances or free-of-charge allowances. This type of approach has not increased the belief of companies in the system, its continuity and effectiveness.

In the questionnaire 37% did not believe that EU ETS leads to targeted emission reductions and the same amount believed that is does, while 26% did not know. The interviewees were more positive about this issue. EU ETS has been working only three years and statistics are only available for that short period and because there are many effecting factors, it is difficult to judge whether the system has reduced emissions. The annual Finnish ETS emissions increased from 2005 (33.1 MCO_2) to 2006 (44.6 MCO_2) and then levelled (42.5 MCO_2) and there was 12% surplus of allowances in the end of the period 2005–2007. Based on this the incentive to reduce emissions during that period was

not particularly high. However, the companies have to consider the future and it is likely that they have anticipated the future reductions in allowances and thus, have conducted some abatement. Considering that the Finnish allowance level drops from that period to the first Kyoto commitment period by 17% it does not seem to be particularly difficult to be achieved. Instead, there are likely to be difficulties in non-ETS sector to reduce emissions to reach to the national target of 0% reduction on of GHG compared to base years 1990 and 1995. The Finnish government is prepared to use Kyoto mechanisms to reach the target.

ET and how to reduce CO_2 clearly is a quite complicated topic. It has to be kept in mind that ET is just a tool, with which a part of internationally agreed emission reductions can be implemented using covering and tight enough emission caps. During the first period the caps were too loose and CO_2 emissions did not reduce, but on the other hand that was a training and adaptation period. EU Commission cuts[43] to the NAPs for the Kyoto period will reduce EU-15 emissions by 3.4% and EU-25 emissions by 2.6% compared with base year levels (http://europa.eu).

Under the Kyoto protocol the EU-15 Member States[44] are committed to reducing their collective greenhouse gas emissions in 2008–2012 to 8% below base year levels. EU-15 GHG emissions in 2005[45] were 2% lower than the Kyoto base year levels, even though economic growth has been more than 35% over the same period. For the EU-25 the emissions reduction to 2005 was 11% from base year levels. The latest projections by MS show that existing policies and measures, among them EU ETS, are expected to reduce EU-15 emissions to 4% below base year levels during the Kyoto period. Plans by ten of the EU-15 MS to buy credits from CDM projects would bring a further reduction of 2.5% and biological 'sinks' of CO_2, e.g. afforestation and reforestation activities, would contribute an additional cut of 0.9%, giving a 7.4% reduction, 0.6% short of the Kyoto target. The target will be more than comfortably achieved on condition that additional policies and measures currently under discussion (including aviation in the EU ETS from 2011 and requiring a 10% cut in GHG emissions from transport fuels between 2011 and 2020) are promptly put in place and fully implemented. The total emission reduction could then increase to 11.4% and the Kyoto target would be clearly passed (http://europa.eu).

[43] EU Commission cuts were 198 million allowances (10% of the allocated).

[44] There is no collective target for EU-25 or EU-27 emissions.

[45] The latest year for which full data are available.

Ollikka et al. (2007) predict that unlike in the first trading period there will be a shortage of allowances in the second period. With the given allocation and growth of emissions the shortage is over 200 million allowances already in the first year of the Kyoto period. Due to economic growth, this shortage will increase about 20 million allowances every year. This gives in total more than 1200 million allowances' deficit for the five-year period. Supply of allowances is increased by units from CDM and JI projects and some abatement can be expected, so that the likely deficit will be much less than 1200 million units. In fact, if the member states can use all available CERs and ERUs, this amount would almost cover the whole shortage. This hardly happens, though; some abatement is therefore necessary during the Kyoto trading period (POMAR/MARMET 2007).

In the questionnaire a mixture of measures was regarded as the most efficient method to reduce CO_2, while environmental taxes and ET with national caps was seen to be the next best choices. Some pointed out that the whole society should be included, which actually is in the Kyoto commitments and is really started to be implemented when also non EU ETS sector got the emission caps and reduction targets (10% in the COM 2008b for 2013-). Many of those who regarded ET with national caps to be the best method, explained further that the system needs to be global to work properly. Indeed, a mixture of measures is used in Finland, including electricity and power production taxes (Finnish law 1996/1260 updated), subsidies and environmental taxes for transportation fuels (Finnish law 1994/1472 updated) and vehicles (Finnish law 1994/1482 updated). In most case these taxes also act to reduce CO_2 emissions and the vehicle tax and part of energy taxes are directly based on carbon content[46]. These taxes have been guiding citizens and companies to more environmentally friendly choices, but their level has remained moderate (about 6.8% of the all taxes in 2006; www.stat.fi). Lobbyists have pressurised the government to remove energy and environmental taxes from the companies and indeed their energy taxation was reduced to half (Finnish law 1996/1260 updated). Even now the energy intensive industries can apply part of the tax back to itself and some taxes were removed from companies. Energy and environmental taxes are central in directing the non-ETS sector, but they are also important in guiding EU ETS sector and in keeping the energy palette wide.

5.4.3 Problems in the EU ETS system

One basic problem with the ET system and other economic incentive systems is that the market does not always act efficiently and short term benefits have maybe gained too much focus in the current

[46] Finnish government is preparing staggering of fuel taxes based on CO_2 emissions.

quartile economy. There are inherent beliefs that the decisions made in business would automatically be better than decisions made by authorities. EU ETS builds on the theory of ecological modernisation, in which the idea is that environmental problems, including climate change, can be solved within current institutional structures by reducing the loading on the environment and by favouring production branches and processes, which are ecologically harmless. Heralds of the ecological modernisation are markets, enlightened consumers, science and technology (Tirkkonen 2000). In opposite is Beck's central thesis (1992) that the crisis of modern society can not be handled with modern institutions.

Some practical problems were raised in this survey. EU ETS should also be able to consider the previous investments in clean technology. Parenting, in which the biggest polluters get the most allowances, and fee-free allocation, were seen as problems of the current EU ETS system. In Finland where energy saving has occurred for long, the cheapest solutions are widely applied and the further reduction of energy use demands greater investments and thus, the abatement prevails at higher allowance prices than elsewhere in Europe (Ruokonen 2004).

According to one respondent "The biggest winner on the ET is water power industry – they do not have a genuine need to decrease CO_2 from the world." In this he was referring to windfall profits that are side-effects of EU ETS in the energy sector. The interviewees regarded windfall profits at least somewhat problematic. Some would like to see some kind of correction mechanism, but others regarded windfall profits as just minor side effects of the system. Actually the opposition has made a legislative proposal in Finnish Parliament in 2008 concerning windfall profits, but likelihood of it getting accepted soon is small.

5.5 Suggestions for developing the EU ETS

5.5.1 NAPs and benchmarking

Questionnaire respondents wished particularly harmonizing of the national allocation plans of EU countries. This improvement to the EU ETS system is already on the way and the Commission (COM 2008) suggests it for the next EU ETS period (2013–). There will not be any NAPs for EU ETS manufacturing any more, but the allocation for the ETS sector is made on the whole EU level directly. This also means that the proportions of emissions for EU ETS and non EU ETS have to be decided first. The Commission suggests that the CO_2 emissions of current EU ETS sectors would

need to be reduced by approximately 21% and non-EU ETS sectors would need to reduce emissions by around 10% compared to 2005 by 2020 (COM 2008b)[47]. The NAPs will in the future be for non-EU ETS sector, sources not covered under Directive 2003/87/EC. The Commission proposed national non-EU ETS reduction targets in its package on January 2008 and Finland's share of reduction was 16%. In the interviews the NAPs received somewhat less interest, probably due to the later timing of the interviews and the fact that most interviewees knew the before mentioned proposal. The popularity of community-wide benchmarks, also obvious in the Commission's survey (ECOM 2005), fits well with the EU wide caps for the ETS sector and also with the emphasised need to monitor and reduce the CO_2 emissions also in other industries.

5.5.2 Allocation periods

In this survey, spanning of EU ETS planning system further to the future got a lot of support in both the questionnaire and interviews. A large majority of companies and associations preferred ten-year or longer allocation periods and pre-announcing two to three years before the subsequent allocation period according to the Commission's EU ETS survey (ECOM 2005). The length of a EU ETS period is currently five years, but the planning system itself is now on a fairly solid basis due to the decisions of the European Council in the spring 2007 and the climate and energy package presented by the Commission in January 2008. The continuity of the system is guaranteed and targets are set for the coming decades (2020 20%[48], 2030 30%, 2040 40% and 2050 50% reductions, respectively (COM 2008a, c). However, based on some questionnaire and interview comments there still is some uncertainty. Some companies feared that emission reduction efforts could be sanctioned in the next period, and so they refrained from reducing emissions in the first period. This impacts liquidity in the CO_2 market negatively, which was also noticed in the EU Commissions survey (ECOM 2005).

5.5.3 New sectors and gases

New sectors were demanded to be included in the EU ETS by most respondents and interviewees. Aviation, aluminium production and chemical industry were sectors, which got support for inclusion in EU ETS, both in the interviews and questionnaire survey. They were also the sectors most

[47] This cost efficient reference option reaches both the 20% GHG reduction target and the 20% renewable energy target simultaneously at a direct economic cost of 0.58% of EU GDP or €91B in 2020. These objectives are projected to be reached at a carbon price of €39 per tonne of CO_2 and at a renewable energy incentive of €45 per MWh (COM 2008b).
[48] By 2020 even 30% reduction if other areas in the world join.

frequently suggested for inclusion in the Commission's questionnaire (EU COM 2005). Some respondents and interviewees thought transportation should be included in the EU ETS, but this issue will largely be steered by other mechanisms such as taxes, which were also mentioned in the interviews. In Finland the government has just renewed the car tax and the principles of vehicle tax, which were both planned to support the use of lower fuel consuming cars. Other available methods include supporting public transport and tolls for private cars. In the EU Commission's Climate and Energy package the target for transportation fuels is 10% of bio-fuels in 2010. Half of the questionnaire respondents suggested including agriculture in EU ETS, but the interviewees saw it as too complicated to be monitored and suggested using other mechanisms.

Including new greenhouse gases in the EU ETS got some support, but it was not seen among the most important measures. The EU has considered its inclusion already in Directive 2003/87/EC, but it must be noted that uncertainties in CO_2 inventories will increase, if EU ETS is extended to cover other sectors or gases that are included in the Kyoto protocol (from ±3% to 21% according to Monni 2005).

5.5.4 Auctioning or free allocation

Auctioning of emission allowances divided the opinions in both the questionnaire and interviews. According to this questionnaire and the EU Commission's survey (EU COM 2005), 65% and 80% respectively of the companies surveyed, would not use auctioning. However, auctioning was regarded as important by many interviewees and questionnaire respondents who emphasized the environment in their ET strategy. It was favoured by government bodies, market intermediaries and NGOs in the Commission's questionnaire (ECOM 2005). Based on literature (e.g. Bohm 1999, Cao 2005) and experiences from the USA, auctioning increases the ET system effectiveness. Benefits include: the provision of a revenue source that can address the economic burden brought about by environmental regulation; creation of an equal opportunity for new entrants in the allowance market, avoidance of the potential for "windfall profits" (allowance output prices rise even though the company had received allowances free of charge) and avoidance of the politically contentious process of allowance allocation. In the Commission's study (EU COM 2005), NGOs suggested earmarking the auctioning revenue for clean technology while companies suggested distributing it within the affected industries (EU COM 2005).

