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A Survey on Phase I“

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List of Abbreviations

AAU	Assigned Amount Unit
BAT	Best Available Technique
CDM	Clean Development Mechanisms
CER	Certified Emission Reductions
CH_4	Methane
CITL	Community Independent Transaction Log
CO_2	Carbon Dioxide
CO_2e	Greenhouse Gas Equivalent
COP	Conference of the Parties
ECCP	European Climate Change Program
EEA	European Environment Agency
EPA	Environmental Protection Agency
ERU	Emission Reduction Unit
ETS	Emission Trading Scheme
EU	European Union
EU C.C.C.	European Union Climate Change Committee
EU ETS	European Union Emission Trading Scheme
EUA	European Union Allowance
GDP	Gross Domestic Product
GWP	Global Warming Potential
HFCs	Hydrofluorocarbons
IEA	International Energy Agency
IPCC	Intergovernmental Panel on Climate Change
ITL	Independent Transaction Log
JI	Joint Implementation
MW	Megawatt
N_2O	Nitrous oxide
NAP	National Allocation Plans
NER	New Entrant Reserve
OTC	Over-the-Counter
PFCs	Perfluorocarbons
SF_6	Sulphur Hexafluoride
SO_2	Sulphur Dioxide
UNFCCC	United Nations Framework Convention on Climate Change
US	United States

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1 Introduction

Climate change is one of the greatest challenges of our time and one of the most important issues our generation and future generations will have to deal with. Something is happening. But what that is, cannot be said exactly. The only thing we do know is that it has to do with the emissions of certain gases and that the consequences could be dire. Noticing and later understanding the problem, led to different reactions in the world. For instance the Earth Summit in Rio de Janeiro and the 3rd Conference of the Parties in Kyoto can be seen as milestones in the combat against global warming. Nations have reacted (if they reacted at all) quite differently to the scientific findings that something had to be done. Chapter 2 gives an overview on the topic of global warming and the measures against it. The European Union decided (among other measures) to implement a multinational emission trading scheme. Organized in phases, it puts a cap on total allowed emissions. Offering a fixed supply of emission allowances, rights to emit, the system wants to take advantage of the simple economic idea that if the prices are high enough the demand will decline. Chapter 3 explains the background of the system. Up to now only the first phase has been completed. Intended as a trial phase to gain experiences, this phase has motivated many authors to write down and interpret the processes and occurrences. I try to evaluate the potential success or possible failure of the trading system by analysing the literature. By comparing the Member States' transposition and implementation of the rules and regulations from the European Commission and their resulting handling of the scheme, Chapter 4 deals with the experiences made during Phase I. During the first years many obstacles arose and the Member States had to learn the hard way that their emission trading system was not yet perfected. Chapter 5 lists some of the problems the participating countries had to face. In the end I give a summary on the findings of Phase I and the conclusions I came to when writing this work.

2 Climate Change

"Climate change is one of the greatest, if not the greatest challenge ever faced by human society. But it is a challenge that we must confront, for the alternative is a future that is unpalatable, and potentially unliveable. While it is quite clear that inaction will have dire consequences, it is likewise certain that a concerted effort on the part of humanity to act in its own best interests has great potential to end in success." (Mann and Kump 2008, p.197). Stern emphasises the importance of fast action. "If the world waits before taking the problem seriously, until Bangladesh, the Netherlands and Florida are under water, it will be too late to back ourselves out of a huge hole. A special challenge of making policy here is that we are fast approaching a crisis which requires decision and action now, but we cannot yet directly experience the real magnitude of the dangers we are causing. And let us be clear, these dangers are on a scale that could cause not only disruption and hardship but mass migration and thus conflict on a global scale. They concern us all, rich and poor." (Stern 2009, p.3)

2.1 Overview – Climate Change: Is That Not Good?

In 1992 the United Nations defined climate change as "a change of climate which is attributed directly or indirectly to human activity that alters the composition of the global atmosphere and which is in addition to natural climate variability observed over comparable time periods" and emissions as "the release of greenhouse gases and/or their precursors into the atmosphere over a specified area and period of time." (United Nations 1992a[1], Article 1)

Greenhouse gas emission is a global problem. Wind currents mingle and spread the emissions all over the world, making the location of the emission irrelevant. A country with tight environmental policies, that uses clean technologies, emits very little and serves as a role model in general, still has to deal with climate change and emissions. A country with high emissions, on the contrary, profits from the emission reductions of cleaner countries. States, who believe that enough is being done by others and want to benefit from the measures taken by others, underestimate the problem. The global emission levels have to be reduced dramatically. Climate change policies are not about reversing the effect, but about reducing the speed and maybe stabilizing the rate of climate change.

[1] United Nations 1992a furtheron referred to as "UNFCCC"

Atmospheric quality is a global public good, which means that the positive and negative influences and impacts it has, cannot be reduced to one country or other part of the world, but it affects the whole world. The characteristics of a public good are that they are non-rivaled and non-excludable. Non-rivaled means that the good can be consumed all the while not reducing the total amount available for others. “Non-excludable” means that anyone can benefit from it without necessarily having to pay for it, maybe without even knowing that they are benefiting from it. As soon as the good is (made) available to one person, it is available to all. - The problem with atmospheric quality being a public good is that no market exists for these goods. Either they are just there (e.g. air, atmospheric quality) or they are provided by the government (e.g. national defence, public fireworks). In case of public goods a common market failure is the free-rider problem. This is the case when consumers benefit of a good, without making a contribution to the good’s maintenance or creation. There are solutions for these problems, but as we dealt with a global public good in our case, it does not become easier. Nordhaus explains that because “global warming is a global public good, the key environmental issue is global emissions, and the key economic issue is how to balance costs and benefits of global emissions reductions.” (Nordhaus 2007)

Just like the location, the timing of the emissions is of little importance. Greenhouse gases have long lifetimes and stay in the atmosphere for several decades. It is important to keep the total aggregated volume of emissions in the atmosphere at a level the environment can deal with. The International Energy Agency (IEA) states that “on current trends, energy-related emissions of carbon-dioxide (CO_2) and other greenhouse gases will rise inexorably, pushing up average global temperature by as much as 6°C in the long term.” (IEA 2008) Stern tries to make a temperature increase on this scale imaginable, when he writes that the ”seriousness of a 5°C increase is clear when we realise that in the last ice age, around 10.000 years ago, the planet was 5°C cooler than now. Most of Northern Europe, North America and corresponding latitudes were under hundreds of metres of ice, with human life concentrated much closer to the equator.” (Stern 2009, p.9)

2.2 Causes of Global Warming

The main cause of global warming, climate scientists agree is the emission of greenhouse gases, with the combustion of fossil fuels (oil, coal, gas) and deforestation being the main, anthropogenic activities responsible. As shown in Figure 1, in 2005 the European Environment Agency (EEA) calculated the sources of climate change and found that the power sector was responsible for 28 per cent of the greenhouse gas emissions, followed by the transport sector and the industrial sector. What might come as a surprise is that households and small businesses, as they use energy, are responsible for a staggering 17 per cent of the total emissions. Over two thirds of the energy used by households is spent on heating homes, the rest is used on heating water, on lighting and on electric appliances and travelling by car and by air.

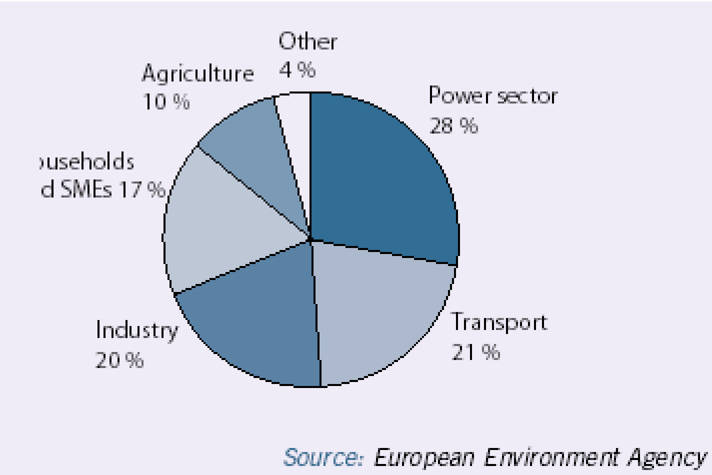


Figure 1 Sources of EU greenhouse gas emissions in 2005.[2]

2.3 Greenhouse Effect

The atmosphere of the Earth consists of a blanket of different gases. The incoming short-wave radiation passes the atmosphere. Outgoing long-wave radiation is absorbed by a few gases. The accumulation of these emitted greenhouse gases trap the sun's heat in the atmosphere. This is essential for life. Without this gas blanket the Earth would be cold and uninhabitable. The increased rate of emission

[2] taken from European Commission (2005a)

of greenhouse gases, however, affects this blanket in a way that outgoing radiation cannot pass through it anymore. Thus the heat is trapped under the blanket and the temperature on Earth rises. With a higher temperature the whole climate system is affected. The actual consequences of a climate change are very difficult to predict.

Figure 2 shows a conceptual model of the greenhouse effect.

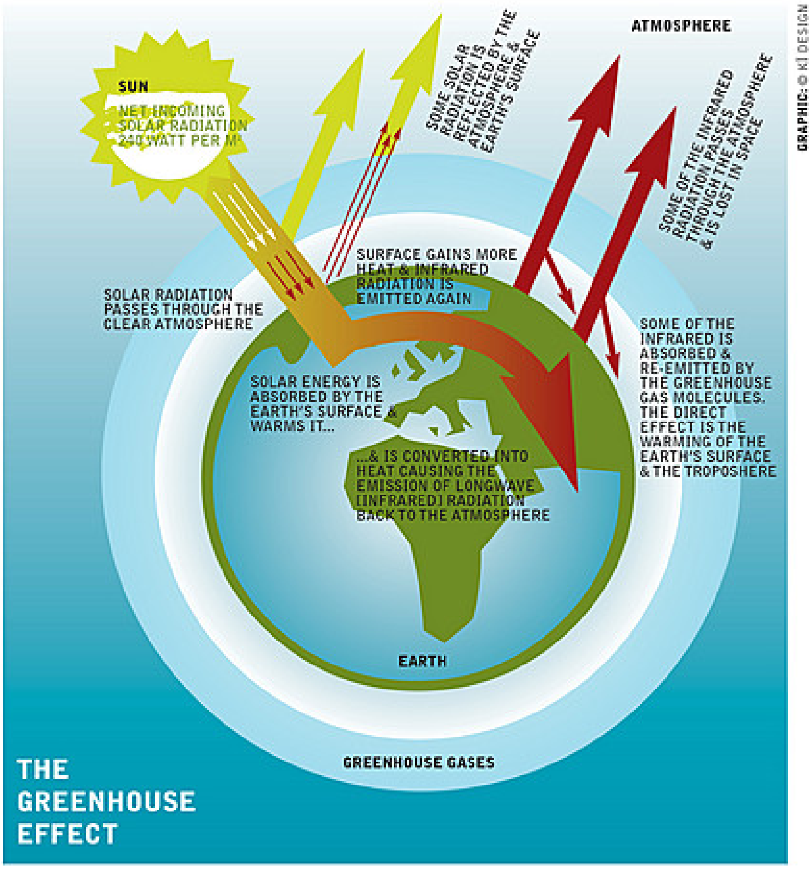


Figure 2 The Greenhouse Effect.[3]

2.3.1 Greenhouse Gases

Greenhouse gases are trace gases. The UNFCCC defines them as “those gaseous constituents of the atmosphere, both natural and anthropogenic, that absorb and re-emit infrared radiation,” in their Article 1. The Kyoto Protocol identifies six greenhouse gases in its Annex A, that have different impacts on

[3] taken from Greenpeace Homepage (2009)

global warming: Carbon dioxide (CO_2), Methane (CH_4), Nitrous oxide (N_2O), Hydrofluorocarbons (HFCs), Perfluorocarbons (PFCs) and Sulphur hexafluoride (SF_6). (United Nations 1997[4])

Figure 3 shows their relative importance within the European Union (EU) in 1990 given in CO_2 equivalents.

