



The EU's Emissions Trading Scheme is the world's first international carbon trading scheme designed to facilitate the commitments made by EU member states in the Kyoto Protocol.

Nils Leffler

# Emissions trading

Most scientists recognize global warming from man-made greenhouse gas emissions (mainly CO<sub>2</sub>), as a serious problem. The main culprit is the widespread use of fossil fuels. The United Nations and the EU have been tackling global emission levels for some time now, saying it is imperative to curb global warming.

These organizations have created legal frameworks, trading systems

and agreements to stabilize CO<sub>2</sub> emissions. The two most important for business, the EU emissions trading system and the Kyoto Protocol are now fully ratified and have been legally binding since January 1st and February 16th 2005 respectively.

The Kyoto Protocol calls for industrialized nations to reduce harmful emissions to at least 5 percent

below 1990 levels by 2012. Up to 128 nations have signed on.

Kyoto defines three mechanisms by which industrialized countries can reduce emissions. All involve co-operation with other countries: a joint implementation system, a clean development mechanism, and emissions trading.

A joint implementation system allows industrialized countries to set up projects to reduce harmful emissions in the atmosphere of other Kyoto countries in return for pollution credits. A clean development mechanism allows participants to pursue emission reduction in developing countries in return for pollution credits.

CO<sub>2</sub> emissions – and the emissions a country avoids – are now tradable commodities. With the appropriate trading system in place, the market should grow considerably over the coming years. The big question, however, concerns the market price. Will it be sufficiently high to motivate authorities and business leaders to include CO<sub>2</sub> reducing strategies in their investment plans?

Global warming is a “modern” problem and humanity, it would seem, is its primary source. Issues such as poverty, economic development, and population growth only compound what is already a very serious concern. In a more positive light, however, humanity is also the solution.

#### Defining the problem

Everyone agrees that planet Earth is currently going through a climate change. Most environmental scientists agree that burning fossil fuels is the main cause.

- Burning fossil fuels emits CO<sub>2</sub> into the air – comprising 70 percent of greenhouse gases. Forests and oceans naturally absorb huge quantities of CO<sub>2</sub> but mankind is saturating nature’s efforts, and CO<sub>2</sub> is accumulating in the atmosphere. This layer of greenhouse gases (GHG) traps the heat of the earth rather than letting it escape into space. The result is an increase in temperatures and more volatile weather patterns.
- Not all scientists share this view, however. Some have established a connection between variability in cosmic radiation from the sun and cloud formation. The thickness and depth of cloud cover have a strong bearing on the heat balance of the earth. The argument is that when solar activity is increased, cloud formation is reduced making it easier for the sun’s rays to reach the surface of the earth. Hence high solar activity should correlate with increasing ground temperature. These scientists argue that the variation in

cloud cover (on average 65 percent) impacts the earth’s climate much more than the carbon dioxide content of the earth’s atmosphere. They suggest that the change in climate brought about by CO<sub>2</sub> over a 100-year period can be accomplished by cloud variation in 3–5 years [1]!

- Some scientists attribute the climate change to cyclical solar activity which appears with an 11-year cycle and a cycle of between 80 and 90 years, the latter is the so-called Geissberg cycle. This cycle passed its minimum in 1980 and has since been in a rising phase, which could, according to these scientists, partially explain the current climate change.

Whatever the causes of global warming, an active approach that limits greenhouse gas emissions is regarded by many as the most prudent course of action. This consensus is reflected by the fact that 128 nations<sup>1)</sup> have signed the Kyoto Protocol.

Under the Kyoto Protocol, industrialized countries will reduce their collective emissions of greenhouse gases by at least five percent compared to the benchmark year 1990.

#### CO<sub>2</sub> emissions and trading

More than a decade ago, most countries signed an international treaty called the United Nations Framework Convention on Climate Change (UNFCCC). The long-term goal of this treaty, which took effect in 1994, is to stabilize and reduce greenhouse gas emissions. In 1997, governments agreed to add the Kyoto Protocol to the treaty. Kyoto includes more powerful and legally-binding measures.