Auctioning has been possible in the EU countries for a certain limit (during the 1st trading period 5% and 2nd period 10% of the allowances), but it has seldom been used by the MS. The Commission, however, sees it as an important way to increase the effectiveness of the system now, when it has settled. Thus, the Commission proposes auctioning of allowances during 3rd EU ETS period, but plans to leave out energy intensive industries acting on a global market to ensure its competitiveness (other method planned are protective tariffs) and to avoid carbon leakages. Auctioning revenues can be used in the development of green technology and redistributing auctioning rights to MS and it can be used in balancing the wealth between the MS. It may be problematic that the ET system that was initially planned to reduce GHGs gets new targets, which are not related to this topic.

Seventy percent of questionnaire respondents would like currently acting companies to get EUAs initially free of charge while in interviews one third had that opinion. A fifth of questionnaire respondents and a third of interviewees suggested the real value of the EU allowances to be paid. The interviewees were much more willing to charge price in allocation of EUAs. The EU Commission's long term option is full auctioning with free allocation taking place throughout the transition period (COM 2008b). This issue, like the auctioning, links to the competition in the global markets and the Commission suggests several ways to mitigate the negative impacts on energy intensive industries including the free allocation of EU ETS allowances on the basis of benchmarks (COM 2008b).

6 Summary of conclusions

Although the energy sector accounted for 61% of the total CO_2 emissions in Finnish ETS, there are many other small companies and relatively low CO_2 emissions, which have challenged the system cost-effectiveness. Therefore, the EU Commission's new proposal to exclude the least emitting installations from EU ETS, on condition that measures are in place for equivalent GHG reductions (COM 2008b), is supported by results from this study. Oil refining, steel and forest industries had high annual CO_2 emissions per installation and they represented respectively, 7%, 16% and 11% of the total Finnish ETS emissions (average of years 2005–2007).

Half of the companies had defined a compliance strategy for EU ETS and trading EUAs was the most prominent measure of compliance. Many energy companies have been able to both price-in and to sell allowances, obtained free-of-charge, and make profit. Internal abatement, the second most important measure, included more energy and material efficient production processes, increasing use of biomass energy, other renewables and fuel changes either now or in the future. A third of the questionnaire respondents answered using CDM/JI and a quarter of them carbon funds, while the bigger companies in particular, with large CO_2 emissions had invested in them and their use is anticipated to increase. The interview and questionnaire results were mainly similar, but interviewees emphasized nuclear power to a greater degree. The more installations the company had in EU ETS the more likely it was to invest in biomass, other renewables or research. Certainly, it cannot be determined what part of internal abatement is solely due to EU ET and what is due to some other reasons, e.g. renewable energy subsidy systems.

Many questionnaire respondents and the media saw threats in the EU ETS system, such as increasing energy costs, high cost levels and weakening ability to compete in global markets. One EU ETS weakness is the windfall profits for some energy companies in the free-of-charge allocation.

Finnish EU ETS companies (75%) have emphasized EMS and CSR, but need to work further with carbon foot prints and delivery of climate change and energy saving information to the clients. More R&D work and practical solutions for energy production and greener products for clients are needed. Company EU ETS strategies are mainly based on economic issues, but quite often also include other aspects such as environmental issues. This is very promising, because then it is likely that the companies concerned have an ethos that enables sustainable decisions which enhance adaptation to the EU ETS system. Even though ET makes an environmental question an economic one and creates

the carbon price, the vision for a better environment and opportunities that the system provides, helps to attain CO_2 reduction targets. Indeed, EU ETS was seen to encourage CSR.

EU ETS can be regarded as a fairly cost-effective system, but maybe not the most cost-effective theoretically available system. The effectiveness of EU ETS in reducing CO_2 emissions can really be questioned based on the first three year period: reductions were not apparent. The caps were set at too high a level and because the companies received the allowances mainly free of charge, at least in the short-term, a clear incentive for emission reduction actions was lacking. In the questionnaire 37% did not believe that EU ETS leads to targeted emission reductions while the same percentage believed that it does. Twenty-six per cent did not know, but importantly, interviewees were more positive about this issue.

With the intention of making the system work, the EU Commission cut the NAPs for the Kyoto period to reduce EU-15 emissions by 3.4%. Thus, the evaluated whole effect of the EU ETS is about 4% of the 8% target. However, it is still uncertain whether scarcity of allowances is enough in the second period. The eventual target is a global ET. The other half of the Kyoto target has to be covered with CDM projects (2.5%), biological 'sinks' of CO_2, (0.9%), transportation fuel GHG reductions and other national renewable energy measures. And is it is questionable whether these reductions are enough to keep the global temperature increase below 2^oC. Indeed, in the questionnaire a mixture of measures was regarded the most efficient method to reduce CO_2 and this is clearly needed to achieve the 20% by 2020 target.

The EU Commission’s message in the climate change and energy package was quite clear: CO_2 emissions have to reduce in comparison with 2005 levels, that is, 2020: 20%, 2030: 30%, 2040: 40% and 2050: 50% (COM 2008a, c), while EU ETS sector and non-ETS sector caps will be 21% and for 10% respectively (2005–2020). Aviation, aluminium production and chemical industry were new sectors, which got most support for inclusion in EU ETS and these have also been mentioned in negotiations about the third EU ETS period. Due to monitoring problems transportation and agriculture are more suitable for tax mechanisms, while including new GHGs does not seem to be a significant factor and may even excessively complicate the system. Auctioning of emission allowances, even though not supported by companies, is theoretically effective in removing some distortions of the system and will provide revenue which can be used to cover the costs and develop green technology. No wonder that the EU Commission’s long term option is full auctioning with free allocation taking place through the transition period.

7 Recommendations

As suggested by the EU Commission, exclusion of the least emitting installations from the EU ETS is recommended on condition that measures are in place for equivalent GHG reductions.

Measures to avoid carbon leakage and to retain the competitiveness of globally acting companies should be considered using measures as the EU Commission suggests, but the CO_2 reduction target should be kept as a primary target.

The EU ETS system should be maintained, as strictly as possible, as a CO_2 reduction mechanism. Additional targets, like balancing EU member state economies should be reconsidered, because several targets make the system bureaucratic and inefficiently. The Commission should adhere to the set targets and apply caps and other measures to ensure they are reached.

More EU ETS information, guidance, counselling and discussion are needed for companies, municipalities, politicians, authorities, media and citizens. The companies must be made to realize that the CO_2 reduction targets are real and the quicker they start adapting and finding new business opportunities the better. More R&D work and practical solutions for energy production and greener products for clients are needed while the non-ETS sector needs counselling to start producing their product carbon footprints. Environmental authorities need more information to be able to demand action. Municipalities need both carrot and stick to start realizing their responsibility in the issue. Politicians are recommended to set CO_2 and renewable energy targets to municipal energy companies and also to demand that the ET prices are directed to the end-user in a transparent and sustainable manner (meaning that the ET pricing is not incorporated in CO_2 free production).

Auctioning should be started, as the Commission has suggested, and the revenues should be used to develop green technology, to both basic and applied research dealing with fuel sustainability and MIPS and it should also be reserved for the administrative costs and strengthening of the authorities.

Inclusion of aviation, aluminium, other metal production and chemical industry in the EU ETS should be implemented.

Some system should be created to cut excessive windfall profits in the energy sector. Governments should strengthen the macro-regulation of ET and expand the channels of public participation.

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APPENDIX 1

The effectiveness of EU ETS

Honoured respondents of the emission trading questionnaire,

To prevent, mitigate and adapt to the climate change is one of the greatest challenges facing the planet. The aim of this questionnaire is to investigate how EU emission trading scheme has impacted industry in Finland and what kinds of compliance strategies and practices have various types of companies and other organisations adapted and what suggestions they have to improve the system. The questionnaire has been sent to companies in the Finnish Emission Allowance Registry.

The questionnaire is part of a research, in which also business executives, opinion leaders of the society and researchers are interviewed. The research is part of the Wales University MBA program, in which the underwriter prepares her dissertation of this topic.

By answering you can influence the future of emission trading policy, because the study report will be submitted to the Minister of Trade and industry and the Minister of Environment, who are also interviewed for the work.

It is possible to answer to the questionnaire also in Finnish language when using the other link given in the respective email.

The responses are confidential and they are not presented individually and in a way to reveal the personality or the company.

Heli Jutila

FT

p. 050-544 2005

heli.jutila@hameenlinna.fi

Background information

1) Respondent's genger?

female male

2) Respondent's age?

<30 30-50 >50

3) In which EU ETS sector is your company/organisation?

- heat and power production
- petroleum refining
- pottery industry
- cement and chalk industry
- glass and fibreglass production
- iron and steal industry
- forest industry
- opt-in installations
- other (please specify)

4) How much were the net sales of your company in 2006? (MEUR= million euros)

- 0-5 MEUR
- 6-20 MEUR
- 21-100 MEUR
- 101-500 MEUR
- 501-1000 MEUR
- 1001-5000 MEUR
- > 5000 MEUR

5) What is the size of the personnel in your company?

- 0-20 persons
- 21-100 persons
- 101-5000 persons
- > 5001 persons

6) Which ownership structure best describes your company?

- single private owner
- commandite company
- limited (Ltd.)/Incorporated (Inc.) company
- listed company / Public limited company (plc)
- state-owned company
- other (please specify)

7) In which market area is your company?

- domestic
- North Europe
- EU
- global
- other (please specify)

8) What is the estimated level of your company's annual CO2 emissions for 2005-2007? (M=million) (Mt=miljoonaa tonnia)

- 0-0,5 Mt/year
- 0,5-1 Mt/year
- 1-5 Mt/year
- 5-10 Mt/year
- > 10 Mt/year
- No estimations done

9) How many CO2 emission allowances installations did your company have for the period 2005-2007?

- 1
- 2-5
- 6-10
- 11-20
- >20

10) How do you expect CO2 emissions of your company to change for 2008-2012?

- increase substantially
- increase
- no change
- decrease
- decrease substantially
- other (please specify)

Keskeytä

Seuraava --> Palauta alkuperäiset

The effectiveness of EU ETS

Operations

11) Which department or function in your company has overall responsibility for the EU ETS operations?

- strategy and business development
- trading
- risk management
- RD
- environmental
- consultancy
- operations/production
- responsibility not specified
- other (please specify)

12) How many persons are involved in the EU ETS operations in your company?

	Full-time	Part-time
0		
1		
2-4		
5-9		
10-20		
>20		

13) Please, briefly describe the EU ETS operations in your company.

14) Does your company price in the value of CO2 allowances?

- Yes
- No

15) What kind of an environmental management system does your company have?

- no environmental management system
- an accredited EMAS system
- an accredited ISO system (please indicate what)
- another accredited system (please indicate what)
- own environmental management system
- it is included in risk management or environmental health mgt or some other system

Keskeytä

<-- Edellinen | Seuraava --> | Palauta alkuperäiset

The effectiveness of EU ETS

16) Is EU ETS included in your accredited or own environmental management system?

- Yes
- No

Keskeytä

<-- Edellinen | Seuraava --> | Palauta alkuperäiset

The effectiveness of EU ETS

17) Has your company calculated its CO2 foot print?