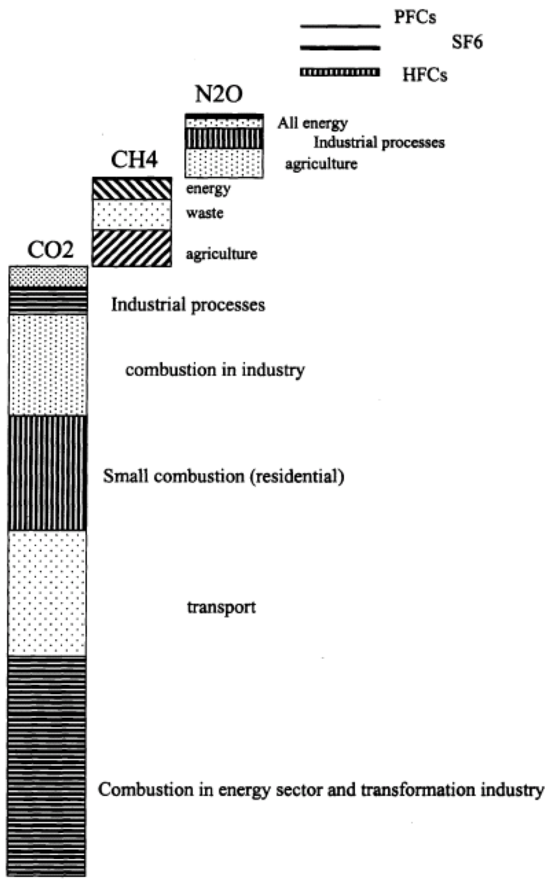


Figure 3 Relative importances of the greenhouse gases within the EU year 1990 – in CO_2 equivalents[5]

2.3.1.1 Carbon Dioxide

CO_2 is the most important of the greenhouse gases, because of the immense quantity in which it is emitted. It accounts for about 82 per cent of the impact of total greenhouse gas emissions, when sorting the greenhouse gases by their global warming potentials. It is released by combustion of anything that contains

[4] United Nations (1997) furtheron referred to as “Kyoto Protocol”
[5] taken from Annex II of European Commission (1999)

carbon, mainly fossil fuels and wood and by respiration of biosphere. The main emitter is the energy industry, with the transport sector, which is responsible for the recent increase of the emission of this gas, in second place. Also households and the manufacturing industries are large CO_2 emitters. CO_2 can be removed from the atmosphere e.g. through absorption by the ocean, through photosynthesis, through carbon sinks.

2.3.1.2 Methane

CH_4 is the second most important of the greenhouse gases in terms of quantity, accounting for about 8 per cent of total greenhouse gas emissions. It is more effective in terms of climate-change quality than carbon dioxide, but considering the overall quantity cannot keep up with CO_2. The main source of methane emissions is found to be the agricultural sector (livestock digestive processes and manure). It is released by fossil fuel production, pulp and paper processing and waste management – any anaerobic decay of matter. Especially coal mining and rice paddies are emitting heavily.

2.3.1.3 Nitrous Oxide

N_2O accounts for about 7 per cent of total greenhouse gas emissions and is released mainly by the chemical industry, by the agricultural sector's use of fertilizers and in fossil fuel combustion processes.

2.3.1.4 Hydrofluorocarbons and Perfluorocarbons

Hydrofluorocarbons and perfluorocarbons are halocarbons. Halocarbons do not exist naturally but are human-produced. They consist of a halogen (fluorine, chlorine, bromine, iodine) and carbon. Hydrofluorocarbons are used in huge quantities in refrigeration. Perfluorocarbons are a by-product of aluminium smelting.

2.3.1.5 Sulphur Hexafluoride

The main emitter of sulphur hexafluoride is the power industry, as it is used to insulate high-voltage equipment. Together the fluorinated gases account for about 1 per cent of total greenhouse gas emission, with a decreasing trend. This may not seem a lot, but due to their high global warming potential, they constitute a problem.

2.3.2 Greenhouse Gas Equivalents

For easier comparison of the gases' climate impact the greenhouse gas equivalents were introduced. CO_2 was fixed at 1. The other greenhouse gases have corresponding values, relative to CO_2. These values are called greenhouse gas equivalents and depend on the gases' global warming potentials (GWP). CO_2 equivalents are a universal standard of measurement (like metre or kilogram). The GWP is measured in three timescales. The time horizons are 20, 100 and 500 years. CO_2 describes the baseline and always has a value of 1. Article 3 of the "Emission Directive"[6] defines that "'tonne of carbon dioxide equivalent' means one metric tonne of carbon dioxide (CO_2) or an amount of any other greenhouse gas listed in Annex II with an equivalent global warming potential."

The greenhouse gas equivalents (CO_2e) are indicated by the gases' global warming potentials and are listed in the table below.

Table 1 Greenhouse gases and their global warming potential[7]

Greenhouse gas	Abbreviation	Global Warming Potential
Carbon Dioxide	CO_2	1
Methane	CH_4	21
Nitrous Oxide	N_2O	310
Perfluorocarbons	PFCs	6.500-9.200
Hydrofluorocarbons	HFCs	140-11.700
Sulphur hexafluoride	SF_6	23.900-32.600

Table 1 can be read that in a 100 year period the global warming potential of one unit of CH_4 is 21 times greater than that of one unit of CO_2 and the global warming

[6] European Parliament (2003) furtheron referred to as „Emission Directive"
[7] taken from the IPCC Homepage

effect of one tonne of N_2O will be 310 times greater than that of one tonne of CO_2. The equivalent values are not absolute numbers. There is uncertainty about how long certain gases remain in the atmosphere, but they constitute an average educated estimate.

2.3.3 Greenhouse Gas Emission Levels in Europe

In 1990, the Kyoto base year, the EU was responsible for around 23 per cent of global greenhouse gas emissions. Today, the European Union is responsible for about 14 per cent of the global greenhouse gas emissions. Figure 4 shows the share of greenhouse gas emissions in the EU-27 by main emitting country in 2006. Germany and the United Kingdom are the largest emitters, followed by Italy and France. This sequence has not changed since 1990.

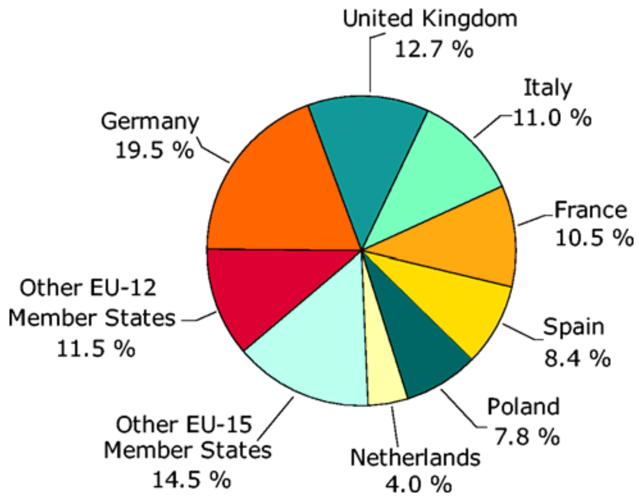


Figure 4 Share of 2006 greenhouse gas emissions in the EU-27 by main emitting country[8]

In 2008 the International Energy Agency (IEA 2008) ranked the world's five largest emitters of energy-related CO_2 that account for about two thirds of the world's CO_2 emissions: China, the United States, the European Union, India and Russia.

Figure 5 shows the world-wide CO_2 emissions in 2009. The world is split into ten regions. Darker areas stand for higher emissions, lighter ones for lower emissions. The emission levels of developing countries are projected to exceed those of industrialised countries by 2020.

[8] taken from the EEA Homepage (2009a)

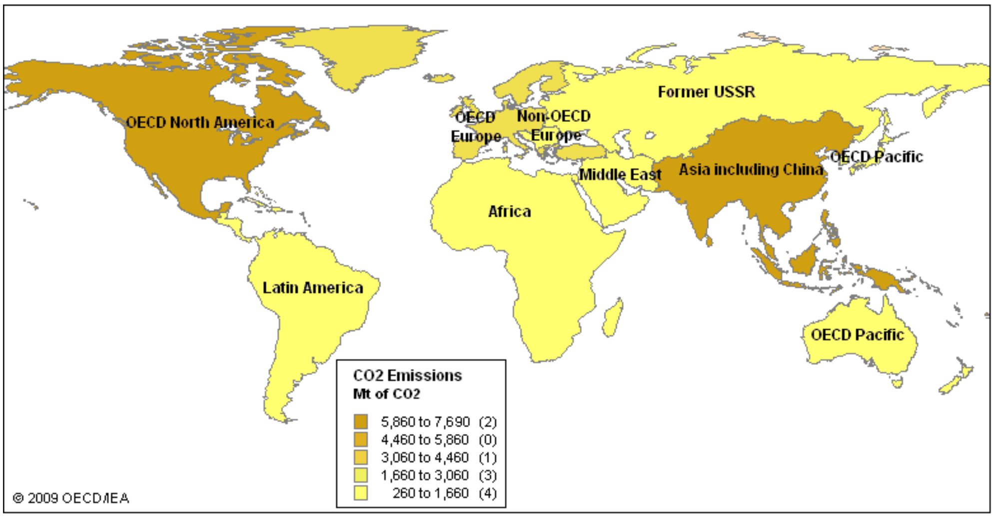


Figure 5 World-wide CO_2 Emissions in 2009[9]

In 2008 the EEA stated, that over 80 per cent of the greenhouse gas emissions were energy-related, “that is, related to the production of electricity and heat, road transportation, etc.” and that the average per capita greenhouse gas emission in the EU-27 was 10.4 tonnes of CO_2e per capita and year (EEA 2008a).

Figure 6 shows a list of the greenhouse gas emissions per capita of EU-27 Member States for 1990 and 2005. In 2005 the annual total average per capita emission level was at 10.5 tonnes of CO_2e. Thus, the emissions in the EU are still declining.