#### The Kyoto Protocol

Under the Kyoto Protocol, industrialized countries will reduce their collective emissions of greenhouse gases by at least five percent compared to the benchmark year 1990. The goal is to lower overall emissions of six greenhouse gases – carbon dioxide, methane, nitrous oxide, sulphur hexafluoride, HFCs, and PFCs – calculated as an average over the five-year period of 2008–2012 [1]. National targets range broadly: eight percent reductions for the EU<sup>2)</sup> and other countries; seven percent for the US; six percent for Japan; zero for Russia; and permitted increases of eight percent for Australia and ten percent for Iceland. Future mandatory targets are expected to be established for the “commitment periods” after 2012.

Targets are binding but the agreement offers flexibility on how countries can meet their targets. For example, countries may partially compensate their emissions through reforestation. They may reforest territories in their own or in other countries. They may also pay for foreign projects that result in GHG reductions.

In addition to emissions trading, two other mechanisms are outlined by The Kyoto Protocol – the Clean Development Mechanism (CDM) and Joint Implementation (JI). These allow flexibility in reaching emission reduction targets by creating a tradable commodity: CO<sub>2</sub> emissions reduction credit.

The CDM is a financial mechanism that promotes sustainable development in developing countries by channeling private-sector investment into emissions reduction projects while offering industrialized governments credit against their Kyoto Protocol targets.

The projects have to be certified by the UNFCCC and must be in addition

1 Time line of CO<sub>2</sub> trading schemes.



to any reduction that would occur anyway in the absence of the certified project. Industrialized countries<sup>3)</sup> may use the certified emission reductions (CER) from these projects to contribute to compliance with Kyoto Protocol targets.

## The National Allocation Plans determine the total quantity of CO<sub>2</sub> emissions member states are allowed to emit.

With JI, industrialized countries can implement projects that reduce emissions or remove carbon from the atmosphere in other signatory countries in return for emission reduction units (ERUs). The ERUs generated by JI projects can be used by the sponsoring countries towards meeting their own emissions targets under the Kyoto Protocol. A JI project, for example, might involve replacing a coal-fired power plant with a more efficient combined heat and power plant. Most JI projects are expected to take place in industrial countries with transitional economies, for example, Eastern Europe.

The intention of emissions trading is to allow the private sector to find the most economically sensible ways of meeting reduction commitments.

### The EU's greenhouse gas emissions trading and national allocation plans

The EU's Emissions Trading Scheme (ETS) is the first international trading

system for CO<sub>2</sub> emissions in the world and is aimed at helping EU member states achieve compliance at lower cost. It has become the EU's principal instrument to reduce emissions of greenhouse gas in energy-intensive and power sectors and, more notably, to meet the EU's Kyoto Protocol target for the period 2008–2012. It covers some 12,000 installations (power generation plants and industries) representing almost half of Europe's CO<sub>2</sub> emissions.

The National Allocation Plans (NAPs) determine the total quantity of CO<sub>2</sub> emissions for member states are allowed to admit. NAPs distinguish between two sectors:

- *The trading sector:* this sector is responsible for, on average, 40–50 percent of the respective country's total CO<sub>2</sub> emissions.
- *The non-trading sector:* this sector represents CO<sub>2</sub> emissions – of the order 50–60 percent – associated with the general public (cars, domestic emissions, etc.).

Each member state must divide its CO<sub>2</sub> emissions, set by NAPs' trading sector, by the number of plants covered by the ETS for the first trading period (2005 to 2007). The idea is that member states limit CO<sub>2</sub> emissions from the energy and industrial sectors through the allocation of allowances, thereby creating scarcity, so that a functioning market can develop and overall emissions be reduced.

A member state can increase emission allowances in the trading sector by:

- Reducing greenhouse gas emissions in the non-trading sector. These would include transport which represents 21 percent of total emissions, households and small businesses (17 percent), and agriculture (10 percent).
- Purchasing emission credits through Kyoto's flexible project-based instruments: CDM (in developing countries) and JI (in other industrialized countries).