- no
- yes, when? _____
- not yet, but is planning to do it. When? _____

18) Does your company produce annually an environmental report and is it included to the company's annual report or is it separate?

- no environmental report
- environmental report, but not annually
- annual environmental report is separate form the annual report
- annual environmental report is included in the annual report

Keskeytä

<-- Edellinen | Seuraava --> | Palauta alkuperäiset

The effectiveness of EU ETS

19) Are EU ETS issues included into your environmental report?

- Yes
- No

Keskeytä

<-- Edellinen | Seuraava --> | Palauta alkuperäiset

The effectiveness of EU ETS

Compliance (or risk management) strategies and measures

20) Has your company defined a compliance strategy for EU ETS?

- Yes
- Under preparation
- No
- Do not know

Keskeytä

<-- Edellinen | Seuraava --> | Palauta alkuperäiset

The effectiveness of EU ETS

21) What is the nature of the compliance strategy for EU ETS of your company?

- separate strategy
- part of environmental management strategy
- part or risk management strategy
- part of acquisition strategy
- part of the company's main strategy

22) Who have been involved in planning the strategy (you may select several)

- only the department responsible for the EU ETS
- some departments of your company in addition to the responsible department. Please specify what.
- all departments of the company
- top management of the company
- the board of the company
- other. Specify, please.

Keskeytä

<-- Edellinen | Seuraava --> | Palauta alkuperäiset

The effectiveness of EU ETS

23) Please briefly describe the compliance strategy for EU ETS of your company.

24) Estimate how much have pure economical issues and how much ethical issues like corporate social responsibility and an sincere aim to a better environment influenced the adopted strategy in your company.

25) What factors lead to the choice of compliance strategy for EU ETS your company has adopted?

26) Please, list three strenghts and weaknesses of the chosen compliance strategy of your company for EU ETS.

Strength1

Strength2

Strength3

Weakness1

Weakness2

Weakness3

27) Has EU ETS changed energy consumption or has it influenced to the selection of fules in your company?

28) What measures of compliance with the EU ETS is your company using?

	1	2	3	4	0
internal abatement	☐	☐	☐	☐	☐
trading EUAs	☐	☐	☐	☐	☐
carbon funds	☐	☐	☐	☐	☐
corporate internal or external CDM/JI projects	☐	☐	☐	☐	☐
product halts	☐	☐	☐	☐	☐
other (please specify)	☐	☐	☐	☐	☐

29) What methods has your company used in internal abatement (You may select several.)?

- ☐ developed more energy and material efficient production processes
- ☐ increased the use of biomass energy
- ☐ increased the use of other renewable energy
- ☐ increased the use of nuclear power
- ☐ increased funding for research and development and innovative technologies
- ☐ no internal abatement has occurred

30) Has your company sold or purchased emission allowances during period 2005-2007? (possible to choose several)

- ☐ Sales < 10 000 EUR
- ☐ Sales 10 000 - 100 000 EUR
- ☐ Sales > 100 000 EUR
- ☐ Purchases < 10 000 EUR
- ☐ Purchases 10 000 - 100 000 EUR
- ☐ Purchases > 100 000 EUR
- ☐ Sold more emission allowances than purchased.
- ☐ Purchased more emission allowances than sold.

31) Has your company invested in clean development mechanism (CDM) or joint implementation (JI) linked to EU ETS?

- ☐ Yes, both
- ☐ Yes, CDM
- ☐ Yes, JI
- ☐ No
- ☐ Do not know

32) How much did your company invest into Carbon Funds? MEUR= million euros.

- ☐ 0 MEUR
- ☐ <1 MEUR
- ☐ 1-4 MEUR
- ☐ 5-10 MEUR
- ☐ >10 MEUR

33) How many credits through CDM/JI or Carbon Funds is your company estimated to obtain?

- 0
- <50 000
- 50 001-100 000
- 100 001-800 000
- 800 001- 1 500 000
- > 1 500 000

34) Please, list three greatest threats and opportunities for your company deriving from the EU ETS and other climate change mitigation policies?

Threat1

Threat2

Threat3

Opportunity1

Opportunity2

Opportunity3

35) Has your company delivered climate change abatement and energy conservation information to your customers?

- Yes, through web pages.
- Yes, included in marketing leaflets.
- Yes, projects in schools related to the topic.
- No.

Keskeytä

<-- Edellinen | Seuraava --> | Palauta alkuperäiset

The effectiveness of EU ETS

Effectiveness and efficiency of the EU ETS

36) According to your opinion does EU ETS lead to CO2 reductions?

- Yes
- No
- Do not know

37) What would you estimate to be the most efficient methods to reduce CO2 (Number the methods in order of importance)?

- Emission trading with national caps like applied in the EU ETS.
- Command and control policy with fixed annual emission limits for each company.
- Environmental taxes.
- A mixture of measures. Describe.
- Do not know.

38) Give reasons for your opinion.

39) How would you improve the EU ETS to reduce CO2 emissions and to function more efficiently? Number in order of importance and give 0 to those choises, which have not been used.

	1 most important	2	3	4	5	6 least important	0 I would not use.
In the beginning of the emission trading period emission allowances should be auctioned. (Not currently used in Finland)							
New sectors should be included to the EU ETS.							
New greenhouse gases should be included to the EU ETS.							
The national allocation plans (NAPs) and their basics in EU countries should be further harmonized.							
The EU ETS planning system span should extend further to the future.							
Community-wide benchmarks should be used when allocating the emission allowances.							
The accounting and taxation policy related to emission trading should be harmonized.							
The nations, which will not reach the national caps, should be sanctioned.							

40) What other measures you suggest to increase the effectiveness of EU ETS or international CO2 emission trading?

41) Should the prevalent companies in EU ETS get the allowances initially free of charge?

- Yes.
- No, they should pay a percentage e.g. 10 % of the price.
- No, they should pay the real value of the EU allowances they get in the beginning of the trading period.

42) Give reasons for your previous answer.

43) Which other sectors should be included in the EU ETS?

- aluminium production
- transportation
- aviation
- chemical industry
- agriculture
- food processing
- other (please specify)

44) Is EU ETS encouraging or discouraging the companies to corporate social responsibility and better environmental management?

- Yes
- No
- Do not know

45) Give reasons for your previous opinion.

46) Is your company involved in the creation of future climate change regulation policy?

- Yes
- No
- Do not know

47) Please, briefly describe the involvement of your company.

48) You can give general comments on the future of different fuels due to the EU ETS.

49) Please, feel free to give general comments on the EU ETS or Kyoto protocol.

50) Leave your email address, if you wish to obtain the results of this survey.

Keskeytä

Haluan lähettää vastaukset

<-- Edellinen | Lähetä | Palauta alkuperäiset

The effectiveness of EU ETS

Kokonaisvastaajamäärä: 69

Background information

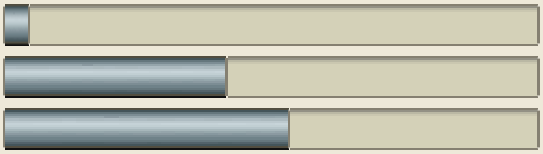
1. Respondent's genger?

Kysymykseen vastanneet: 67 (ka: 1,9)

(1.1) female	6 %	4
(1.2) male	94 %	63

2. Respondent's age?

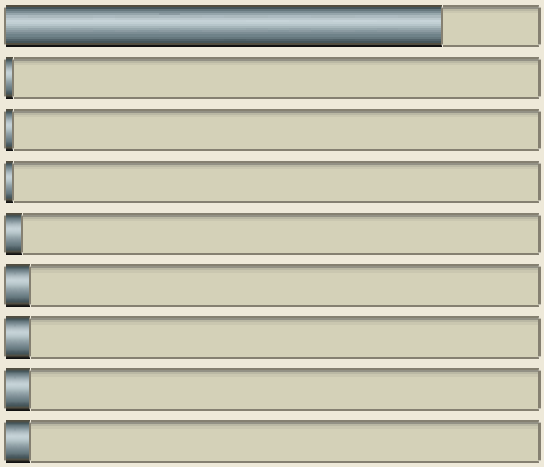
Kysymykseen vastanneet: 67 (ka: 2,5)



(2.1) <30	4,5 %	3
(2.2) 30-50	41,8 %	28
(2.3) >50	53,7 %	36

3. In which EU ETS sector is your company/organisation?

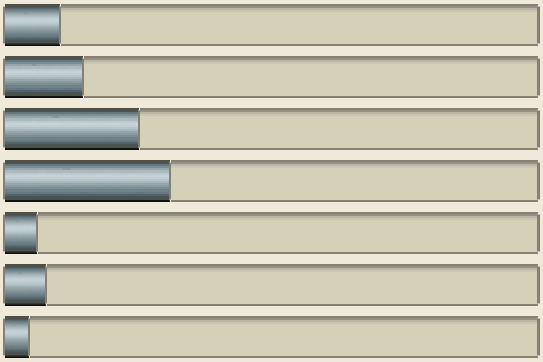
Kysymykseen vastanneet: 67 (ka: 2,3)



(3.1) heat and power production	82,1 %	55
(3.2) petroleum refining	1,5 %	1
(3.3) pottery industry	1,5 %	1
(3.4) cement and chalk industry	1,5 %	1
(3.5) glass and fibreglass production	3 %	2
(3.6) iron and steal industry	4,5 %	3
(3.7) forest industry	4,5 %	3
(3.8) opt-in installations	4,5 %	3
(3.9) other (please specify)	4,5 %	3

4. How much were the net sales of your company in 2006? (MEUR= million euros)

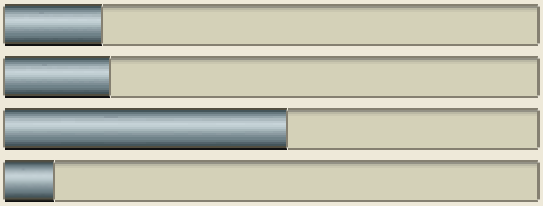
Kysymykseen vastanneet: 67 (ka: 3,5)



(4.1) 0-5 MEUR	10,4 %	7
(4.2) 6-20 MEUR	14,9 %	10
(4.3) 21-100 MEUR	25,4 %	17
(4.4) 101-500 MEUR	31,3 %	21
(4.5) 501-1000 MEUR	6 %	4
(4.6) 1001-5000 MEUR	7,5 %	5
(4.7) > 5000 MEUR	4,5 %	3

5. What is the size of the personnel in your company?

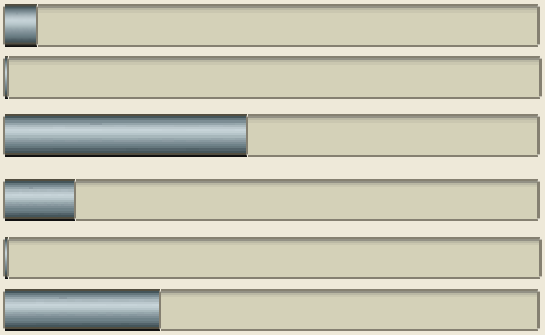
Kysymykseen vastanneet: 66 (ka: 2,5)



(5.1) 0-20 persons	18,2 %	12
(5.2) 21-100 persons	19,7 %	13
(5.3) 101-5000 persons	53 %	35
(5.4) > 5001 persons	9,1 %	6

6. Which ownership structure best describes your company?

Kysymykseen vastanneet: 68 (ka: 4)