[9] taken from the IEA Homepage (2009)

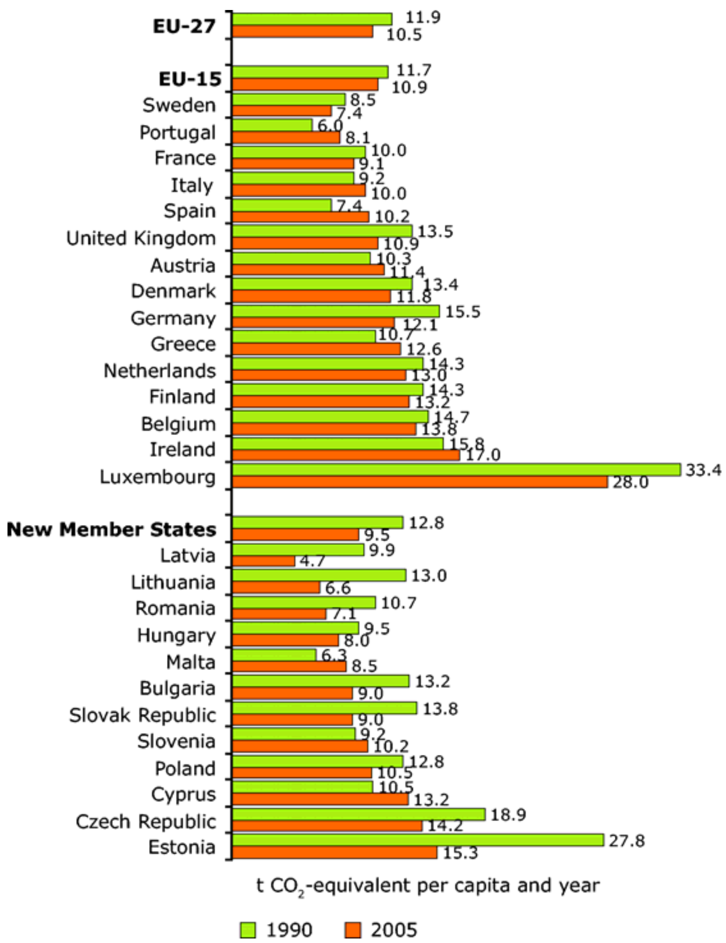


Figure 6 Greenhouse gas emissions per capita of EU-27 Member States for 1990 and 2005[10]

If this number is compared to India which, Stern writes, “has seen [economic] growth of around 8%, yet per capita emissions are still below 2 tonnes CO_2e per annum” these numbers come into perspective. He proposes that a 2 tonnes CO_2e per capita and year has to be a worldwide goal (Stern 2009, p.20).

Figure 7 shows the per capita emissions relative to the population in 2000 for selected regions, taking into account all Kyoto gases. The total emissions of the selected countries and regions are given by the area of each rectangle, i.e. per capita emissions times population size.

[10] taken from the EEA Hompage (2009b)

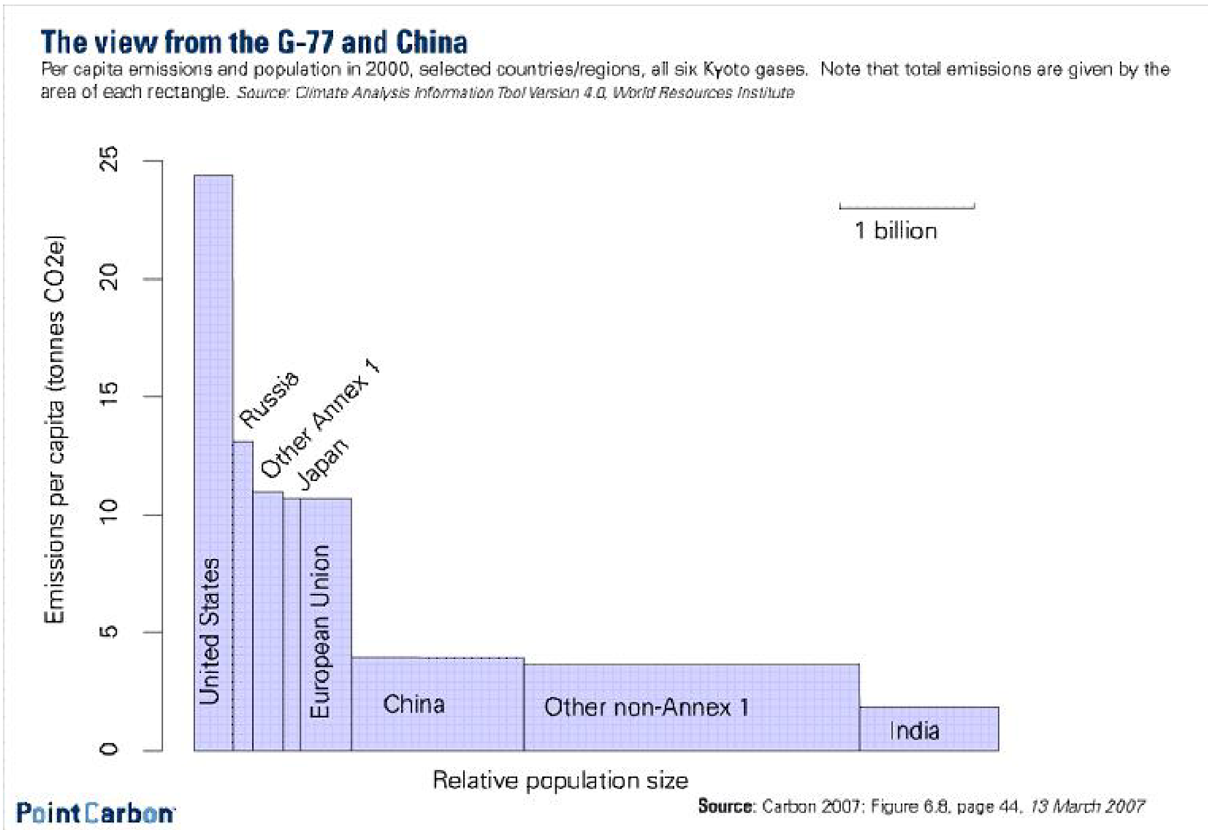


Figure 7 Per capita emissions relative to population in 2000[11]

2.4 Impacts of Global Warming

One impact of global warming is the rising of sea levels that threaten coastal lowlands (e.g. the Netherlands, Florida and the Bangladesh delta), coastal cities and islands (e.g. the Maledives) with flooding. Flooding can cause freshwater pollution due to seawater intrusion.

Another (expected) consequence of global warming is the melting of glaciers, which can cause floods. Glaciers are used as water resources in some areas and if they disappear, life in those areas faces a severe problem, as these resources retain water and provide homogenous supply during the entire year.

The warm temperatures in recent times have caused the – once immense – Greenland ice sheet to retreat. Should this ice sheet melt completely, the sea

[11] taken from Point Carbon (2007a)

levels would rise up to seven meters and the Gulf Stream would be affected. The Gulf Stream warms north-western Europe.

The number of extreme weather events is rising. Higher maximum temperatures, higher risks of droughts and fires, storms, more heat waves, and floods happen with increased frequency. This also has a negative effect on agricultural yields, with maximum effect in poor countries. Changes of rainfall patters may occur changing climate, threatening water resources of the concerned regions.

Another consequence of global warming is mass extinction of species. This will occur, when their habitats change too quickly for them to adapt and in that way become unliveable.

In 2007 the European Commission communicated that climate change was already having pronounced environmental, economic and social impacts. Current examples are “lack of snow suffered by European ski resorts” and the 2003 heat wave in Europe when 20.000 people in the EU died prematurely from heat stress and increased air pollution from ozone. Large-scale forest fires raged in Europe and farmers lost over EUR 10 billion in income due to crop damage. (European Commission 2007a)

Stern explains, what comes as a surprise for some people, that the “danger from climate change lies not only, or even primarily, in heat. Most of the damage is from water, or the lack of it: storms, droughts, floods, rising sea levels. The levels of warming that we risk would be profoundly damaging for all countries of the world, rich and poor. A transformation of the physical geography of the world also changes the human geography: where we live, and how we live our lives.” He states that “the developing world will be hit earliest and hardest, while the rich world has more resources and technologies, and the majority of the responsibility for past emissions that have taken us to the very difficult starting point for action. The sense of injustice felt intensely and very understandably by the developing world is a crucial element in the perception of the equity and thus the feasibility of any global deal. A major effort by rich countries to support the adaptation of developing nations is a key part of an equitable deal.” (2009, p. 9 and 176)

2.5 Understanding the Problem

Since climate change has become an issue, there have been several milestones in the history of understanding the problem. I would like to name only (some of) those, that led to the launching of the European Emissions Trading Scheme.

2.5.1 Earth Summit – Rio de Janeiro from 3 to 14 June 1992

In Rio de Janeiro from June 3 to June 14, 1992 the Earth Summit took place. At this United Nations Conference on Environment and Development the United Nations Framework Convention on Climate Change (UNFCCC) was signed. It is the first international, legally binding agreement on climate change reduction of this size. Its objective is the "stabilization of greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous anthropogenic influence with the climate system." It was agreed, that the world had to work together against climate change, but that the burdens each nation had to carry had to be differentiated. The Convention entered into force on March 21, 1994. As of today, 192 nations have adopted the UNFCCC.

Principle 7 of the Rio Declaration on Environment and Development (United Nations 1992b[12]) notes: "In view of the different contributions to global environmental degradation, States have common but differentiated responsibilities. The developed countries acknowledge the responsibility that they bear in the international pursuit to sustainable development in view of the pressures their societies place on the global environment and of the technologies and financial resources they command."

2.5.2 3rd Conference of the Parties – Kyoto from 1 to 10 December 1997

At the 3rd Conference of the Parties the Kyoto Protocol was done. It is an international agreement, adopted on December 11, 1997 in Kyoto, Japan, that sets legally binding targets for a list of developed countries, originally 38

[12] United Nations 1992b furtheron referred to as "Rio Declaration"

industrialised countries and the EU-15, for the reduction of a number of greenhouse gases. The emission targets presently apply to 37 industrialised countries and the EU-15, as the United States have chosen not to ratify the Protocol.

Article 3 of the Kyoto Protocol reads: “The Parties included in Annex I shall, individually or jointly, ensure that their aggregate anthropogenic carbon dioxide equivalent emissions of the greenhouse gases listed in Annex A do not exceed their assigned amounts, calculated pursuant to their quantified emission limitation and reduction commitments inscribed in Annex B and in accordance with the provisions of this Article, with a view to reducing their overall emissions of such gases by at least 5 per cent below 1990 levels in the commitment period 2008-2012.” (United Nations 1997[13])

Annex I is an annex of the UNFCCC and lists the parties, developed and developing countries, that have agreed to limit their anthropogenic emissions. In 1990 the Annex I nations were responsible for around 64 per cent of the greenhouse gas emissions worldwide. Annex I parties are Australia, Austria, Belarus, Belgium, Bulgaria, Canada, Croatia, Czech Republic, Denmark, Estonia, European Community, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Japan, Latvia, Liechtenstein, Lithuania, Luxemburg, Monaco, The Netherlands, New Zealand, Norway, Poland, Portugal, Romania, Russian Federation, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey, Ukraine, United Kingdom of Great Britain and Northern Ireland and the United States of America. Among the Annex I countries only the United States of America have not ratified the Kyoto Protocol.

Non-Annex I countries, are (mainly developing) countries, that have ratified the Kyoto Protocol, but which have no emission targets.

Annex B is an annex of the Kyoto Protocol, in which Kyoto’s 5 per cent emission limitation level is assigned and redistributed to 39 Annex I countries, which have ratified the Protocol and which were considered to be industrialised countries in

[13] United Nations (1997) furtheron referred to as “Kyoto Protocol”

1992 (established at the negotiation of UNFCCC). Annex B parties are the same as Annex I except Belarus, Turkey and the United States of America. The countries listed in Annex B of the Kyoto Protocol have differentiated emission reduction targets.

Annex A is an annex of the Kyoto Protocol that lists the greenhouse gases and the sectors/source categories.