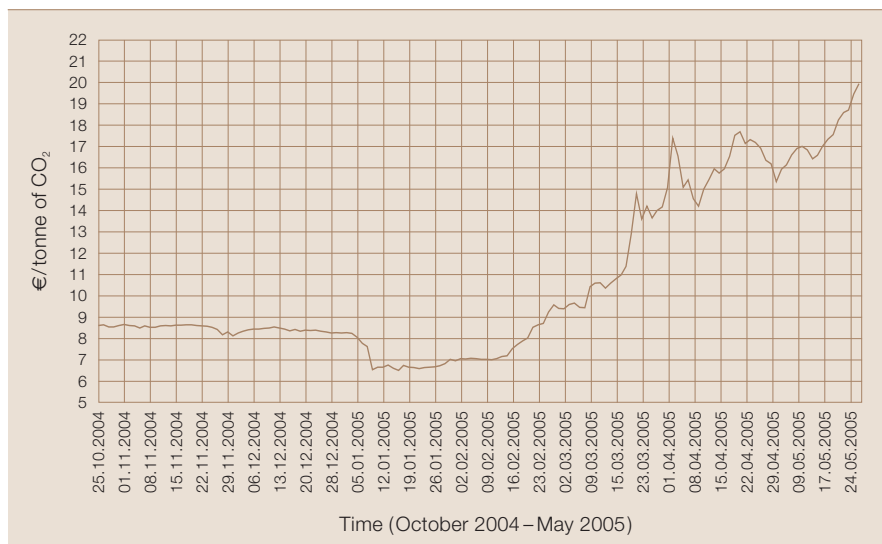
The price of a tonne of CO<sub>2</sub> emission will be a function of supply and demand, as in any other free market. Market intermediaries already quote prices for small quantities of allowances offered, or bid with a current price of € 20 per tonne CO<sub>2</sub> (May 2005) <sup>2</sup>.

Recent commission studies conclude that the targets can be achieved at an annual cost of 2.9 to 3.7 billion, which is less than 0.1 percent of GDP in the EU.

<sup>3a</sup> shows greenhouse gas emissions per GDP for selected countries around the world. <sup>3b</sup><sup>4)</sup> illustrates the change in aggregate greenhouse gas emissions between 1990 and 2001. <sup>3c</sup><sup>5)</sup> shows the burden sharing targets for greenhouse gas using 1990 as the base year. <sup>3d</sup><sup>5)</sup> compares the total yearly CO<sub>2</sub> emission per person in different European countries.

<sup>2</sup> EEX (European Energy Exchange) CO<sub>2</sub> price index (from October 2004–May 2005)

Source <http://www.eex.de>



### Effect on companies

The 12,000 installations covered by the ETS include combustion plants, oil refineries, coke ovens, iron and steel plants, and factories making cement, glass, lime, brick, ceramics, pulp and paper. The number of companies affected by the directive is obviously smaller, as large companies have many impacted plants [2].

Even though NAPs vary from country to country, the companies covered by the ETS had to submit a record of their CO<sub>2</sub> emissions by January 2005. As a first deliverable, they must submit a sufficient number of allowances to cover emissions during 2005 by April 2006. If a company delivers too few or no allowances, a penalty of € 40 (for the period 2005–2007) per

non-delivered allowance will be imposed by the member state and their respective industries. This will be increased to € 100 for the period 2008–2010.

In larger member states between 1,000 to 2,500 plants are covered, while in most other member states the number of plants covered tends to range from 50 to 400.

#### Effectiveness of the ETS

One of the underlying principles of the European Climate Change Programme is identifying the most cost-effective measures to achieve the Kyoto targets. Recent commission studies conclude that the targets can be achieved at an annual cost of € 2.9 to € 3.7 billion, which is less than 0.1 percent of GDP in the EU.

One of these studies concluded that without the ETS, costs could reach 6.8 billion! Therefore the scheme does not jeopardize, but rather protects the competitiveness of the EU economy.

Implementing Kyoto opens up new economic opportunities but EU businesses will incur inevitable additional costs. If governments do not use the trading scheme to assist compliance, more costly measures will have to be imposed on the non-trading sector. Costs have to be viewed in relation to the opportunities arising for suppliers of clean, low-carbon technologies in Europe and beyond, and the medium-term advantage for European industry in the transition to a low-carbon global economy.