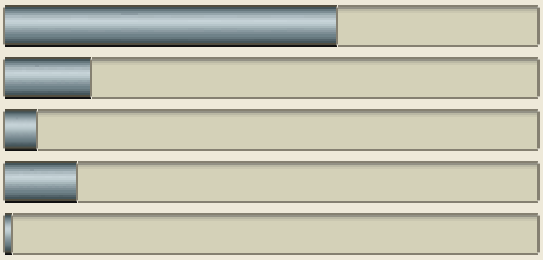
(6.1) single private owner	5,9 %	4
(6.2) commandite company	0 %	0
(6.3) limited (Ltd.) / Incorporated (Inc.) company	45,6 %	31
(6.4) listed company / Public limited company (plc)	13,2 %	9
(6.5) state-owned company	0 %	0
(6.6) other (please specify)	29,4 %	20

Kysymys [6.6] (Which ownership structure best describes your company? . other (please specify))

1. Mankalayhtiö (8679312)
2. Osa globaalia konsernia (listautunut) (-11431433)
3. kunta (-11436174)
4. kunnan liikelaitos (-11449704)
5. Oy useita omistajia (-11478233)
6. 100 % kunta Oy (8679300)
7. kunnallinen Oy (8925869)
8. kunnan omistama laitos (8925757)
9. kunnallinen OY (8925686)
10. kunta (8925770)
11. kunnallinen liikelaitos (8925691)
12. kunta (8925827)
13. kaupungin liikelaitos (8943872)
14. kunta (8943864)
15. kunnan liikelaitos (8925736)
16. kuntaomistaja (8679429)
17. kunnallinen liikelaitos (8943870)
18. kunta (8925837)
19. kunnan liikelaitos (8679570)
20. Kansainvälisen konsernin tytäryhtiö (8679474)
21. kunnallinen liikelaitos (8943874)
22. kuntayhtymä (8679347)
23. kuntaomisteinen (8679367)
24. ulkomainen osakeyhtiö (8679554)

7. In which market area is your company?

Kysymykseen vastanneet: 67 (ka: 1,7)



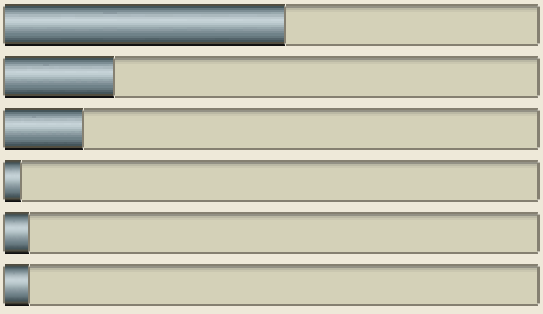
(7.1) domestic	62,7 %	42
(7.2) North Europe	16,4 %	11
(7.3) EU	6 %	4
(7.4) global	13,4 %	9
(7.5) other (please specify)	1,5 %	1

Kysymys [7.5] (In which market area is your company? . other (please specify))

1. kotimaa + vienti Venäjälle ja Baltiaan (8679474)

8. What is the estimated level of your company's annual CO2 emissions for 2005-2007? (M=million) (Mt=miljoonaa tonnia)

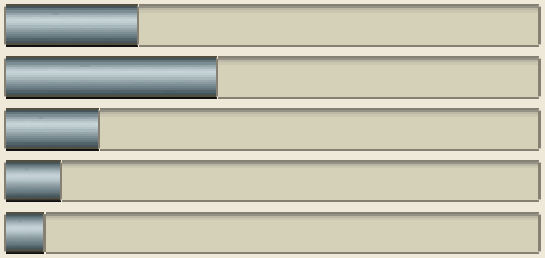
Kysymykseen vastanneet: 68 (ka: 2)



(8.1) 0-0,5 Mt/year	52,9 %	36
(8.2) 0,5-1 Mt/year	20,6 %	14
(8.3) 1-5 Mt/year	14,7 %	10
(8.4) 5-10 Mt/year	2,9 %	2
(8.5) > 10 Mt/year	4,4 %	3
(8.6) No estimations done	4,4 %	3

9. How many CO2 emission allowances installations did your company have for the period 2005-2007?

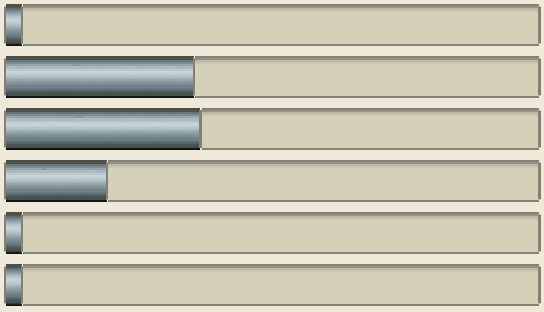
Kysymykseen vastanneet: 68 (ka: 2,4)



(9.1) 1	25 %	17
(9.2) 2-5	39,7 %	27
(9.3) 6-10	17,6 %	12
(9.4) 11-20	10,3 %	7
(9.5) >20	7,4 %	5

10. How do you expect CO2 emissions of your company to change for 2008-2012?

Kysymykseen vastanneet: 68 (ka: 2,9)



(10.1) increase substantially	2,9 %	2
(10.2) increase	35,3 %	24
(10.3) no change	36,8 %	25
(10.4) decrease	19,1 %	13
(10.5) decrease substantially	2,9 %	2
(10.6) other (please specify)	2,9 %	2

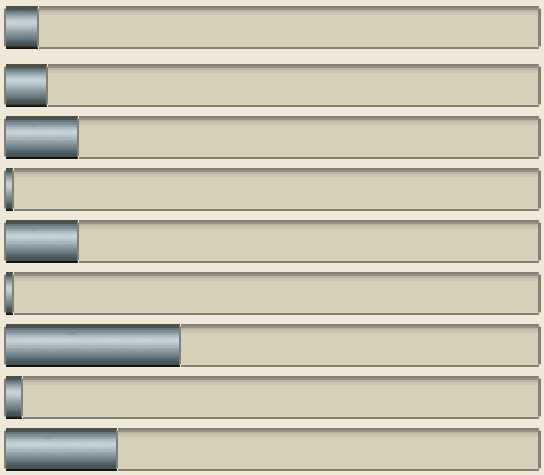
Kysymys [10.6] (How do you expect CO2 emissions of your company to change for 2008-2012? . other (please specify))

1. riippuu saaduista päästöoikeuksista ja sitä myötä tuotantomääristä sekä tuotemarkkinoiden kehityksestä ja niiden vaikutuksesta tuotantoon (8679590)
2. Vähenee kun laitos seisoo (8679311)

Operations

11. Which department or function in your company has overall responsibility for the EU ETS operations?

Kysymykseen vastanneet: 67 (ka: 5,9)



(11.1) strategy and business development	6 %	4
(11.2) trading	7,5 %	5
(11.3) risk management	13,4 %	9
(11.4) RD	1,5 %	1
(11.5) environmental	13,4 %	9
(11.6) consultancy	1,5 %	1
(11.7) operations/production	32,8 %	22
(11.8) responsibility not specified	3 %	2
(11.9) other (please specify)	20,9 %	14

Kysymys [11.9] (Which department or function in your company has overall responsibility for the EU ETS operations? . other (please specify))

1. minulla (8679312)
2. Logistiikka (-11430755)
3. yrityksen johto (-11449704)
4. Hallitus (-11479462)
5. 3 hengen tiimi (tekn,osto,rahoitus) (-11494495)
6. Energiaosastolla (8679501)
7. Energiankauppa, vastaa sekä energianmyynnistä ja -hankinnasta, myös päästökaupasta (8925770)
8. Päävastuu jakautuu energiantuotannon (tuotanto&päästöt, päästöluvat, todentaminen) ja energiakeskuksen (fyysinen päästökauppa) välillä. (8943872)
9. toimitusjohtaja (8679436)
10. jaettu vastuu tuotannolla ja energianhankinta/riskienhallinta (8925736)
11. kukin liiketoiminta vastaa omalta osaltaan (8925748)
12. Käyttöpalvelut/kunnossapito (8679581)
13. laitoksen johto (8679570)
14. kaukolämpö, sähkökauppa (8925699)

12. How many persons are involved in the EU ETS operations in your company?

Kysymykseen vastanneet: 68

	Full-time (arvo: 1)	Part-time (arvo: 2)
0 (ka: 1,154; yht: 13)	84,6% 11	15,4% 2
1 (ka: 1,704; yht: 27)	29,6% 8	70,4% 19
2-4 (ka: 1,913; yht: 46)	8,7% 4	91,3% 42
5-9 (ka: 1,9; yht: 10)	10% 1	90% 9
10-20 (ka: 2; yht: 2)	0% 0	100% 2
>20 (ka: 2; yht: 4)	0% 0	100% 4
ka: 1,765; yht: 102	23,5% 24	76,5% 78

13. Please, briefly describe the EU ETS operations in your company.

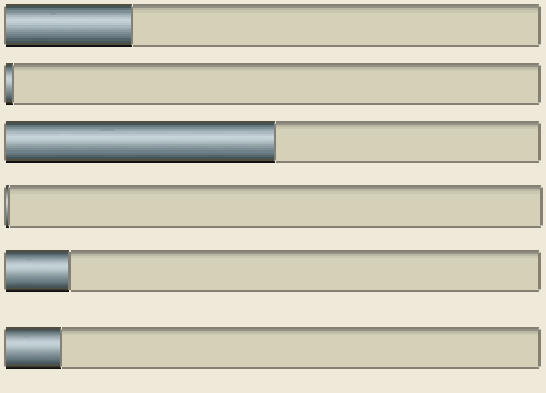
14. Does your company price in the value of CO2 allowances?

Kysymykseen vastanneet: 68 (ka: 1,3)

(14.1) Yes	67,6%	46
(14.2) No	32,4%	22

15. What kind of an environmental management system does your company have?

Kysymykseen vastanneet: 67 (ka: 3,1)



Kysymys [15.3] (What kind of an environmental management system does your company have? . an accredited ISO system (please indicate what))

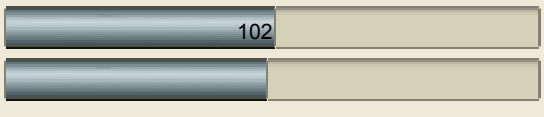
1. 14001 (8679563)
2. ISO14001 (8679327)
3. 9001,14001,18001 (-11433452)
4. ISO 14000 (-11430755)
5. 14001 (-11438049)
6. ISO 14000 (-11466020)
7. ISO14000 (-11486721)
8. ISO 14000 (-11494495)
9. ISO 18001 (-11567888)
10. ISO 14001 (-11633186)
11. ISO 14001 (8679345)
12. 14001 (8925869)
13. 14001 (8679501)
14. käyttöönotossa (8925770)
15. Sertifioitu laatu, ympäristö, työterveys- ja turvallisuusstandardit täyttävä toimintajärjestelmä. (8925781)
16. 9001, 18000,14000 (8925827)
17. ISO-14001 (8943872)
18. SFS-EN ISO 14001 (8943864)
19. 14001 (kysymykseen 14 selvennys, ei voida koska tuotemarkkinat globaalit) (8679590)
20. ISO 14001 (8679382)
21. ISO14001 (8925748)
22. ISO 14001 (8679580)
23. EQS (8943870)
24. (8925661)
25. ISO14000 (8925812)
26. ISO 14001:2004 (8679474)
27. (8925668)
28. (8679295)
29. ISO 14001 (8925733)
30. ISO 14 001 (8719344)
31. ISO-14001 (8925866)
32. 14001 (8679309)
33. ISO 14001 (8679367)
34. 14001 (8679495)
35. ISO 14001 (8679554)

Kysymys [15.4] (What kind of an environmental management system does your company have? . another accredited system (please indicate what))

1. Ei vastauksia

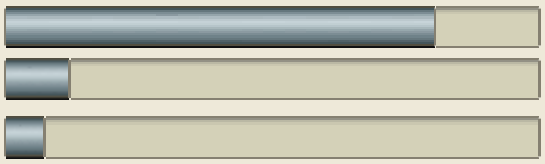
16. Is EU ETS included in your accredited or own environmental management system?