By signing the Kyoto Protocol developed countries agreed to lower their greenhouse gas emissions by on average 5.2 per cent below the 1990 emission levels between 2008 and 2012. This five-year time horizon was chosen – rather than a deadline – to smooth out unforeseeable emission fluctuations due to e.g. weather, volcanic eruptions, or political happenings (e.g. war). The European Community, which ratified the Kyoto Protocol on May 31, 2002 and signed the Protocol as one party, has committed itself to reducing its overall greenhouse gas emissions by 8 per cent during the compliance period. - As of May 2009, 184 countries have ratified the Kyoto Protocol (United Nations 2009).

Table 2 shows the targets the Annex I countries agreed to.

To reach the targets the countries agreed upon, the Kyoto Protocol suggests national measures but additionally offers three flexible mechanisms, sometimes called “flexmex”, to mitigate the greenhouse gases: joint implementation (JI), clean development mechanisms (CDM) and emission trading.

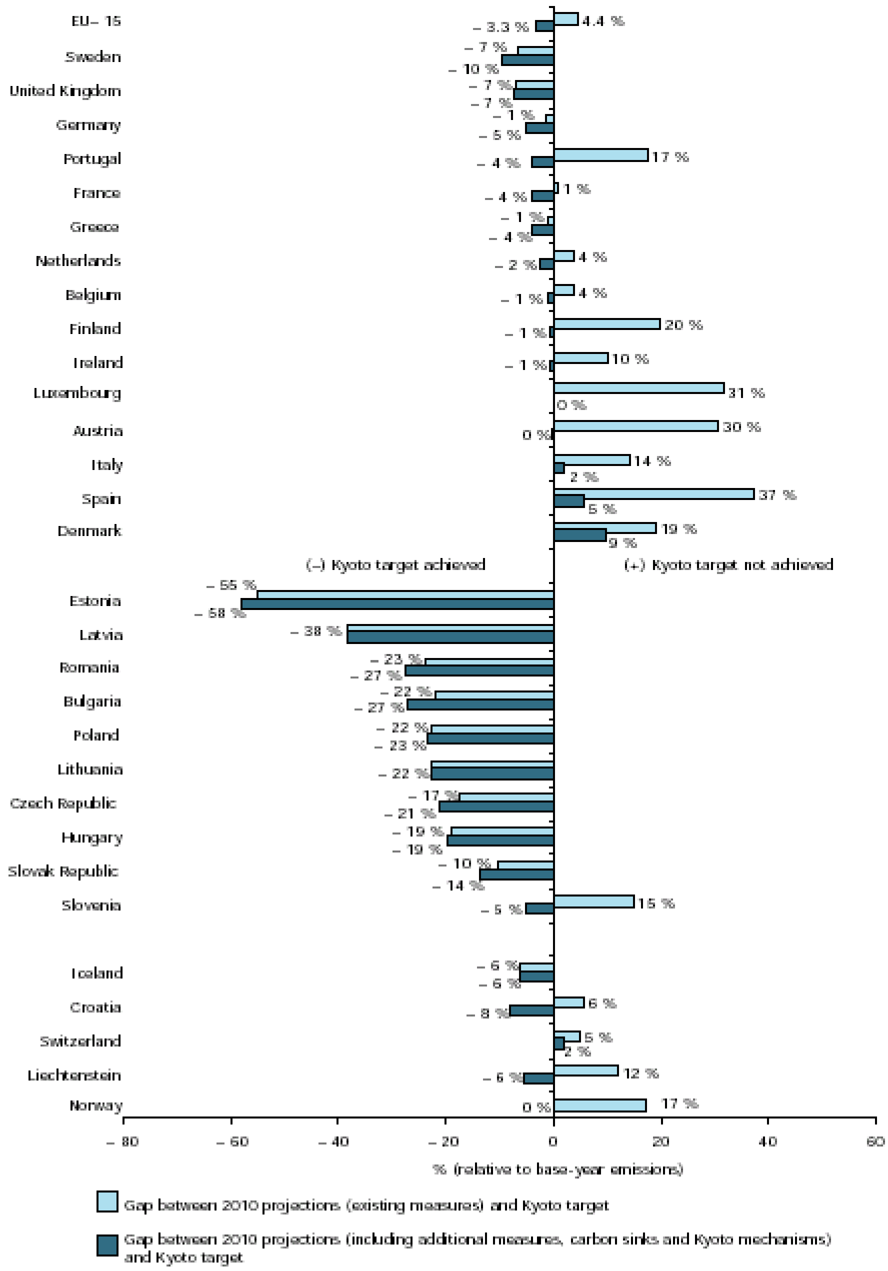
Article 25 of the Kyoto Protocol stipulates that the “Protocol shall enter into force on the ninetieth day after the date on which not less than 55 Parties to the Convention, incorporating Parties included in Annex I which accounted in total for at least 55 per cent of the total carbon dioxide emissions for 1990 of the Parties included in Annex I, have deposited their instruments of ratification, acceptance, approval or accession.” This condition was finally met when the Russian Federation, who is responsible for 17.4 per cent of the emissions, ratified the Protocol on November 18, 2004. Thus, the Kyoto Protocol, the international reaction to climate change, finally came into force on February 16, 2005 with the agreement of 141 countries. Should a party fail to meet its Kyoto target, it has to compensate for the difference, increased by a 30 percent penalty, in the subsequent commitment period, starting 2013.

Table 2 Emission reduction targets of Annex I Parties.

Annex I Party	Emission Limitation
Belarus, Turkey	Party for which there is a specific COP and/or CMP decision
Austria, Belgium, Bulgaria, Czech Republic, Denmark, Estonia, European Community, Finland, France, Germany, Greece, Ireland, Italy, Latvia, Liechtenstein, Lithuania, Luxemburg, Monaco, The Netherlands, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland, United Kingdom of Great Britain and Northern Ireland	-8%
United States of America	-7%
Canada, Hungary, Japan, Poland	-6%
Croatia	-5%
New Zealand, Russian Federation, Ukraine	0%
Norway	+1%
Australia	+8%
Iceland	+10%

In 2008 the EEA calculated the projections of the emission levels of the states participating in the European Union Emission Trading Scheme (EU ETS) and compared them to the individual targets.

As visible Figure 8, some states will have problems reaching their Kyoto target, if further measures are not taken (EEA 2008a).



Source: EEA, based on EU Member States greenhouse gas inventories and projections.

Figure 8 Gaps between EU Kyoto and burden-sharing targets and projections for 2010.

The costs of the implementation of the Kyoto targets vary, depending on the estimates. In 2002 the European Commission estimated that “the total compliance costs of meeting the Kyoto Protocol targets can be as low as 0.06% of EU projected GDP [gross domestic product] in 2010, if the EU adopts the most efficient policies to reduce greenhouse gas emissions.” (European Commission

2002) The “Green Paper” states, “Estimates show that Community-wide trading by energy producers and energy intensive industry could reduce the costs of implementing the Community’s Kyoto commitments by nearly a fifth compared with separate Member State schemes that did not allow for cross-border trading. This represents a potential cost saving of approximately EUR 1.7 billion per year.” (European Commission 2000[14]) In 2005 the European Commission recalculated the figures and had to make corrections. It now estimated that “the scheme should allow the EU to achieve its Kyoto target at a cost of between EUR 2.9 billion and EUR 3.7 billion annually. This is less than 0.1% of the EU’s GDP. Without the scheme, compliance costs could reach up to EUR 6.8 billion a year.” (European Commission 2005b) In 2007 the European Commission issued a Memo on climate change, in which it writes that the ”Commission's impact assessment shows that taking action to limit climate change is fully compatible with sustaining global economic growth. Investment in a low-carbon economy will require around 0.5 % of total global GDP over the period 2013–2030. This would reduce global GDP growth by just 0.19 % per year up to 2030, a fraction of the expected annual GDP growth rate of 2.8%, and this is without taking into account associated health benefits, greater energy security and reduced damage from avoided climate change. This is a small insurance premium to pay for significantly reducing the risk of irreversible damage, particularly when compared with the Stern Review's estimate that uncontrolled climate change will cost between 5 and 20% of GDP in the longer term.” (European Commission 2007b).

2.5.3 EU Burden Sharing Agreement of April 25, 2002

Article 4 of the Kyoto Protocol allows that the European Community, whose Member States have signed the Protocol individually but that has also signed as one party, can redistribute its overall 8 per cent target between its Member States as long as the outcome stays the same. It is often referred to as a “bubble” that is put over the participating states. The states under the “bubble” have agreed to a common goal, to reduce their emissions by 8 per cent, and that it was unimportant who underneath that bubble exactly reduced how much, as long as the overall goal was reached. Each Member State is allotted an individual target, for which it

[14] European Commission (2000) furtheron referred to as “Green Paper”

is then individually responsible, with the target of the bubble playing only a role in aggregated form. De Sepibus explains, “The idea of burden sharing can be traced back to the elaboration of the EU negotiating position in preparation for the third Conference of the Parties (COP3) in December 1997 in Kyoto, at which the Kyoto Protocol was adopted. The EU bubble was found necessary to allow the Community to adopt a common negotiating position for a challenging target under the Kyoto Protocol.” (de Sepibus 2007a)

As mentioned above the Rio Declaration calls for “common but differentiated responsibilities”. To take into account the characteristics and economic possibilities of the Member States the EU “Burden Sharing Agreement” was reached on 17 June 1998 at a meeting of the Environment Council (European Commission 1999). In this so-called “Bubble Agreement” the individual targets of the Member States of the EU, then EU-15, were politically agreed upon. The overall emission reduction target of 8 percent was split between the Member States, to give poorer countries lighter burdens compared to richer Member States, i.e. the Kyoto target was differentiated into national goals for each Member State.

Annex I of the Communication on the Burden Sharing agreement lists the countries and their reduction targets, in percentile and in absolute terms, as shown in Table 3.

On March 2, 2002 the individual targets of the EU Member States were agreed in legally binding form and came into force on April 25, 2002 by Council Decision (European Council 2002).

According to their Kyoto Protocol targets the countries can issue Kyoto emission permit units, so called assigned amount units (AAUs), up to their compliance level. Issuing refers to the creation of the AAUs. The total of AAUs issued forms the country’s emission budget. Emission trading redistributes the AAUs. The overall amount stays the same. One AAU permits the emission of one tonne of CO_2e. The EU ETS Member States allocate, i.e. distribute, European Union Allowances (EUAs), by taking the according number of AAUs from their national emission budget, transforming them into EUAs which are then allocated to sectors and further on to companies and installations in the allocation process as put down in the National Allocation Plans (NAPs). One EUA permits the holder of the certificate to emit one tonne of CO_2e.

Table 3 Individual targets of the EU-15[15]

	Burden sharing in %	Burden sharing in Mt CO_2e
Austria	-13%	64
Belgium	-7.5%	129
Denmark	-21%	57
Finland	0%	73
France	0%	637
Germany	-21%	949
Greece	+25%	130
Ireland	+13%	64
Italy	-6.5%	506
Luxemburg	-28%	10
Netherlands, The	-6%	196
Portugal	+27%	87
Spain	+15%	347
Sweden	+4%	72
United Kingdom	-12.5%	678
European Community	-8%	3998

2.5.4 Emission Directive

Stern explains that there “are, broadly speaking, three policy instruments that can be used to put a price on greenhouse gas emissions: a tax, in which case the price is determined by the level of the tax; trading of a fixed number of emission permits, the number and initial allocation of which is set by the government – in which case the price is set by the interaction of buyers and sellers in the market; and regulations or technical requirements which may need more costly equipment or processes – the implicit price is then the extra cost divided by emissions saved.” (Stern 2009, p.102) After the Kyoto Protocol negotiations in December 1997, the European Commission issued a communication, introducing the idea of EU-wide emission trading (European Commission 1998).