The recently adopted “Linking Directive” will further lower the costs and

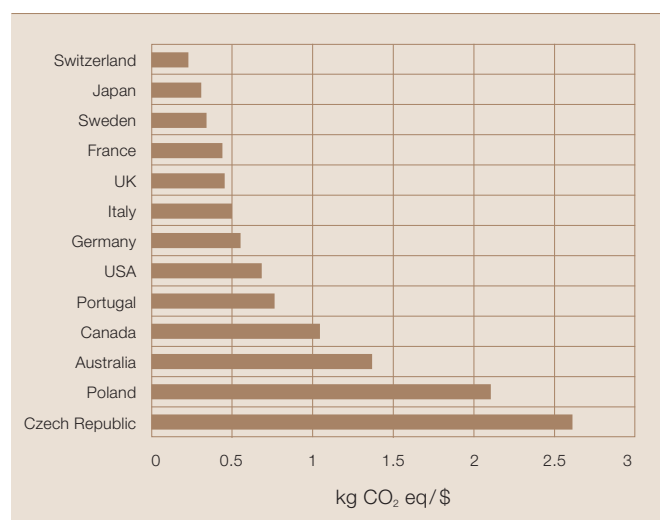
protect the competitiveness of EU businesses. As its name implies, the Linking Directive will create a “link” between the flexible mechanisms of the Kyoto Protocol (JI and the CDM) and the EU ETS. In principle, companies implement emission reduction projects outside the EU through JI or CDM will be able to convert the credits they earn from these projects into allowances that can be used for compliance under the ETS.

#### Business concerns with the ETS

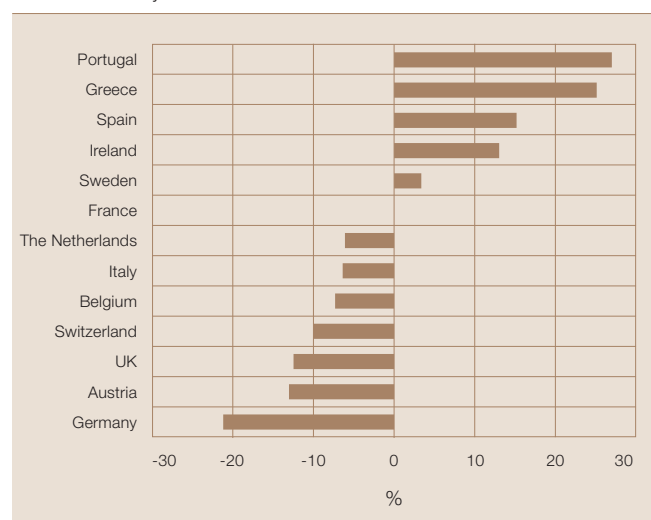
If all major industrial countries would take part in the EU trading scheme, global industrial companies would compete on equal terms. At the moment, however, this is not the case and some European businesses have voiced concerns related to the EU ETS. These concerns are described in

### 3 Emissions and targets of EMS participants.

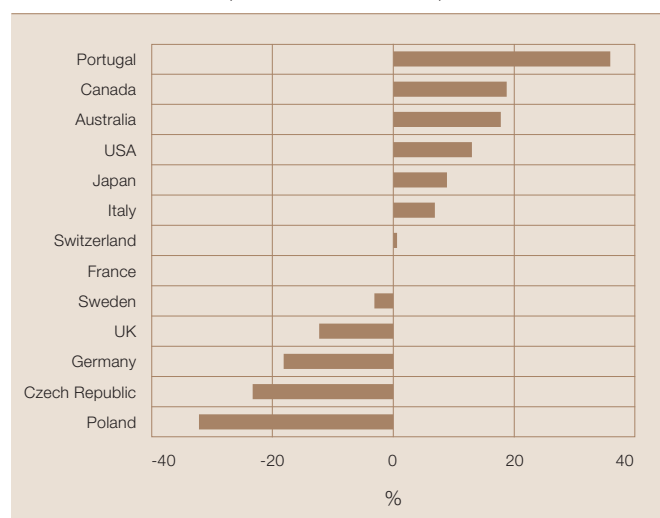
a) Green house gas emissions per GDP



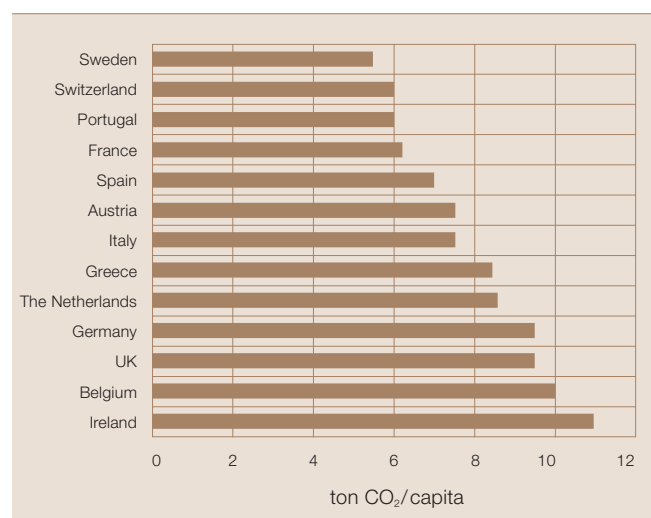
c) Burden sharing targets for green house gas emissions using 1990 as the base year. Source: IEA 2004.