Kysymykseen vastanneet: 53 (ka: 1,5)



17. Has your company calculated its CO2 foot print?

Kysymykseen vastanneet: 68 (ka: 1,3)



(17.1) no	80,9 %	55
(17.2) yes, when?	11,8 %	8
(17.3) not yet, but is planning to do it. When?	7,4 %	5

Kysymys [17.2] (Has your company calculated its CO2 foot print? . yes, when?)

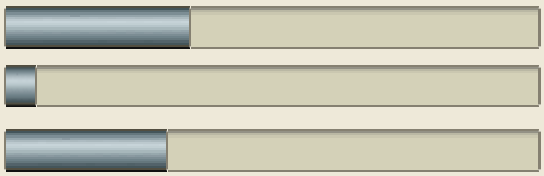
1. (8679563)
2. 2006-2007 (8679501)
3. kuukausittain (8925827)
4. Ensimmäiset päätuotteiden elinkaari-inventaariot on tehty 90-luvun puolen välin jälkeen. Näistä tiedosta käy ilmi CO2-jalanjälki (8679590)
5. (8925661)
6. (8925668)
7. 2006 (8943874)
8. aina (8679566)

Kysymys [17.3] (Has your company calculated its CO2 foot print? . not yet, but is planning to do it. When?)

1. 2008 (-11494495)
2. 2008 (-11633186)
3. CO2 päästöt lasketaan jo, ei sen pidemmälle (8943864)
4. Asiakkaiden kysymysten takia laskentaa ja raportointia kehitetään tälläkin hetkellä. (8679590)
5. 2008 (8679309)
6. 29.01.08 (8679558)

18. Does your company produce annually an environmental report and is it included to the company's annual report or is it separate?

Kysymykseen vastanneet: 69 (ka: 2,5)



(18.1) no environmental report	34,8 %	24
(18.2) environmental report, but not annually	5,8 %	4
(18.3) annual environmental report is separate form the annual report	30,4 %	21
(18.4) annual environmental report is included in the annual report	29 %	20

19. Are EU ETS issues included into your environmental report?

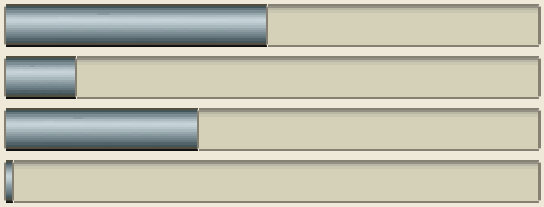
Kysymykseen vastanneet: 49 (ka: 1,2)

(19.1) Yes	75,5 %	37
(19.2) No	24,5 %	12

Compliance (or risk management) strategies and measures

20. Has your company defined a compliance strategy for EU ETS?

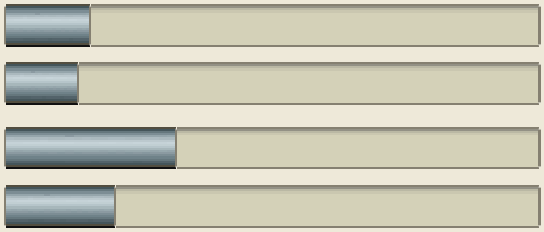
Kysymykseen vastanneet: 69 (ka: 1,9)



(20.1) Yes	49,3 %	34
(20.2) Under preparation	13 %	9
(20.3) No	36,2 %	25
(20.4) Do not know	1,4 %	1

21. What is the nature of the compliance strategy for EU ETS of your company?

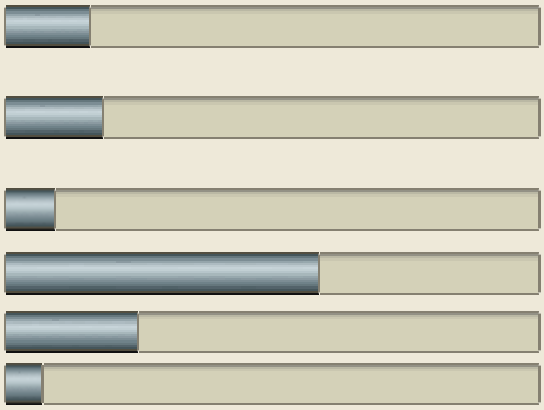
Kysymykseen vastanneet: 44 (ka: 3,1)



(21.1) separate strategy	15,9 %	7
(21.2) part of environmental management strategy	13,6 %	6
(21.3) part or risk management strategy	31,8 %	14
(21.4) part of acquisition strategy	20,5 %	9
(21.5) part of the company's main strategy	18,2 %	8

22. Who have been involved in planning the strategy (you may select several)

Kysymykseen vastanneet: 44 (ka: 3,6)



(22.1) only the department responsible for the EU ETS	15,9 %	7
(22.2) some departments of your company in addition to the responsible department. Please specify what.	18,2 %	8
(22.3) all departments of the company	9,1 %	4
(22.4) top management of the company	59,1 %	26
(22.5) the board of the company	25 %	11
(22.6) other. Specify, please.	6,8 %	3

Kysymys [22.2] (Who have been involved in planning the strategy (you may select several) . some departments of your company in addition to the responsible department. Please specify what.)

1. liiketoiminnan suunnittelu (-11486721)
2. tiimi + johtoryhmä (-11494495)
3. Energian ohjausryhmä, jonka puheenjohtajana toimii ylimmän johdon asiantuntija (8679501)
4. KL,ET,MM,EK (8925827)
5. Kehitys (8943872)
6. (8925661)
7. (8943874)
8. Energiaosasto (8679495)

Kysymys [22.6] (Who have been involved in planning the strategy (you may select several) . other. Specify, please.)

1. liiketoimintayksiköt (8925748)
2. Emoyhtiön Outokumpu Oyj:n ympäristö- ja riskienhallintaorganisaatiot (8679495)
3. ulkopuolista asiantuntemusta (8925699)

23. Please briefly describe the compliance strategy for EU ETS of your company.

24. Estimate how much have pure economical issues and how much ethical issues like corporate social responsibility and an sincere aim to a better environment influenced the adopted strategy in your company.

25. What factors lead to the choice of compliance strategy for EU ETS your company has adopted?

26. Please, list three strenghts and weaknesses of the chosen compliance strategy of your company for EU ETS.

Strength1
1. We can use many types of fuels (8679563)

Strength2
1. The process can be stopped if the economically value are not good (8679563)

Strength3
1.

Weakness1
1. Biofuels are not enough (8679563)

Weakness2
1. The CO2 price if they are too high we start to use rawmaterial which belong to the pulp industry (8679563)

Weakness3
1.

27. Has EU ETS changed energy consumption or has it influenced to the selection of fules in your company?

1. No change yet, perhaps in the future when the prices are high enough (8679563)
2. Has changed consumption (8679327)

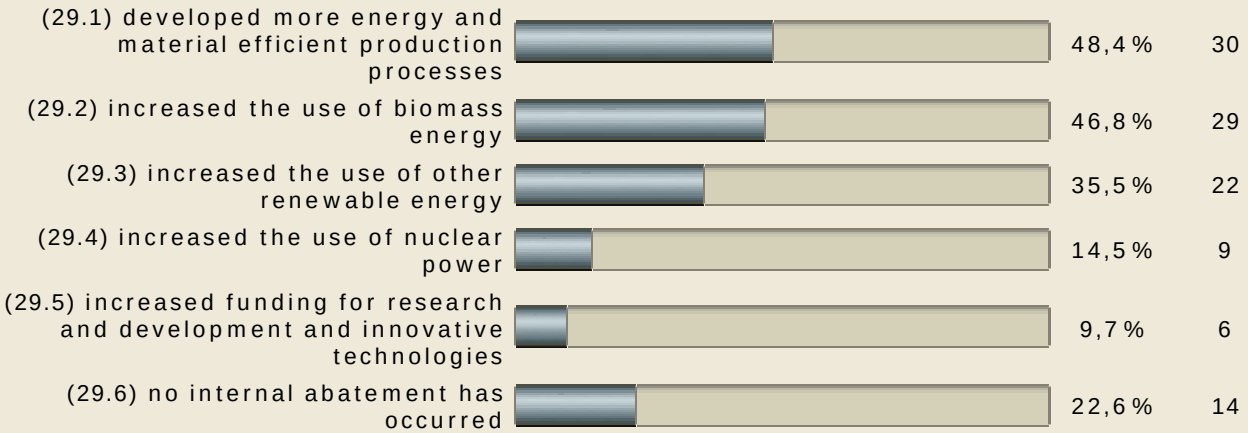
28. What measures of compliance with the EU ETS is your company using?

Kysymykseen vastanneet: 68

	1	2	3	4	0
internal abatement (ka: 1,35; yht: 60)	23,3% 14	21,7% 13	11,7% 7	8,3% 5	35% 21
trading EUAs (ka: 1,507; yht: 67)	55,2% 37	25,4% 17	9% 6	4,5% 3	6% 4
carbon funds (ka: 0,772; yht: 57)	1,8% 1	12,3% 7	12,3% 7	3,5% 2	70,2% 40
corporate internal or external CDM/JI projects (ka: 1,283; yht: 53)	7,5% 4	7,5% 4	15,1% 8	15,1% 8	54,7% 29
product halts (ka: 0,588; yht: 51)	3,9% 2	9,8% 5	3,9% 2	5,9% 3	76,5% 39
other (please specify) (ka: 1,46; yht: 50)	4% 2	4% 2	18% 9	20% 10	54% 27
ka: 1,175; yht: 338	17,8% 60	14,2% 48	11,5% 39	9,2% 31	47,3% 160

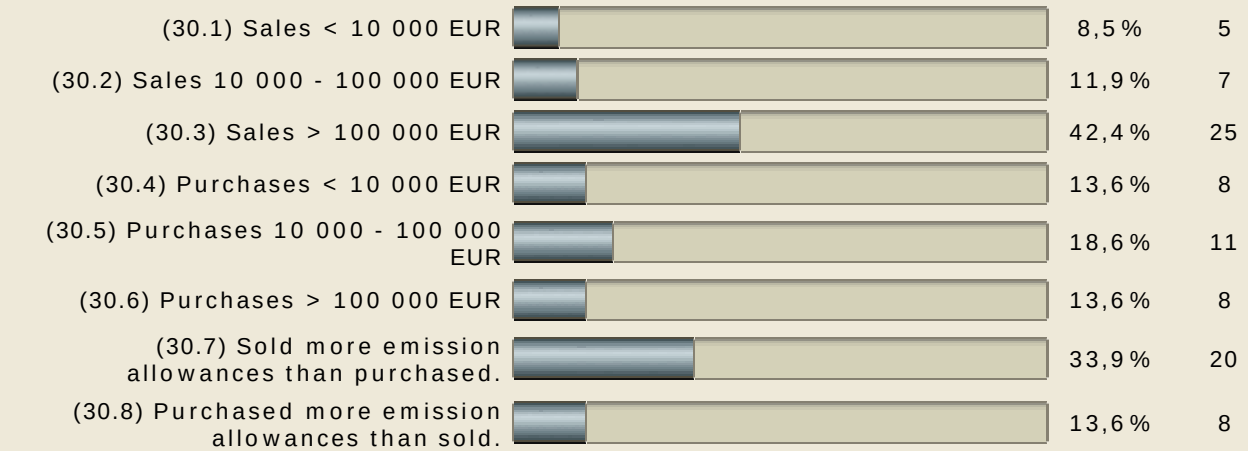
29. What methods has your company used in internal abatement (You may select several.)?