[15] adapted from European Commission (1999)

In March 2000 the European Commission published the "Green Paper on greenhouse gas emissions trading within the European Union", which suggests international emission trading as the preferable measure towards Kyoto compliance as it gives companies more flexibility in reaching their targets. "Emission trading, whether domestic or international is a scheme whereby entities such as companies are allocated allowances for their emissions. Companies that reduce their emissions by more than their allocated allowance can sell their "surplus" to others who are not able to reach their target so easily. This trading does not undermine the environmental objective, since the overall amount of allowances is fixed. Rather, it enables cost-effective implementation of the overall target and provides incentives to invest in environmentally sound technologies." Proposing emission trading as the measure of choice was a surprising step, since up to then the European Commission had preferred regulatory measures to market-based instruments. In June 2000 the EU started its European Climate Change Program (ECCP) to find solutions for and to give recommendations how to deal with the climate change problem in a cost-efficient way. The results – among which was a framework of an Emission Directive – were presented to the European Commission. In October 2001 the Proposal of an Emission Directive was finally accepted and published by the European Commission (European Parliament 2001). The trading proposal was presented, in a first reading in the European Parliament, by the European Commission to the European Parliament and the Council of Environmental Ministers, who proposed several further amendments. In July 2003, after the proposed amendments had been negotiated, the Emission Directive was agreed on in a second reading. On July 22, 2003 the Council and the European Parliament finalized the text of the Emission Directive. On October 13, 2003, after the approval of all (then) 15 EU Member States and the European Parliament, the European Parliament and the Council established a scheme for greenhouse gas emission allowance trading within the Community in their "Emission Directive[16]", Directive 2003/87/EC, which came into force on October 25, 2003.

[16] European Parliament (2003a) furtheron referred to as "Emission Directive"

Ellerman explains “the ETS Directive, which provides the legal basis for the EU ETS, can be seen, like all EU directives, as a specialized multi-national agreement within the broader framework of the Treaties that have established the European Union. Although surely different in many particulars, a global trading regime will exhibit a similar high degree of decentralization.” (Ellerman 2008)

On January 1, 2005 the EU ETS was launched. The reason for this date was Article 3 of the Kyoto Protocol, which reads: “Each Party included in Annex I shall, by 2005, have made demonstrable progress in achieving its commitments under this Protocol.” The European Commission then decided that “the Community could set up its own internal trading regime by 2005” in 1998. (European Commission 1998)

3 European Union Emission Trading Scheme

Pizer writes, a “global externality requires global cooperation, international emissions trading lowers costs for all nations, and emission pricing is the key to the development of new climate-friendly technologies.” (Pizer 2006) As the price is a function of supply and demand and thus left to the market forces the ETS can be seen as an economic policy that enables the Kyoto targets to be reached cost-effectively. Article 17 of the Kyoto Protocol reads that Annex B countries “may participate in emission trading for the purposes of fulfilling their commitments […].” Ellerman explains that the “EU ETS was conceived in the late 1990s as a means of ensuring that the then fifteen members of the European Union (EU15) could meet their commitments under the Kyoto Protocol in the First Commitment Period (2008-2012).” (Ellerman 2008)

Originally planned as a voluntary measure, the learning phase was planned to assist EU countries in reaching their Kyoto targets. By 2002 the emission trends showed that several EU countries would miss their targets. Consequently the EU then changed the voluntary into a mandatory measure.

3.1.1 Main Characteristics of the EU ETS

Buchner et al. explain, “The EU ETS is basically a mandatory system, with binding rules, central monitoring and administrative experts. However, despite the hierarchical character of the system, national control over cap setting gave it fundamental decentralized character compared, for example, to the US SO_2 [sulphur dioxide] and NO_x [nitrogen oxides] trading system.” (Buchner et al. 2007)

In Article 1 of the “Emission Directive” it says the aim of the EU ETS is to help the participating countries reach their Kyoto targets during 2008-2012 at minimum cost, “to promote reductions of greenhouse gas emissions in a cost-effective and economically efficient manner.” It does not suggest new environmental targets.

The EU ETS is organized in phases. Phase I is from 2005-2007 and often referred to as “learning phase”, “warm up phase”, “pilot phase” or “trial period”. Phase II lasts from 2008 to 2012 and is called “compliance phase” or “Kyoto phase”. Phase I was launched to avoid a shock during the compliance phase. It was argued that a new market of that dimension would not work from one day to the other and that the price building process would need some time. Also the issue of sudden emission reductions was identified as a potential problem source. Phase I was seen as a possibility to gain experience with the new market and an option to assist the participating member states, the “trading states”, reach their imposed Kyoto targets and to give them the chance to familiarize themselves with the EU ETS and the idea of emission limits, in other words, by offering a “learning by doing” period. The “Green Paper”, published in 2000, points out the necessity of the learning phase: “As emission trading is a new instrument for environmental protection within the EU, it is important to gain experience in its implementation before the international emission trading scheme starts in 2008.”

The EU ETS takes place on the level of installations. Article 3 of the “Emission Directive” defines an installation as “a stationary technical unit where one or more activities listed in Annex I are carried out.”

3.1.2 Cap-and-Trade System

The cap-and-trade system was considered rather late as the instrument of choice against climate change, in Europe. Up to then the long-standing command-and-control policies were the mainly used measures. The kick-off to use a cap-and-trade system in the context of environmental policies was given by the United States (US) during the negotiations of the Kyoto Protocol's climate change policies. The US had a (working) SO_2 allowance system, which is a tradable permit system that started in 1990 as a product of the Clean Air Act Amendments and covers SO_2 and N_2O emissions. Former US president Bill Clinton requested the use of this flexible market-based instrument, while Europe suggested a command-and-control policy. In the end, Europe reluctantly accepted the US proposal. Former US president George Bush followed Bill Clinton's term of office, in January 2001, with entirely different views on environmental policies. In March 2001 the US, at that time responsible for about one third of the world's greenhouse gas emissions and thus the biggest emitter of greenhouse gases, surprisingly backed out of the Kyoto Protocol, delaying its entering into force for an until then unknown time period.

Still, the EU ETS, as we know it today, a cap-and-trade system, was kept and has advanced to the largest, mandatory, multinational market for CO_2 in the world within a few years. The EU ETS is a product of the Kyoto Protocol, but still by now it is quite independent of it. Of the 184 countries that have ratified the Kyoto Protocol, only 27 countries, 14.7 per cent, participate in the scheme, in 2008 three non-EU-countries join in, increasing this percentage to 16.3 per cent.

The EU ETS Member States had to transpose the "Emission Directive" – another consequence of the Kyoto Protocol – into national law by December 31, 2003. At that time it was unclear when and unlikely if the Kyoto Protocol would come into force at all, with the US, then the world's largest emitter – in 2006 overtaken by China as largest emitter – having declared that it would not ratify. By laying down the EU ETS in EU law, the Kyoto Protocol itself became unnecessary for this particular environmental policy. The Kyoto Protocol considers the time period until 2012, while the EU ETS is planned to continue with at least another phase, Phase

III from 2013-2020. On January 1, 2005, the EU ETS was launched independent of the Kyoto Protocol, which did not come into force until February 16, 2005, thanks to the Russian Federation that ratified the Protocol 90 days before.

From the environmental point of view, the advantage of a cap-and-trade system over a control-and-command system is the emission ceiling, the target level, the cap. A certain amount of emission allowances is available, but not more. By setting a cap an emission reduction target can be reached exactly, thus the environmental outcome is known from the beginning. Other regulatory measures cannot ensure that a target will be reached as there are many uncertainties, e.g. number of new plants, technologies used,… - In case of taxes the companies emit at will and then pay the taxes for their emissions. The tax revenues can be used for other environmental policies, but the total emission level of a country cannot be controlled. - On January 1, 2005 the quantitative limit on greenhouse gas emissions, the cap, became obligatory for the trading partners of the EU ETS.

From the economic point of view, the advantage of a cap-and-trade system is the market for the emission allowances, the trade. A company receives a certain amount of emission allowances in the beginning of the trading period. These allowances have a certain value on the carbon market. The company now has two choices. It can keep and use the allowances for itself or it can sell them to other companies. If the company does not need as many allowances as it received, or if the company estimates that it is cheaper to reduce its emissions and sell the surplus allowances, it can do so on the market, making additional profits. The investment decisions a company faces are described in Chapter 4.7. If the company does not have sufficient allowances and emission reductions are not reasonably feasible, it can buy additional allowances on the market, from companies with inexpensive mitigation options, thus optimising the cost-efficiency of the system.

The macro cap-setting, the overall cap for each country, as Convery et al. explain "was achieved in a decentralized, negotiated process between the Commission and Member State governments that reflected the political structure of the European Union. The "micro" aspects of allocation could best be characterized as an extended industry-government discussion dictated by data availability and the ETS mandate to distribute at least 95% of allowances to installations for free." (Convery et al. 2008)

3.1.3 Scope: Greenhouse Gases, Sectors, Installations

The EU ETS covers the CO_2 emissions. No other greenhouse gases are covered by the scheme yet.

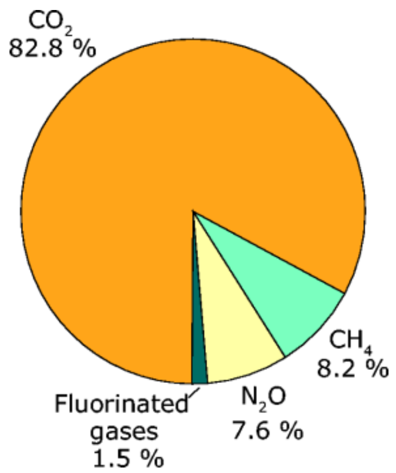


Figure 9 Percentages of emitted greenhouse gases[17]

As can be seen in Figure 9 CO_2 is responsible for the major share of the greenhouse gases emitted.

The reason for not including the other five greenhouse gases the Kyoto Protocol names, right from the start, is mainly simplicity. Since experience with emission trading still has to be built up, authorities want to keep the scheme as simple as possible. It is likely that other greenhouse gases will be included later, but the initial focus is on CO_2. Covering other greenhouse gases by the EU ETS would certainly have a positive effect on the market as a whole, as one can assume liquidity to increase with more gases covered and the market broadened. This in turn can lead to higher market efficiency.

[17] taken from the EEA Homepage (EEA Homepage 2009c)

Annex I of the “Emission Directive” lists the energy-intensive, key industrial sectors that are obliged to participate. Covered under the scheme are the energy sector, the metals sector, the minerals sector and other sectors making pulp and paper. Table 4 lists the sectors and their corresponding thresholds that are covered by the EU ETS. The 20 Megawatt-threshold refers to all aggregated on-site combustion activities.