b) Change in aggregate green house gas emissions in the period 1990–2001. Source: Report on the national GHG inventory data from Annex I Parties (FCCC/SBSTA/2003/14).



d) Yearly CO<sub>2</sub> emissions per person in different European countries Source: IEA 2004







### Example of the effects of greenhouse gas emissions trading

Companies A and B both emit 100,000 tonnes of CO<sub>2</sub> per year. The government gives each of them 95,000 emission allowances (one allowance represents the right to emit one tonne of CO<sub>2</sub>). At the end of each year, the companies must surrender the number of allowances corresponding to their emissions during the year.

Companies A and B must cover 5,000 tonnes of CO<sub>2</sub> and they have two ways of doing this: by reducing their emissions by 5,000 tonnes; or buying 5,000 allowances on the market. Their decision will be made by comparing the costs of reducing their emissions by 5,000 tonnes with the market price for allowances.

Assuming an allowance market price of € 10 per tonne of CO<sub>2</sub>. If company A's reduction costs are € 5, it will reduce its emissions because it is cheaper than buying allowances. With such a difference, company A may even be able to reduce its emissions by more than the required € 5,000. If company B's reduction costs are € 15, it makes more sense for this company to buy allowances rather than reduce emissions.

Company A decides to reduce its emissions by 10,000 tonnes and in doing so spends € 50,000. Because the company's low reduction costs enabled it to do this, it can then, under the ETS, sell allowances. It therefore decides to sell a further 5,000 tonnes and receives € 50,000. By doing this, company A fully offsets its emission reduction costs by selling allowances. Without the ETS, it would have had to incur a net cost of € 25,000.

Company B spends € 50,000 to buy 5,000 tonnes. In the absence of the flexibility provided by the ETS, company B would have had to spend € 75,000. The allowances company B buys represent a reduction of emissions, even if the company did not reduce emissions.

It is this flexibility in the system that makes emissions trading the most cost-effective manner of achieving a given environmental target. The overall cost to industry would have been higher if company B had been forced to reduce emissions at its own plant at a higher cost.

a report [3] published by the Centre for European Policy Studies (CEPS).

The ETS is the instrument EU member states should use to meet their Kyoto commitments in the period 2008–2012. The objective is for the energy-intensive and power sectors to embark on a trajectory of low carbon emissions at the lowest possible cost. The scheme must overcome a few challenges such as fair implementation, competitiveness of European international industry, power sector investment requirements and profitability, rising power prices, and power market structure. These are described in the following paragraphs.

#### Implementation

It should be pointed out that the split between the trading and non-trading sectors is a national political decision and varies from country to country. The burden of carbon abatement, however, is focused on only a few sectors of the economy in the member states and is not shared fairly by other greenhouse gas (GHG) generating sectors, such as transportation, domestic and agriculture. Over time a better balance should be achieved.

Past performance is used when deciding the total number of allowances allocated to a state's industries. This model is deemed sufficient and fair, at least for now. However, to create the right incentive to cut emissions in the near future, many European industries believe past performance must not be used in future negotiations.

The non-trading sector should also participate to achieve the overall goal. The market price for allowances must create the necessary incentive for change.

#### Competitiveness

Energy intensive industries such as cement, pulp and paper, glass, steel and metal, aluminum, chemicals and refining will be affected by higher power prices and the increased cost of process emissions. Consequently, some of these industries will suffer a competitive disadvantage because their competitors may not be subject to the same constraints, or prices are

fixed on an international commodity market. In either of these situations the companies might not be able to pass their increased cost onto the market.

#### Power sector investment

The electricity generating industry will be required to reduce a significant amount of carbon emissions. Energy efficiency, fuel switching strategies and

portfolio management must be short-term behavioral changes. Long-term activities include structural changes towards a less carbon-intensive power production. Regulatory modifications, price stability and the industry's profitability are parameters that will dictate the pace structural change will take before sustainable low carbon production is implemented.