Kysymykseen vastanneet: 62 (ka: 2,8)



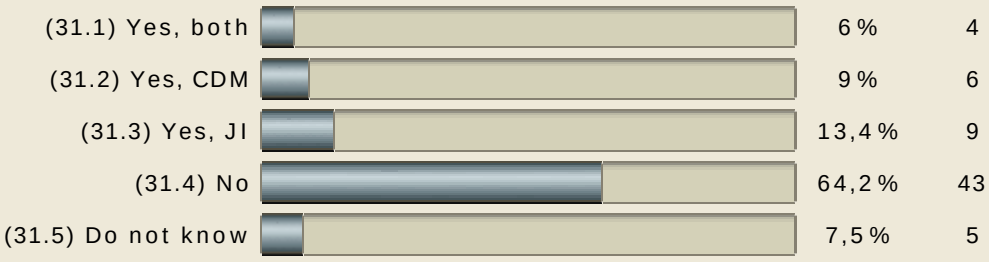
30. Has your company sold or purchased emission allowances during period 2005-2007? (possible to choose several)

Kysymykseen vastanneet: 59 (ka: 4,7)



31. Has your company invested in clean development mechanism (CDM) or joint implementation (JI) linked to EU ETS?

Kysymykseen vastanneet: 67 (ka: 3,6)

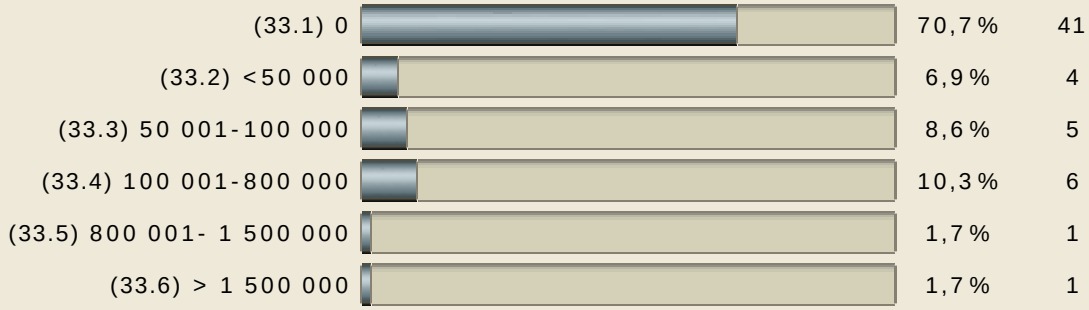


32. How much did your company invest into Carbon Funds? MEUR= million euros.

Kysymykseen vastanneet: 60 (ka: 1,5)

33. How many credits through CDM/JI or Carbon Funds is your company estimated to obtain?

Kysymykseen vastanneet: 58 (ka: 1,7)



34. Please, list three greatest threats and opportunities for your company deriving from the EU ETS and other climate change mitigation policies?

Threat1
1. Using rawmaterial as fuels (8679563)
2. auctioning for phase three (8679327)

Threat2
1. Biofuels are not enough (8679563)

Threat3
1.

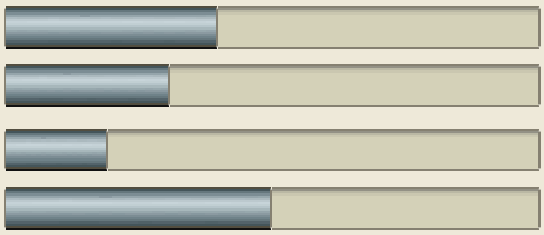
Opportunity1
1. Increasing use of waste (8679563)
2. to invest renewable production (8679327)

Opportunity2
1. Increasing use ose of biofuel imported (8679563)

Opportunity3
1.

35. Has your company delivered climate change abatement and energy conservation information to your customers?

Kysymykseen vastanneet: 68 (ka: 2,6)

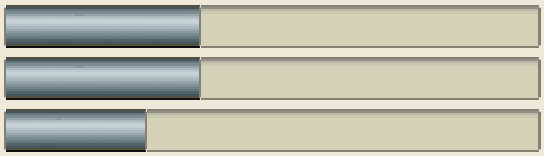


(35.1) Yes, through web pages.	39,7 %	27
(35.2) Yes, included in marketing leaflets.	30,9 %	21
(35.3) Yes, projects in schools related to the topic.	19,1 %	13
(35.4) No.	50 %	34

Effectiveness and efficiency of the EU ETS

36. According to your opinion does EU ETS lead to CO2 reductions?

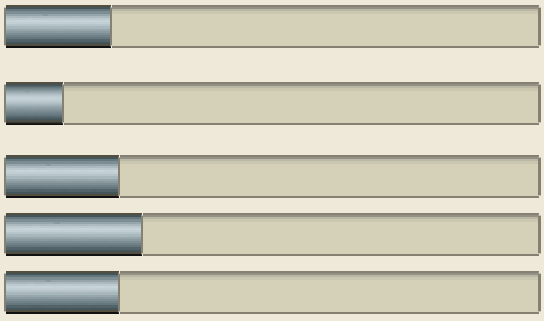
Kysymykseen vastanneet: 68 (ka: 1,9)



(36.1) Yes	36,8 %	25
(36.2) No	36,8 %	25
(36.3) Do not know	26,5 %	18

37. What would you estimate to be the most efficient methods to reduce CO2 (Number the methods in order of importance)?

Kysymykseen vastanneet: 66 (ka: 3,2)



(37.1) Emission trading with national caps like applied in the EU ETS.	19,7 %	13
(37.2) Command and control policy with fixed annual emission limits for each company.	10,6 %	7
(37.3) Environmental taxes.	21,2 %	14
(37.4) A mixture of measures. Describe.	25,8 %	17
(37.5) Do not know.	21,2 %	14

Kysymys [37.4] (What would you estimate to be the most efficient methods to reduce CO2 (Number the methods in order of importance)? . A mixture of measures. Describe.)

1. Vapaaehtoiset liiketalouteen perustuvat keinot (8679362)
2. Toimialakohtainen vertailumalli (-11438049)
3. verot, globaali päästökauppa, puhtaan teknologian kehittäminen (-11466020)
4. (8679399)
5. (8925869)
6. Globaali, tasapuolinen päästökauppa (8679501)
7. (8925770)
8. (8925691)
9. Edellisten yhdistelmä. (8943872)
10. 36 kysymykseen: johtaa paikallisesti, mutta voi johtaa jopa globaalin tilanteen pahenemiseen hiilivuodon myötä, tässä menee kuitenkin vuosia, mutta esim. metsäteollisuudesta on jo nyt esimerkkejä (8679590)
11. päästöttömän tekniikan kehittämiseen tulisi panostaa enemmän , päästökauppa on tähän asti ollut enemmän rahan siirtoa taskusta toiseen (8925736)
12. EU-laajuinen päästökatto päästökauppasektorille ja päästöoikeuksien huutokauppa (8925748)
13. alueellinan päästökauppa ja ympäristöverot (8925661)
14. Koko yhteiskunta, eikä vain teollisuus mukaan: polttoaineverot + passiivienergiatalot asumiseen + voimakas satsaus uusiutuvaan energiaan + investoinnit kehitysmaihin ja niiiden ihmisten koulutukseen (8679474)
15. Laitosten benncmarkiin perustuva maailmanlaajuinen järjestelmä (8925668)
16. Ilman globaalia kauppaa millään päästöjen rajoituksella ei ole merkitystä (8925733)
17. kansainväliset rajoitteet, uuden tekniikan tuki (8679309)
18. TEKNOLOGIAN KEHITTÄMINEN (8925699)

38. Give reasons for your opinion.

1. Trading is always more efficient than taxes (8679327)

39. How would you improve the EU ETS to reduce CO2 emissions and to function more efficiently? Number in order of importance and give 0 to those choises, which have not been used.

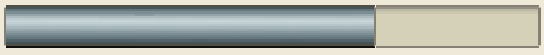
Kysymykseen vastanneet: 63

	1 most important (arvo: 1)	2 (arvo: 2)	3 (arvo: 3)	4 (arvo: 4)	5 (arvo: 5)	6 least important (arvo: 6)	0 I would not use. (arvo: 7)
In the beginning of the emission trading period emission allowances should be auctioned. (Not currently used in Finland) (ka: 5,738; yht: 61)	4,9% 3	8,2% 5	4,9% 3	4,9% 3	8,2% 5	4,9% 3	63,9% 39
New sectors should be included to the EU ETS. (ka: 2,984; yht: 61)	29,5% 18	24,6% 15	16,4% 10	4,9% 3	8,2% 5	4,9% 3	11,5% 7
New greenhouse gases should be included to the EU ETS. (ka: 5,207; yht: 58)	0% 0	12,1% 7	13,8% 8	8,6% 5	12,1% 7	13,8% 8	39,7% 23
The national allocation plans (NAPs) and their basics in EU countries should be further harmonized. (ka: 2,167; yht: 60)	41,7% 25	26,7% 16	21,7% 13	3,3% 2	0% 0	3,3% 2	3,3% 2
The EU ETS planning system span should extend further to the future. (ka: 2,61; yht: 59)	30,5% 18	30,5% 18	15,3% 9	10,2% 6	3,4% 2	5,1% 3	5,1% 3
Community-wide benchmarks should be used when allocating the emission allowances. (ka: 3,259; yht: 58)	24,1% 14	24,1% 14	12,1% 7	10,3% 6	10,3% 6	8,6% 5	10,3% 6
The accounting and taxation policy related to emission trading should be harmonized. (ka: 3,569; yht: 58)	10,3% 6	19% 11	25,9% 15	17,2% 10	10,3% 6	10,3% 6	6,9% 4
The nations, which will not reach the national caps, should be sanctioned. (ka: 3,831; yht: 59)	15,3% 9	11,9% 7	16,9% 10	22% 13	11,9% 7	8,5% 5	13,6% 8
ka: 3,671; yht: 474	19,6% 93	19,6% 93	15,8% 75	10,1% 48	8% 38	7,4% 35	19,4% 92

40. What other measures you suggest to increase the effectiveness of EU ETS or international CO2 emission trading?

41. Should the prevalent companies in EU ETS get the allowances initially free of charge?

Kysymykseen vastanneet: 66 (ka: 1,5)