Table 4 Scope: Sectors and thresholds[18]

<u>Energy activities</u> Combustion installations with a rated thermal input exceeding 20 MW (except hazardous or municipal waste installations) Mineral oil refineries coke ovens <u>Production and processing of ferrous metals</u> Metal ore (including sulphide ore) roasting or sintering installations Installations for the production of pig iron or steel (primary or secondary fusion) including continuous casting, with a capacity exceeding 2.5 tonnes per hour <u>Mineral industry</u> Installations for the production of cement clinker in rotary kilns with a production capacity exceeding 500 tonnes per day or lime in rotary kilns with a production capacity exceeding 50 tonnes per day or in other furnaces with a production capacity exceeding 50 tonnes per day Installations for the manufacture of glass including glass fibre with a melting capacity exceeding 20 tonnes per day Installations for the manufacture of ceramic products by firing, in particular roofing tiles, bricks, refractory bricks, tiles, stoneware or porcelain, with a production capacity exceeding 75 tonnes per day, and/or with a kiln capacity exceeding 4 m3 and with a setting density per kiln exceeding 300 kg/m3 <u>Other activities</u> Industrial plants for the production of (a) pulp from timber or other fibrous materials (b) paper and board with a production capacity exceeding 20 tonnes per day

As with the gases, it is likely that other sectors will be included in the scheme at later times.

Bleischwitz et al. explain that the “energy-intensive sectors have not been included in general because they are energy users rather than producers, e.g. the chemical

[18] taken from Annex I of the “Emission Directive”

sector, waste incineration, aluminium and other metal industries are not included." (Bleischwitz et.al. 2007) One reason for this is the polluter pays principle, which suggests charging the original emitter, which would be the energy producer. Non-covered sectors face other national environmental regulations and the possibility of loading a double burden on the companies is given. This has a negative effect on the competition, which is higher in the energy-intensive industries than is in the energy-producing industry that hardly has to deal with any competition due to their grid monopolies. A second reason could be that the emissions coming from these installations are relatively small compared to the number of installations. Including them in the scheme would require a great deal of additional administrative expenditure and was not considered reasonable during the learning phase.

During Phase I around 12.000 installations were covered by the EU ETS in the 25 (27 with Bulgaria and Romania participating from 2007) Member States. This number varied during Phase I (as it is varying in Phase II), due to plant closures and new entrants. Together these installations are responsible for about 45 per cent of the EU's total CO_2 emissions, corresponding to about 30 per cent of EU's total greenhouse gas emissions. About two thirds of the installations covered are combustion installations, accounting for 72 per cent of total CO_2 emissions (of the installations participating in the EU ETS).

Member States can choose to opt-in. During Phase I opt-ins are limited to installations, that are listed in Annex I of the "Emission Directive", but do not reach the threshold, that automatically includes them in the EU ETS, i.e. the installations are too small to automatically fall under the scheme and thus are left a choice whether they want to participate or not. During Phase II the scope for opt-ins is broadened. Member States can now additionally opt-in greenhouse gases and installations not listed in the "Emission Directive". - An installation will voluntarily opt-in to the EU ETS if participating has monetary advantages. If compliance is cheaper when an installation is part of the scheme, it will enter. If an installation's compliance costs are lower outside the EU ETS, it will choose not to participate.

Under certain circumstances installations can "opt-out" during Phase I, opt-outs in Phase II are prohibited. Opting-out refers to not participating in the scheme by choice even though the installation would be covered by the scheme. An opt-out has to be accepted by the European Commission and is only possible if the installation faces similar monitoring and reporting rules as it would under the EU ETS.

3.1.4 Linkage: Joint Implementation and Clean Development Mechanisms

Linkage refers to the use of system-foreign credits to ensure compliance. In case of the EU ETS it relates to any non-EUA credit.

As stated before, the Kyoto Protocol suggests three flexible mechanisms to mitigate the greenhouse gases: emission trading (Article 17) as well as joint implementation (Article 6) and clean development mechanisms (Article 12). The EU ETS, which is a product of Article 17, wants to take advantage of the other two, project-based, flexible mechanisms to further lower the costs of emission reduction. Since the location of the emission reduction is globally irrelevant, these mechanisms allow a reduction in other countries that allow for a cheaper mitigation. Also the "Emission Directive", in favour of further linkage of the EU ETS with other emission trading schemes suggests in its Article 25, "agreements should be concluded with third countries listed in Annex B to the Kyoto Protocol which have ratified the Protocol to provide for a mutual recognition of allowances between the Community scheme and other greenhouse gas emission trading schemes […]." This means, that one condition for countries to issue CERs or ERUs is the ratification of the Kyoto Protocol. Only countries that have ratified, may issue Kyoto emission credits.

Apart from the obvious advantage of further cost reduction if the trading scheme is linked to CDM and JI, another benefit is the broadened market. This has a positive effect for all market participants. Especially the smaller players have an advantage, since the market power of the big players is reduced as the market is expanded. In a broader market price does not react as strongly as in a smaller market, thus price volatility is lessened by linking the schemes. Another advantage is that by including developing countries in climate change projects, a step towards international collaboration is taken. Obviously it is too early – and maybe it will never be possible at all – to extend the system to one global emissions trading scheme, but not allowing any linkage may be the wrong approach as experiences and system requirements should be shared to motivate and assist other countries.

One disadvantage of linking is the considerable administrational costs of assessing and monitoring the projects. The approval process of these projects is very complex. It has to be proven, that additional emission savings relative to business-as-usual developments – estimated trends if no changes to current behaviour are made – will occur through a certain project; savings, that would not take place without the project. This additionality criterion is the heart of the approval process and its Achilles heel.

Stern sees the future of the combat against climate change in international emissions trading. Aware of the problems of an additionality criterion he writes, “[…] the worry is that the price will be too low if international trading is opened up and thus domestic incentives to cut back will be blunted. The answer to this question, surely, is not to curtail the opportunity to lower the costs of reductions via trade, but to raise the ambitions and get more reductions for the money. […] The answer is to commit to 30% reductions and to more trade. It would not only achieve more, it makes it more likely that other countries will set their sights higher as part of a global deal.” (Stern 2009, p.163) By limiting the amount of Certified Emission Reductions (CERs) and Emission Reduction Units (ERUs) that may be used – instead of EUAs –, a flooding of the market with credits which would result in its breakdown, can be prevented. Stern further argues that profits from selling additional credits will decrease and by 2050 will be smaller than now, “because by then most countries will, we hope, have taken significant action and there will be fewer cheap abatement opportunities to sell. In this sense we would expect the volume of trade to rise over the next twenty years or so, and then start to fall. That would be a feature of success.” (Stern 2009, p.164)

The additionality criterion is estimated in a baseline process that compares the business-as-usual scenario and the scenario with realization of the project in question. Credits are only issued for the additional emission reductions. As there is a lot of money involved host countries are tempted to declare high business-as-usual emissions, in order to increase the additional savings they can sell. A larger supply of credits would weigh heavy on their prices and maybe jeopardize the whole functionality of the EU ETS. Article 10 of the "Linking Directive[19]" requires: "In order to avoid double counting, CERs and ERUs should not be issued as a result of project activities undertaken within the Community that also lead to a reduction in, or limitation of, emissions from installations covered by Directive 2003/87/EC, unless an equal number of allowances is cancelled from the registry of the Member State of the CER's or ERU's origin." Only after the approval process certificates are generated for the surplus of emission reductions.

On July 23, 2003 a Proposal for a Linking Directive was issued by the European Commission (European Parliament 2003b). On September 15, 2004, after a long negotiation process, the "Linking Directive", an amendment to the "Emission Directive", was adopted by the foreign ministers of the EU. It broadens the possibilities of the EU ETS, increasing its cost efficiency by linking the EU ETS with Kyoto's flexible mechanisms, CDM and JI.

Article 5 of the "Linking Directive" states: "Member States may allow operators to use, in the Community scheme, CERs from 2005 and ERUs from 2008. The use of CERs and ERUs by operators from 2008 may be allowed up to a percentage of the allocation to each installation, to be specified by each Member State in its national allocation plan." This percentage has to be consistent with the Member State's Kyoto targets. This means that companies can return a certain number of CERs (CDM credits) from 2005 on and a certain number of CERs as well as ERUs (JI credits) from 2008 instead of EUAs at the end of the compliance period. The Linking Directive restricts the percentage of CERs and ERUs that may be used as well as the projects that can yield CERs and ERUs. - The Member State making use of these credits has to stay on its Kyoto path. To ensure a reasonable percentage, the European Commission ordered that the percentage had to be stated in the National Allocation Plan starting from Phase II. Each Member State requires different amounts of these credits.

[19] European Parliament (2004) furtheron referred to as "Linking Directive"

Through the “Linking Directive” the “Emission Directive” was amended by further restrictions regarding the projects that can generate allowances. In Article 11a it now reads: “[…] Member states are to refrain from using CERs and ERUs generated from nuclear facilities […] and […] from land use, land use change and forestry activities.” The demand for these certificates is high.

3.1.4.1 Clean Development Mechanism

Article 12 of the Kyoto Protocol allows for CDM, a project-based flexible mechanism, that enables Annex I countries to generate additional emission credits by conducting environmental projects in non-Annex I countries. - Non-Annex B countries or Non-Annex I to the UNFCCC countries are developing countries that have ratified the Kyoto Protocol, but do not have legally binding greenhouse gas emissions limitations.

Article 12 of the Kyoto Protocol states, the “purpose of the clean development mechanism shall be to assist Parties not included in Annex I in achieving sustainable development and in contributing to the ultimate objective of the Convention, and to assist Parties included in Annex I in achieving compliance with their quantified emission limitation and reduction commitments […].” This means that apart from overall emission reduction, CDM projects have the positive side-effect of assisting the developing countries to press ahead with their development, as they “will benefit from project activities resulting in certified emission reduction.”

Disadvantages of the CDM credits are their long lead times. It can take years from the project initiation to the actual credit issuance. Only projects initiated after 2000 are eligible.

The project approval procedure is supervised by the CDM Executive Board, which manages the validation and issuance process of CERs.

3.1.4.2 Joint Implementation

Article 6 of the Kyoto Protocol allows for JI, a project-based flexible mechanism, that enables Annex I countries – under certain circumstances also listed in Article 6 of the Protocol – to generate emission credits by conducting environmental projects in other Annex I countries. It states that any Annex I country “may transfer to, or acquire from, any other such Party [Annex I country] emission reduction units resulting from projects aimed at reducing anthropogenic emissions by sources or enhancing anthropogenic removals by sinks of greenhouse gases in any sector of the economy […].”

One crucial difference between CDM credits and JI credits is that since the Annex I countries have greenhouse gas emission targets under the Kyoto Protocol and thus a national emission budget of their own, the AAU budget, ERUs (JI credits) cannot be produced endlessly. If that were not the case the market would be flooded with credits, that way ruining any scarcity, which is, obviously, a necessity to keep the market working. Thus, the host country can issue ERUs, but in turn has to deduct the emission quantity pendant from its own national emission budget. The ERUs are then transferred to the purchasing country. That way the overall emission level remains the same, only the location where the emission takes place is a different one, i.e. the permission to emit is solemnly redistributed to a different country. Opposed to JI, CDM creates new Kyoto credits, i.e. on a whole an overall higher emission level is allowed since additional emission permits are made available.

3.2 Transposition and Implementation

The “Emission Directive” required the Member States “to bring into force the laws, regulations and administrative provisions necessary to comply with this Directive by 31 December 2003 at the latest.” This means, that all participating countries had to transpose the “Emission Directive” in national law by December 31, 2003. The Member States had to be notified of all legislative measures taken by any Member State concerning the compliance with the “Emission Directive”. Alas, the december-2003-deadline was too tight. In the beginning of 2004 the European Commission sent first written warnings to all (then EU-15) States.