## Clean Development Mechanism (CDM) in action

In 2004, ABB in Denmark won a large district heating contract in the city of Harbin (1000 km northeast of Beijing), in one of China's coldest provinces. The purpose of the contract is to improve and optimize the heat supply to 900,000 citizens. With a production capacity of up to 1000 MW, this system represents the largest single district heating network in the entire region.

Reducing pollution is also a goal. The investment has been nominated as a Clean Development Mechanism (CDM) project. In other words, the reduction in greenhouse gases realized through improvements in the combustion and operational efficiency of the system can be counted towards the Danish commitments to the Kyoto Protocol. The Danish government will pay compensation to China for these savings. Project completion is planned for the end of the 2006.

## Emission Trading in practice

### Some practical aspects of emission trading

The legal framework of the trading scheme does not regulate how and where the market in allowances takes place. Companies with commitments may trade allowances directly with each other, or they may buy or sell via a broker, bank or other allowance market intermediary.

It could also be the case that a company purchasing a fossil fuel (coal or gas) will be offered allowances in combination with the fuel. Finally, organized markets (allowance exchanges) may develop.

There will also be an electronic registry system. This is now being developed in preparation for 1 January 2005. This registry system is separate from trading activity – not all trades result in changes in ownership of allowances, but where a trade culminates in a change in ownership there will be a transfer of allowances between accounts in the registry system. In this way, the registry system is similar to a banking system which keeps track of the ownership of money in accounts but does not track the deals made in the goods and services markets which were the cause of the money changing hands. So the registry system is not a marketplace; the way in which allowances are traded is a decision made by the participants in the market.

The system will be purely electronic, allowances will not be printed on paper but exist only in an online registry account. Each company with a commitment and any person interested in buying or selling allowances will need an account. The system will consist of a national component in each Member State where the allowances are held and a hub at European level, which will conduct automated checks on each transfer of allowances to ensure that the rules of the Directive are respected. Some of the data held in the registry will be released periodically, in accordance with UN rules and a forthcoming Regulation. A balance will be sought between environmental transparency and commercial confidentiality.

## Conclusion

The EU's Emissions Trading Scheme is the world's first international carbon trading scheme and was devised to meet the requirements of the Kyoto protocol at the lowest possible cost.

Although several concerns have been registered by the European trading industry, this scheme must be seen as a good first attempt in driving the energy-intensive industrial sectors toward a low carbon trajectory.

However, the non-trading sector should also participate to achieve the overall goal. The market price for allowances must create the necessary incentive for change. Where this price level might be found varies from industry to industry. It is highly likely the price needs to climb from that shown in **2** before investments in CO<sub>2</sub> reducing technologies become attractive. In the next round of allocations tighter limits might be necessary to drive the price towards a level at which sustainable long-term change is ensured.

### Nils Leffler

Chief Editor  
ABB Review  
nils.leffler@ch.abb.com

### Footnotes

- <sup>1)</sup> The Protocol is legally binding on its 128 parties since 16 February 2005. The United States and Australia are among the major industrialized countries that do not to support the treaty.
- <sup>2)</sup> The EU has made its own internal agreement – known as the "Burden Sharing Agreement" – to meet its 8 percent reduction target by distributing different rates to its member states. These targets range from a 28 percent reduction by Luxembourg to a 27 percent increase in CO<sub>2</sub> emissions by Portugal.
- <sup>3)</sup> Annex I includes Annex B countries and refers to industrialized and transitional countries that have agreed to an absolute reduction target under the Kyoto Protocol. It contains Belarus and Turkey, which are excluded from Annex B.
- <sup>4)</sup> Source: Report on the national GHG inventory data from Annex I Parties (FCCC/SBSTA/2003/14).
- <sup>5)</sup> Source: IEA 2004

### References

- [1] Croon, Ingmar; "Grodor blir Prinsar – och tvärtom", To be published, October 2005.
- [2] Ravemark, Dag; Åhström, Johan; "GHG Emissions Trading and CO<sub>2</sub> effects of HVDC projects." Internal ABB report, December 2004.
- [3] "Business consequences of the EU emissions trading scheme", CEPS task force report No.53, February 2005.