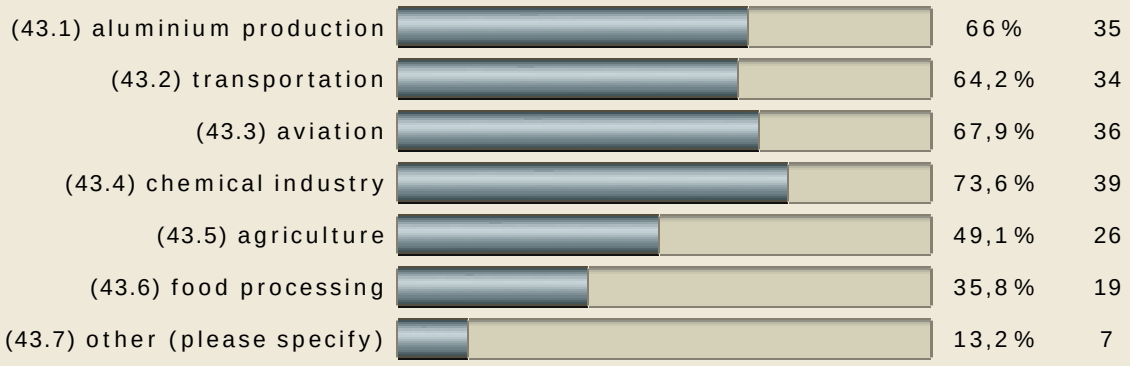


(41.1) Yes.	69,7%	46
(41.2) No, they should pay a percentage e.g. 10 % of the price.	12,1%	8
(41.3) No, they should pay the real value of the EU allowances they get in the beginning of the trading period.	18,2%	12

42. Give reasons for your previous answer.

43. Which other sectors should be included in the EU ETS?

Kysymykseen vastanneet: 53 (ka: 3,4)

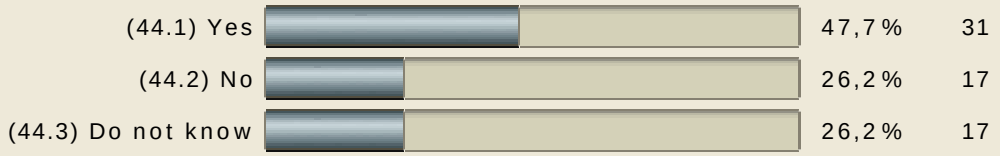


Kysymys [43.7] (Which other sectors should be included in the EU ETS? . other (please specify))

1. Pästökaupan byrokratia on niin suuri, että pitäisi pidättäytyä laajentamisesta (-11466020)
2. Kaatopaikat ja jätevedenpuhdistamot (-11476306)
3. Erillislämmitys (8679497)
4. Pitkällä tähtäimellä kaikki merkittävät kasvihuonekaasujen päästäjät. Tosin vasta silloin, kun päästömarkkinat ovat globaalit. (8679501)
5. EU:n ei tulisi laajentaa päästökauppa yksin. (8925781)
6. kaikki, jos vain EU-maiden talous sen kestää (8943864)
7. laivaliikenne (8925748)
8. joko kaikki tai ei mitään (8679311)
9. Kaikki päästömääriensä osuudella (8719344)

44. Is EU ETS encouraging or discouraging the companies to corporate social responsibility and better environmental management?

Kysymykseen vastanneet: 65 (ka: 1,8)

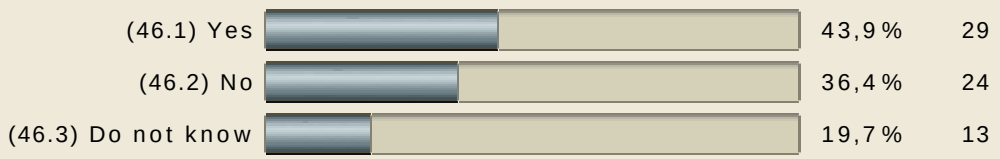


45. Give reasons for your previous opinion.

1. Encouraging my answer (8679327)

46. Is your company involved in the creation of future climate change regulation policy?

Kysymykseen vastanneet: 66 (ka: 1,8)



47. Please, briefly describe the involvement of your company.

48. You can give general comments on the future of different fuels due to the EU ETS.

49. Please, feel free to give general comments on the EU ETS or Kyoto protocol.

1. EU,internal trade with EUA will end 31.12.2007. It is not possible to tranfer EUA from this period to Kyoto period. That means that every company save biofuels now and are using fissil fuels as much as possible becaus the price of EUa are very low just now. Next year 2008 the saved biofuels are used so the emision will decrease again, so the total emision is will be an avarge for two years. (8679563)

50. Leave your email address, if you wish to obtain the results of this survey.

APPENDIX 3

Interview of a politician: The Minister of Environment
Can a tape recorder be used? Would you like that the results are handled only anonymously.

Background information
Personal information: name, position, length of carrier, length of the Minister period, time in Parliament, time on Parliament's Environmental Committee

Since when have you been involved with the EU emission trading policy?

How well you know the basic actors in the emission trading policy: forest industry and energy sector?

The linkage of emission trading to climate and environmental policy and to the administrative structures

How well does EU ETS link to the other climate and energy policies of the government?

Climate and energy policy is being renewed. Will it take a position to EU ETS?

What are the primary alignments of the climate change policy in the government? What about in your p

What do you see the Role of the Environmental Ministry being in the emission trading? What is your personal role?

How do You feel the fact that Energy Market Authority (the national EU ETS authority) is under the Ministry of Trade and Industry? Does it have meaning in reaching the environmental targets of the emission trading? Is the synergy in permitting lost in relation to other air pollution based environmental permitting?

What kind of influence You or our country can have on the future EU ETS policy. Give reasons.

Is EU ETS encouraging or discouraging the companies to corporate social responsibility, social responsibility and better environmental management? Why?

- [ ] Yes
- [ ] No
- [ ] Do not know

Give reasons for your previous opinion.

EU ETS compliance strategies of companies
What kinds of compliance strategies you know or think the companies have for EU ETS? Have they been created based on economic or environmental starting points?

What measures of compliance with the EU ETS is your company using?

(Number three most important measures, give 4 to other measures used and 0 to those not used)

- [ ] internal abatement
- [ ] trading EUAs
- [ ] carbon funds
- [ ] corporate internal or external CDM/JI projects
- [ ] product halts
- [ ] other (please specify)

What methods has your company used in internal abatement (You may select several.)?

- [ ] developed more energy and material efficient production processes
- [ ] increased the use of biomass energy
- [ ] increased the use of other renewable energy
- [ ] increased the use of nuclear power
- [ ] increased funding for research and development and innovative technologies
- [ ] no internal abatement has occurred

Do you think that the companies price in the value of CO_2 allowances?

Have Finnish companies sold or bought more emission allowances during the emission trading period 2005-2007?

Is EU ETS according to you mind more an opportunity than a threat for Finnish companies (and other organisations involved in emission trading)?

Do the companies deliver enough information about climate change and energy saving to their clients? What kind of information is not given d of information there is plenty of? Is the Energy Market Authority delivering enou

Climate change is shown on many energy companies' internet sites. Does it to your mind mirror more the companies' trial to uplift their image or real ambition to influence to the development?

Effectiveness, bottle-necks and opportunities to develop the EU ETS

According to your opinion does EU ETS lead to CO_2 reductions?

- [ ] Yes
- [ ] No
- [ ] Do not know

Give reasons.

What would you estimate to be the most efficient methods to reduce CO_2 (Number the methods in order of importance)?

- [ ] Emission trading with national caps like applied in the EU ETS
- [ ] Command and control policy with fixed annual emission limits for each company
- [ ] Environmental taxes
- [ ] A mixture of measures. Describe._____
- [ ] Do not know

Give reasons for your opinion.

How would you improve the EU ETS to reduce CO_2 emissions and to function more efficiently?
Number in order of importance and give 0 to those choices, which have not been used.

- [ ] In the beginning of the emission trading period emission allowances should be auctioned. (Not currently used in Finland)
- [ ] New sectors should be included to the EU ETS.
- [ ] New greenhouse gases should be included to the EU ETS.
- [ ] The national allocation plans (NAPs) and their basics in EU countries should be further harmonized.
- [ ] The EU ETS planning system span should extend further to the future.
- [ ] Community-wide benchmarks should be used when allocating the emission allowances.
- [ ] The accounting and taxation policy related to emission trading should be harmonized.
- [ ] The nations, which will not reach the national caps, should be sanctioned.

What other measures you suggest to increase the effectiveness of EU ETS or international CO2 emission trading?

Should the prevalent companies in EU ETS get the allowances initially free of charge?

- [ ] Yes
- [ ] No, they should pay a percentage e.g. 10 % of the price
- [ ] No, they should pay the real value of the EU allowances they get in the beginning of the trading period.

Why?

Do you feel that the windfall profits are a problem in the energy sector?

Should it be possible to move (save) the emission allowances between the emission trading periods? Now it is not possibile, but between years it is. Due to this in itself good principal now in the end of emission trading period companies are using fossile fuels instead of renewables to save renewable to the future emission trading period when renewable have more value. Should this problem be solved or not?

Which other sectors should be included in the EU ETS´

- [ ] aluminium production
- [ ] transportation
- [ ] aviation
- [ ] chemical industry
- [ ] agriculture
- [ ] food processing
- [ ] other (please specify)

Give reasons.

The national emission trading cap of Finland was reduced in EU Commission by about 95%. How do yo

The new emission trading law handling in Parliament has not ended yet. When the main handling and decision making will occur?

There has been discussion using cheese slicer principle. Do you think that the auctioning of emission allowances should be discussed now in the handling. Would you be ready to support such proposal? Did you support it last year in the handling? How do you base your position?

Almost all the national emission caps were lowered in EU Commission (except GB which stayed at the same level). Do you think that the nations try to gather excessively high national caps?

Are the cuts to the national caps for the future emission trading period big enough that the Kyoto targets are reached and the climate change is mitigated?

Do the new EU countries have needless slack in their national caps. What should be done?

Kyoto protocol, international climate change policy and the role of different actors and measure

What does the government intend to do to reduce the greenhouse gas emissions (traffic and settlements) outside the EU ETS to follow the Kyoto protocol. When studying the reports it seems that the state is mainly just buying emission allowances. What carrots and sticks shall be used?

How important you regard the projects in clean development mechanism (CDM), joint implementation (JI) and coal funds?

On what time scale You believe USA will accept Kyoto protocol?

Should developing countries be included in Kyoto and in what time scale?

How is Kyoto protocol taken into consideration in development policy and how it should be regarded in future?

What other measures than EU ETS the Ministry of Environment regards as important in mitigating and adapting to climate change?

How important measure is EU ETS in mitigating climate change? (On a scale from 1-6: the most important - one of the most important - important - fair influence - little influence - no influence)

You can give general comments on the future of different fuels due to the EU ETS.

Please, feel free to give general comments on the EU ETS or Kyoto protocol.

Thank you!

Appendix 4. *Strengths and weaknesses of the chosen compliance strategy for EU ETS.*
Content analysis and categorizing of the answers in question 26. The respondent have in many cases listed the strengths and weaknesses of the system and not their own strategy. Numbers in brackets indicate the number of answers.