Ellerman and Joskow explain that an EU Directive is only a framework “that has to be given legal force and implementation through a process called transposition, which requires member states to issue legislative and regulatory measures to implement the directive within each national jurisdiction.” (Ellerman and Joskow 2008)

Excursus: Decision making on EU level:

> There are mainly three institutions involved in decision-making on European Union level: the European Commission, the European Parliament and the Council of Ministers.
>
> In case of environmental decisions, legislation is adopted by the Council of Ministers, the 27 representatives of the discussed field of each EU Member State, and the European Parliament, 785 deputies from all Member States, that are elected directly. The European Commission’s role is, on the one hand, proposing new legislation, and on the other hand, the supervision of the correct transposition and implementation of the decided legislation.
>
> In most cases, EU legislation starts with the European Commission issuing a Green Paper. The purpose of the Green Paper is mainly to give an incentive to start to consider possible improvements and to introduce a new topic for debates. Once the discussions on a certain topic are on-going, the European Commission issues a White Paper, taking into account the views and comments of the interested parties. The White Paper is an announcement for proposals to come. Next, the European Commission makes a proposal. The proposal is sent to the Council that consults the Parliament. The Parliament can approve, reject or ask for amendments of the proposal. If the latter is the case, the Commission has to consider the suggested amendments. If the Commission accepts the proposed changes, it again has to send the now amended proposal to the Council, that again consults the Parliament,… The Council and the European Parliament co-decide on each proposal. It is voted on in the European Parliament and – if no veto is made – adopted.

There are different sorts of EU legislation: directive, regulation and decision. A directive ”adopted by the Council in conjunction with the European Parliament or by the Commission alone, […] is addressed to the Member States. Its main purpose is to align national legislation. A “directive” is binding on the Member States as to the result to be achieved but leaves them the choice of the form and method they adopt to realise the Community objectives within the framework of their internal legal order.” (European Commission Homepage 2009) A directive has to be transposed into national law after its adoption by a given date, but gives the Member States a certain freedom of how the set objectives are to be reached. The transposition can take several years. A “regulation” is stricter. It leaves no choice on how it is to be implemented, but simply enters into force on a fixed day, in all Member States. A “decision” is like a regulation, with the difference, that it does not concern the Member State as a whole, but solemnly those directly addressed in the decision.

3.3 Allocation Process

Kruger et al. explain that “in establishing the permit market, the authority makes three fundamental decisions. First, it defines who will participate in the market – the sources of emissions that can buy and sell permits. This effectively determines demand in the permit market, since the demand curve is the horizontal summation of the demand curves of the individual sources. Second, when the authority specifies the cap, it sets the supply in the market because this determines the number of permits that will be available. Third, it sets the market in motion by allocating the permits among the sources.” (Kruger et al. 2007) Under the EU ETS this authority is the European Commission. It gives the Member States a lot of freedom on how it intends to allocate the emission allowances, but can take influence by rejecting (parts of) the NAPs.

The allocation process contains several steps. First a NAP has to be developed by the Member State. Then it has to be submitted to the European Commission for approval. After the approval the allowances can be issued to the installations according to the NAP.

3.3.1 Development of the National Allocation Plan

As a step A, each Member State has to develop a NAP that determines the total quantity of EUAs the Member State intends to allocate to which sectors (macro allocation) and, in more detail, to which companies (micro allocation) for a certain commitment period. Furthermore it has to contain a list of installations included in the EU ETS, the allocation methods used for each installation and the treatment of new entrants.

For each trading period an individual NAP has to be prepared. The first trading period is 2005-2007, the second one 2008-2012. A third one will follow 2013-2020.

To assist the Member States with the development of their NAPs, the Non Paper was published in April 2003. It was not intended as a guidance paper, but mainly "discusses the implementation of Annex III criteria […]." (European Commission 2003[20]) The Non Paper suggests that the process of establishing a national allocation plan should contain six steps. The first step should be a top-down, economy-wide analysis to define the share of total allowable emissions under the Kyoto Protocol. The second step should be a bottom-up exercise of data collection on installation level. In a third step the data gained from step one and two should be compared and consolidated. In the fourth step the amount of allowances a Member State intends to allocate to a certain sector should be calculated. Step five calls the attention to new entrants. In a final step the Member State is asked to summarise its work and make a draft of the NAP.

To help the Member States with the development of their NAPs the European Commission published a Guidance Paper in January 2004, composed of a series of guidelines, rules and suggestions that the NAPs have to abide to. The deadline of submission and publication of the NAPs to the European Commission for the

[20] European Commission 2003 furtheron referred to as "Non Paper"

first trading period was March 31, 2004. The deadline for later phases is 18 month before their start. In case of Phase II that is June 30, 2006.

The "Guidance Paper" also determines in its annex the standardized format the NAP has to have. (European Commission 2004a[21]) The NAP needs to include the total quantity of allowances, the quantity of allowances at activity level and the quantity of allowances at installation level (Points 1-3). Next (Point 4), technical aspects (reduction potentials, early actions and clean technology) are listed, followed by community legislations and policies (Point 5). Then (Point 6), it is required to state how the public has access to the NAPs and how the public opinion is taken into account and how and where the public can make suggestions. Under Point 7 the Commission asks the Member State to state criteria, other than those listed in the "Emission Directive", that have been applied when developing the NAP. Lastly (Point 8), a complete list of the installations covered has to be added.

3.3.2 Approval of National Allocation Plan

As a step B, the NAP is submitted to the European Commission for approval. The European Union Climate Change Committee, EU C.C.C., a committee of 27 experts, representatives of the Member States, assists the European Commission with the assessment of the NAP by expressing their views on the content of the NAP.

The assessment of the NAPs is based on the "Emission Directive", which names 11 criteria in its Annex III, which are not exhaustive. The Member States are granted a certain freedom when it comes to issuing allowances. They of course cannot issue as many allowances as they want, but they are not given an explicit number either. The "Emission Directive" just says the Member States could issue as many allowances as they wanted as long as they moved within the borders the criteria set and as long as they respected the listed criteria. This is important since scarcity is necessary for a reasonable market price to form. Only if supply is lower than demand, do companies have an incentive to invest in cleaner technologies.

[21] European Commission 2004a furtheron referred to as "Guidance Paper"

The criteria listed in Annex III of the “Emission Directive” for the establishing of the National Allocation Plans are:
Criteria 1-3 concern the Kyoto targets, the emission projections and a Member State’s potential to reduce emissions. They prohibit overallocation and as stated in the “Emission Directive” require that “the quantity shall be consistent with a path towards achieving or over-achieving each Member State’s target under Decision 2002/358/EC [Burden Sharing Agreement] and the Kyoto Protocol” for Phase I. The allocated amount should not be higher than the amount that is likely to be needed, and it should take into account projections of the compliance path and the actual – technological and economic – potential of installations to reduce their emissions. Criterion 4 calls attention to other legislations of the individual Member States, as they should be consistent with the NAPs and not violate/contravene other national laws and regulations of the country in question. Criteria 5-7 concern non-discrimination between sectors and companies, new entrant reserves and early action. Non-discrimination between companies and sectors is a mandatory criterion and prohibits state aid. The NAPs have to state how new entrants have access to allowances and if a new entrants reserve is set aside, and what is done with the surplus allowances that may remain in the reserve at the end of a trading period. Early actions are emission reducing activities that are done before the NAP is Commission-approved and thus have an influence on the total amount of allowances allocated to an installation, especially in the case that the allowances are grandfathered, an allocation method where the total allocated amount depends on historical emission levels. Criteria 8-9 demand information on how clean technology is considered and how the involvement of the public is dealt with; how suggestions and comments made by the public are taken into account and where decisions that were made are accessible by the public. Criterion 10 mandatorily requires the NAP to contain a list of all installations covered by the scheme and how many allowances each of these installations are to receive. Criterion 11 is optional and asks the Member State to specify how competition from countries not participating in the EU ETS is dealt with.

The European Commission can either accept the NAP unconditionally, partially reject/conditionally approve it or reject it as a whole. Up to now no plan has been rejected completely. - It has to come to a decision within three months of the submission of the NAP. Article 9 of the “Emission Directive” allows that “within three months of notification of a national allocation plan by a Member State under paragraph 1, the Commission may reject that plan, or any aspect thereof, on the basis that it is incompatible with the criteria listed in Annex III or with Article 10 [method of allocation].” The Commission has to give reasons for rejections it makes.

Unconditionally accepted plans do not need any changing. Partially rejected plans are conditionally accepted, i.e. the plans need some changing before the authorities can start the allowance allocation process. The required changes depend on the European Commission, which has to explain its decisions and give reasons why it does not accept a plan as it stands. If the Member State then implements the proposed changes the plan automatically qualifies. If the Member State does not accept the suggested changes, a new plan has to be made, which subsequently has to be submitted to the European Commission for assessment.

According to Memos of the European Commission three main topics for partially rejecting a NAP could be identified: excessive allocation, allocation exceeds projected emissions and ex-post adjustments. (European Commission 2004b, 2005b) Following cases of excessive allocation were identified by the European Commission, ”Firstly, where a Member State does not reason how the Kyoto target in 2008-2012 would be respected, but left a gap to be closed with measures to be defined later. Secondly, where a Member State states the intention to purchase Kyoto credits, but does not demonstrate credible and reliable steps to realise these purchases. Thirdly, where a Member State bases its plan on projections (including economic and emission growth rates) that are inconsistent and exaggerated compared to official growth forecasts by the Member State itself or other impartial sources.” (European Commission 2005b) Ex-post adjustments are prohibited. After a NAP has been approved by the European Commission the Member State can vary the exact amount of allowances at installation level, if new data is available on the requirements of a plant. The total number of allowances must not be higher than the Commission approved amount. After possible minor changes the final allocation decision is made and published at national level. From this point on no changes are possible anymore. The final allocation decision is followed by the allocation of EUAs in the national electronic registry.

3.3.3 Allocation of Allowances

As a (final) step C, after the European Commission's approval, the total amount of permits of the Member State as well as the installations (ex-post adjustments are prohibited) is fixed and cannot be changed anymore. The EU ETS-wide cap is determined by the sum of the caps set by the participating countries, i.e. the European Commission does not set a certain cap for the Member States that is differentiated among them, but instead the final cap is only fixed and determined, when the individually approved caps are added up.

The Member State is granted the total amount of EUAs for the whole trading phase and can choose how to divide them per year of that specific phase. Most Member States chose to issue the EUAs – more or less – proportionally, i.e. during three year-long Phase I 1/3 per year, during five year-long Phase II 1/5 per year. The Member State's authorities in charge of allowance allocation can proceed to allocate the assigned amount of EUAs to the installations according to the NAP. The allocation process is completed.

3.4 Monitoring, Verification, Reporting of Emissions

According to Article 6 of the "Emission Directive" before an operator is issued permits he has to show that he is capable of "monitoring and reporting his emissions. A greenhouse gas emissions permit may cover one or more installations on the same site by the same operator." Monitoring means that the required emission data is collected and archived for later analysis to determine the number of EUAs that have to be surrendered.

Permits and allowances are not synonyms. An allowance is the tradable unit of the EU ETS, issued by the Member State. A permit sets the monitoring of the emissions and the reporting requirements for an installation and is site-specific.

The emissions of CO_2 can either be determined by measurements or by calculations, with the formula given in Annex IV of the “Emission Directive”, that states the principles of monitoring and reporting. Each year the participating companies, i.e. each operator under the scheme, have to report their aggregate emissions of the year. The produced data is verified by a third party.