Strengths	Weakness
Process improvements to energy efficiency, to energy conservation and energy use of by-products (3)	Fear of the sufficiency and rising price of bio-fuels (Competition between energy and pulp use in the case of wood) (2)
Local bio-fuels, wood (4)	Abundant use of by-products causes extra disturbances in steam production (1)
Waste incineration (1)	Forced to use oil as a supplementary fuel, own oil boilers (2)
Natural gas (1)	Natural gas and peat (2) are included in CO_2 ET
Ability to use many types of fuels (2)	Coal plant for the time being (1)
Procurement from joint production (1)	Inability to influence to the emissions except burning natural gas. (1)
Efficient, continuous emission monitoring; control (3)	Does not help to prevent the price increase effect of electricity on production costs (1)
Own emissions were small, received emission allowances mainly enough and thus, the investments were small (6)	Connection to authorities is too weak (1)
Ability to move the allowance price to the product price (2)	Increases costs (2), when having to buy allowances (2)
Ability to make earnings (2)	The amount of allowances decreased almost 78 % to the second period (1)
Optimizing investments e.g. through funds, making other investments (3)	Demands resources and is complicated to maintain (2)
Guarantees the right for the allowances necessary for the process (1)	Does not bring speculative profits (1)
The process can be stopped if the economically value are not good (2)	Price sensitivity; The price can be high at the procurement, allowances may be left in hand; the price of allowances dropped during the first ET period (3)
Important actor on European level (1)	No production flexibility, narrow freedom of action (2)
Plenty of know-how, experienced personnel (2)	Continuity, short target, does not reach adequately past Kyoto period (3)
Minimizes risks (2), small risks (2)	Alignments are late (1)
Operatively easy package, easy to control (1)	Current production apparatus is technically useable still 10-25 years (1)
Adaptation (1)	The forthcoming investment is big for the second ET period. (1)
Anticipation, predictability, consistency (2)	No opportunity for risk taking (1)
Can survive with luck (3, but one respondent)	Allocation models (1)
	Lack of history (1)
	Slow-motions of a big organisation, central decision-making and restricted local knowledge (1)

Appendix 5. *Threats and opportunities of the chosen compliance strategy for EU ETS.*
Content analysis and categorizing of the answers in question 34. The respondent have in many cases listed the threats and opportunities of the system and not their own strategy. Numbers in brackets indicate the number of answers.

Threat	Opportunity
Increasing energy prices (12)	Increasing emission-less and low-emitting production, Compatibility of the cleaner energy increses (2)
Availability of biofuels, concern that the raw materials of forest industry get burned (5)	Bio-fuels and waste fuels and other renewables and their increasing use and investments in them (10)
Comments about peat, production mix, denying some energy source, energy political risk (4)	Moving to natural gas (1)
Competitive ability of the electricity production outside EU increases.	Making energy saving as business (1)
Costs running away (7)	Price of energy increases (1)
Increasing sales prices, high prices (3)	Energy efficiency improves (1)
Customers reducing production or out of business (2)	Taking advantage of the market mechanisms, improving compatibility (2)
Distorted competition (2), deteriorating ability to compete (5)	Light, recyclable products with small carbon foot print have increasing markets in future (2)
Investments elsewhere, away from EU (2)	New energy production ways demand developed materials such as steals (1)
Difficulty to transfer costs to prices on global market, reduced profitability (3)	Marketing the company in using renewable energy (1)
EU emission trading does not notice global competition and the effectiveness of the actors, and thus, encourages carbon leaking and can even increase global CO2 emissions. Energy prices increase and drive industry from EU. This is not a threat, but realism. (1)	Increasing use of eletricity as traffic fuel (1)
Decreasing growth.(1)	Emissions truely decrease (1)
Production economically unfeasable (2), production halts, ending for a long-time or completely (4)	Selling allowances (2)
Increasing and tighter bureaucracy demands more work, which is no use for anybody (2)	Increasing offering of ET services to the customers (1)
Additional effects of taxes (1)	Improved image (2)
Insecure environment, speculative market, continuity, anticipation decreased (4)	Developing technology (2)
Uneven allocation for different sectors, changed allocation basis, amount of allowances and fees, auctioning (6)	Big actor is able to move around its allowance allotment (1)
Allowance price increases (2)	Joint projects: electricity is produced in jointly owned plants (wind, nuclear power, and in future CO_2 free coal plants)(1)
Kyoto periods NAP2 allocation took from us a significant part of the money, which we would have invested in renewables. (1)	Own production, which is left, is based on renewables and also CO_2 free energy and the unit cost fluctuation decreases even from current.(1)
Technics (1)	With an outside partner it may be possible to use district heating cascade in the production of second generation bio-fuels (1)
Ending of development work (1)	The markets of by-products develop (1)
	Some mechanism must fall into our hands as investment subsidy etc. (1)
	Nothing (4)

Appendix 6: Results of the interview in an abbreviated form. /2

Date	16.11.2007	27.12.2007	27.12.2007	23.1.2008	28.1.2008	28.1.2008	28.1.2008	
Name	Kimmo Tiilikainen	Jarno Ilme	Mauri Pekkarinen	Tuuli Kaskinen	Stefan Sundman	Kimmo Ollikka	Tuula Pohjola	Average
Position	Minister of Environment	ET Manager	Minister of the Economy	Consultant	Energy Manager	Researcher	Docent	
Genger1	1	1	1	2	1	1	2	1,29
Age2	2	2	3	1	2	2	3	2,14
Primtype	2	1	2	3	5	4	4	3,00
EThisty	5	4	1	8	6	3	7	4,86
KnowETse	2	4	3	2	4	3	3	3,00
CSR44	1	1	1	1	1	1	1	1,00
CSR24	1	1		2	2	2	1	1,50
intern28	2	2		2	1	3	2	2,00
tradeEUA28	1	1		1	2	1	1	1,17
carbfund28		3		3	3	1	4	2,80
CDM/JI28	3	3		4	3	2	3	3,00
halts28	9	9		9	9	9	9	9,00
other28		0		5	0	0	0	1,00
Intmet29A	1	2		1	2	1	1	1,33
Intmet29B	2	1		3	1	2		1,80
Intmet29C	4	3		4	3	3		3,40
Intmet29D	4	4		2	3		2	3,00
Intmet29E	4	9			4			5,67
Intmet29F	4	9		9	9	9	9	8,17
Pricein14	3	1		3	2	1	1	1,83
SBEUA30	7	7		7	9	7	7	7,33
Chalthre		2	4	1	2	1	3	2,17
Info		2		2	1	1	2	1,60
CO2red36	2	1	1	1	1	1	1	1,14
CO2red37	4	1	1	4	1	3	3	2,43
Auction39	2	9	1	2	9	1	5	4,14
Newsect39	3	3		3	1	3	2	2,50
Newgas39	3	3		5	2	4	3	3,33
NAPharm39	1	2	1	3	7	2	4	2,86
Span39	4	1		1	3	5		2,80
Benchmark39	1			4	4	9	6	4,80
Acctax39	3			6	3	9	1	4,40
Sanctions39	4		3	7	9	9		6,40
Other40	3	1		0	1	1	2	1,33
FreeEUA41	2	1	3	3	1	4	2	2,29
TranEUA	1	3	3	2	1	1	2	1,86
alumini43	1	1	1	0	1	0	1	0,71
transport43	0	0		1	0	0	1	0,33
aviation43	1	1	1	1	1	1	1	1,00
chemic43	1	1	1	1	0	0	0	0,57
agricult43	0	0		0	0	0	0	0,00
foodind43	0	0	1	0	0	0	0	0,14
other43	0	0		0	0	0	0	0,00
Comcuts	1	1	1	3	1	1	2	1,43
newEU				1	1	1	1	1,00
CDMim	1	1	1	3	1	2	1	1,43
ETsign	2	1	1	2	2	2	4	2,00

Genger1: 1= male, 2= female; Age2: <30, 30-50, >50; Primtype: 1= auhority, 2= politician, 3= env. agent, 4= researcher, 5= industry rep.; Ethisty: ET history in years; KnowETse: Knowledge of ET sector: 1=bad, 2= satisfactory, 3= good, 4= excellent; CSR44: Does EU ETS encourage to CSR: 1= yes, 2= no, 3= do not know; CSR24: How much economic issues and how much CRS have influenced to the adopted strategy: 1= economic grounds, 2= mainly economic, partly from environmental starting points;

Measures of compliance with the EU ETS: intern28= internal abatement, tradeEUA28= trading EUAs, carbfund28= carbon funds, CDM/JI28= corporate internal or external CDM/JI projects, halts28= production halts, other28= other measures; internal abatement methods: Intmet29A= developed more energy and material efficient production processes, Intmet29B= increased the use of biomass energy, Intmet29C= increased the use of other renewable energy, Intmet29D= increased the use of nuclear power, Intmet29E= increased funding for research and development and innovative technologies, Intmet29F= no internal abatement has occurred.

Pricein14= Do companies price in the value of EUAs: 1= yes, 2= no; SBEUA30: Have companies sold or purchased more emission allowances during period 2005-2007? 7= Sold more than purchased, 9= don't know; Chalthre: Is EU ETS according to you mind more an opportunity than a threat for Finnish companies: 1= opportunity, challenge more, 3= threat more, 2= both; Info: Do the companies deliver enough information about climate change: 1= yes, 2= know

CO2red36: Does EU ETS lead to CO2 reductions? 1=yes, 2= no, 3= don't know; CO2red37: The most efficient methods to reduce CO2: 1= Emission trading with national caps like applied in the EU ETS, 2= Command and control policy with fixed annual emission limits for each company, 3= Environmental taxes, 4= A mixture of measures; How would you improve the EU ETS to reduce CO2 emissions and to function more efficiently? Number in order, 1 most imp., 9= not be used. Auction39: allowance auctioning in the beginning of ET period; Newsect39: New sectors should be included to the EU ETS; Newgas39: New greenhouse gases should be included to the EU ETS.; NAPharm39: NAPs should be harmonized;Span39: EU ETS planning system span should extend further to the future.; Benchmark39: Community-wide benchmarks should be used emission allowance allocation.;Acctax39: Accounting and taxation policy related to ET should be harmonized.; Sanctions39: The nations, exceeding national caps, should be sanctioned. Other40: What other measures you suggest to increase the effectiveness of EU ETS or international CO2 emission trading?

FreeEUA41: Should prevalent companies in EU ETS get allowances initially free of charge? 1= yes, 2= no, pay partly, 3= no, pay completely, 4= no,pay completely except if on global market then free of charge; TranEUA: Should it be possible to bank EUAs between ET periods? Which other sectors should be included in the EU ETS? 1= yes, 2= no, 3= this is partly possible, alumini43=aluminium production, transport43= transportation, aviation43=aviation, chemic43= chemical industry, agricult43= agriculture, foodind43= food processing, other43=other.

Comcuts: Are cuts to NAPs of Kyoto period big enough to meet Kyoto targets? 1= yes, 2= no, 3= do not know; newEU: Do new EU countries have slack in their NAPs. 1=yes, 2=no; CDMim: How important you regard CDM, JI and carbon funds? 1=increasingly important, 2= important, but some critique, 3= critique, 4= decreasing in importance.; ETsign: How important measure is EU ETS in mitigating climate change? 1= the most important, 2= one of the most important, 3=important, 4=fair influence, 5=little influence, 6=no influence