The European Commission has published “Monitoring and Reporting Guidelines” stating rules and suggestions concerning the monitoring, verification and reporting of the emissions. The “Monitoring Guidelines” name eight principles the monitoring and reporting is based on: Completeness, Consistency, Transparency, Accuracy, Cost effectiveness, Materiality, Faithfulness and Improvement of performance in monitoring and reporting emissions. (European Commission 2004c[22])

Annex V of the “Emission Directive” lists the criteria for verification. Each Member State must submit a report of the verified emissions to the Commission. Deadline is March 31 of the following calendar year. The report must specify each company’s compliance with the “Emission Directive”. Should the report turn out not to be satisfactory or is not submitted at all, the company is excluded from further trades until this subject is cleared.

The companies have to return, “surrender” the required number of allowances of a certain year by April 30 of the following calendar year, thus have to make sure to be in possession of enough allowances by that date; e.g. the allowances for 2005 have to be surrendered by April 30, 2006. The “Emission Directive” states “Member States shall ensure that, by 30 April each year at the latest, the operator of each installation surrenders a number of allowances equal to the total emissions from that installation during the preceding calendar year as verified in accordance with Article 15 [Verification], and that these are subsequently cancelled.”

Issuance and surrender of EUAs each year instead of once each commitment period, was chosen as the preferable method in order to enforce the company’s paying attention to its emissions and to reduce price volatility at the end of a trading period.

[22] European Commission 2004c furtheron referred to as “Monitoring Guidelines”

3.5 Penalties for non-compliance

If a participating company is not in possession of the number of allowances it needs at the end of the year, it has to pay a fine per missing allowance. One EUA enables a company to emit 1 tonne of CO_2. During Phase I (2005-2007) non-compliance is penalized with EUR 40 for each excess tonne of CO_2, during Phase II (2008-2012) the fine is EUR 100. In addition the names of the operators that have not complied are published.

Paying the fine, does not compensate for failing to surrender the required number of permits. The missing allowances still have to be returned in the subsequent calendar year. Article 16(4) of the “Emission Directive” states, ”payment of the excess emissions penalty shall not release the operator from the obligation to surrender an amount of allowances equal to those excess emissions when surrendering allowances in relation to the following calendar year.” Thus, the emission cap is not affected by non-compliance. The penalty can be seen as the price of borrowing of EUAs.

The Member States deal with the penalty in different ways. In some, for instance, the penalty is tax deductible, a controversial possibility, since it works against the polluter pays principle, as the polluter is “rewarded” for polluting. Apart from penalizing excess emissions, the Member States have imposed different penalties for infringements of national provisions. The EEA gives an overview of how the infringements are punished in the different Member States. Operation without permit, infringements of monitoring and reporting obligations, and omission to notify changes are, partly heavily, fined and can, in some countries, even result in imprisonment of up to 120 days. (EEA 2008b)

3.6 Emission Permit Market

Anyone – covered or not covered by the scheme – can participate in the market. The only requirement is the holding of an account in the national registry. Each installation covered by the scheme receives a certain amount of EUAs. These can be seen as the currency of the emission trading market. Participating installations can either buy or sell their EUAs depending on their requirements, on the free market for the market price. The price is a function of demand and supply. The installation decides, for itself, if it is cheaper to lower its emissions and thus lower its allowance requirement in order to make profits from selling its surplus allowances or to do without emission reductions and pay for additional permits.

Figure 10 shows how the European Commission explained the benefits of emission trading for companies in a folder in 2008:

How does emissions trading benefit companies and the environment?

Companies A and B both emit 100 000 tonnes of CO_2 per year. Let us say their governments give each of them emission allowances for 95 000 tonnes, leaving them to find ways to cover the shortfall of 5 000 allowances. This gives them a choice between reducing their emissions by 5 000 tonnes, purchasing 5 000 allowances in the market or taking a position somewhere in between. Before deciding which option to pursue they compare the costs of each.
Let us imagine that the market price of an allowance at that moment is € 20 per tonne of CO_2. Company A calculates that cutting its emissions will cost it € 10 per tonne, so it decides to do this because it is cheaper than buying the necessary allowances. Company A even decides to take the opportunity to reduce its emissions not by 5 000 tonnes but by 10 000. Company B is in a different situation. Its reduction costs are € 30 per tonne, i.e. higher than the market price, so it decides to buy allowances instead of reducing emissions.
Company A spends € 100 000 on cutting its emissions by 10 000 tonnes at a cost of € 10 per tonne, but then receives € 100 000 from selling the 5 000 allowances it no longer needs at the market price of € 20 each. This means it fully offsets its emission reduction costs by selling allowances, whereas without the emissions trading system it would have had a net cost of € 50 000 to bear (assuming that it cut emissions by only the 5 000 tonnes necessary).
Company B spends € 100 000 on buying 5 000 allowances at a price of € 20 each. In the absence of the flexibility provided by the ETS, it would have had to cut its emissions by 5 000 tonnes at a cost of € 150 000. Emissions trading thus brings a total cost-saving of € 100 000 for the companies in this example. Since Company A chooses to cut its emissions (because this is the cheaper option in its case), the allowances that Company B buys represent a real emissions reduction even if Company B did not reduce its own emissions.

Figure 10 Benefit of emission trading[23]

[23] Taken from European Commission 2008a

3.7 Transaction Registries

The European Commission decided upon a “Registry Regulation” to secure a standardized system of registries. It sets rules for the establishment and operation of the national registries to secure their compatibility and linkage possibility. (European Commission 2004d[24]) Article 19 of the “Emission Directive” requires from the Member States: “The establishment and maintenance of a registry in order to ensure the accurate accounting of the issue, holding, transfer and cancellation of allowances.”

The registry shows the banking of allowances, issuances, holdings, sales, purchases, cancellations, transfers and surrenders/retirements of permits taking place in the country of each company. Each Member State has an individual, national registry. The Registry Regulation required the establishment of national registries by December 31, 2004. This deadline was only met by few countries. Each company, that wants to participate in the market for emission allowances, has to open an account, the “operator holding account”, at its national registry. Any person can hold allowances. The registry is open to the public.

The national registries are set up in the form of standardised electronic databases, making it – theoretically – easy to link them. The Community Independent Transaction Log (CITL) is a European Central Administrator, provided for in Article 20(1) of the “Emission Directive” that supervises all national registry systems, on an EU-wide basis, and coordinates all permit movements, i.e. movements of EUAs. The CITL in turn is linked with the United Nations Framework Convention on Climate Change Independent Transaction Log (UNFCCC ITL) kept by the UN Climate Change Secretariat, based in Bonn, Germany, that coordinates all movements of AAUs, the emission units covered under the Kyoto Protocol. After many difficulties the connection of the CITL to the ITL was finally completed on October 16, 2008.

The EUAs are held in electronic accounts in each Member State’s registry. They are identifiable by a serial number and do not exist in a printed version.

[24] European Commission 2004d furtheron referred to as „Registry Regulation“

4 First Phase 2005-2007

4.1 Overview – who's in?

Initially fifteen EU Member States, the EU-15, were part of the EU ETS: Austria, Belgium, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Luxemburg, The Netherlands, Portugal, Spain, Sweden and The United Kingdom. On May 1, 2004 the European Union was expanded by ten Eastern European States, the EU-10. This EU enlargement contained: The Czech Republic, Estonia, Hungary, Latvia, Lithuania, Poland, Slovakia, Slovenia, Cyprus and Malta. Participating in the EU ETS was one of the conditions to become a Member of the EU. On January 1, 2007 Bulgaria and Romania were included in the EU and thus the EU ETS. Therefore, by the end of Phase I 27 nations participated in the EU ETS – with a total of almost 500 million inhabitants. On January 1, 2008 Iceland, Liechtenstein and Norway, countries not in the European Union, but part of the European Economic Area, entered the EU ETS.

4.2 Allocation Process

Ellerman writes "the first round of cap-setting could best be described as a negotiation between individual Member States and the Commission in which both sides were trying to agree on a mutually agreeable cap in the face of the large data uncertainties and some confusion over what installations met the definition for inclusion. Moreover, the absence of any international obligation to limit GHG [greenhouse gas] emissions in these years allowed a more relaxed approach to cap-setting." (Ellerman 2008) The Member States had to prepare and publish their NAPs by March 31, 2004. The 10 new Member States that joined the EU on May 1, 2004, were asked to keep this deadline, but could make use of a later deadline – their joining the EU on May 1, 2004. All new Member State made use of this exception of a delayed deadline. The states had difficulties keeping to the deadline. From the EU-15 only Austria, Denmark, Finland, Germany, Ireland and the Netherlands met the deadline. From the 10 new Member States only Latvia, Lithuania, the Slovak Republic and Slovenia kept their (extended) deadline.

Ellerman notes, “The Commission exercised its power to review and to reject with considerable discretion. In practice, it focused on three criteria (out of eleven): the Member State total (to guard against cap inflation), the list of installations with their allocations (to ensure inclusiveness), and the absence of ex-post adjustments in allocation.” (Ellerman 2008)

The assessment resulted in following decisions:
On July 7, 2004 the Commission finished the assessment of eight plans. The plans of Denmark, Ireland, The Netherlands, Slovenia and Sweden were accepted unconditionally. The remaining three, those of Austria, Germany and the United Kingdom, were partially rejected. On October 20, 2004 the Commission finished the assessment of another eight plans. The plans of Belgium, Estonia, Latvia, Luxemburg, Portugal and the Slovak Republic were accepted unconditionally. The remaining two, those of Finland and France, were partially rejected. On December 27, 2004 the Commission finished the assessment of five plans. The plans of Cyprus, Hungary, Lithuania and Malta were accepted unconditionally, while Spain’s plan was partially rejected. On March 8, 2005 the Commission finished the assessment of the Poland’s plan. It was partially rejected. On April 12, 2005 the Commission accepted the plan of the Czech Republic unconditionally. On May 25, 2005 the Commission partially rejected the plan of Italy. On June 20, 2005 the Commission accepted the last plan, the one of Greece, unconditionally.

The reasons so many NAPs were partially rejected, were mainly overallocation and ex-post adjustments. Ex-post adjustments are explained in a Memo of the European Commission when “the Member State plans to intervene in the market after the allocation is done, and redistributes the issued allowances among the participating companies […].” (European Commission 2004b) This means there are changes and corrections of the initial allocation amounts if new data is gained, i.e. there can be a redistribution of EUAs among the companies after allocation of EUAs to operators. The EU Commission prohibited ex-post adjustments to prevent misunderstandings, to lower the administrational costs and to avoid uncertainty for the participating companies. The “Emission Directive”, Annex III, lists the criteria the NAPs have to comply with. Criterion 10 prohibits these ex-post adjustments, as it states, “the plan shall contain a list of the installations covered by this Directive with the quantities of allowances intended to be allocated to each.” Germany and the United Kingdom took the European Commission to court. Both cases concerned ex-post adjustments.

Table 5 shows the final number of allocated allowances per country and year for Phase I and II.

Table 5 Kyoto target and allocated allowances by country, Phase I and II[25]

Emissions trading in the EU 2005-2012

EU member state	Kyoto target (% change against base year)	2005 - 2007		2008 - 2012	
		Allocated CO_2 allowances (million tonnes per year)	Share in EU	Allocated CO_2 allowances (million tonnes per year)	Share in EU
Austria	-13%*	33.0	1.4%	30.7	1.5%
Belgium	-7.5%*	62.1	2.7%	58.5	2.8%
Bulgaria	-8%	42.3**	1.8%	42.3	2.0%
Cyprus	-	5.7	0.2%	5.48	0.3%
Czech Republic	-8%	97.6	4.2%	86.7	4.2%
Denmark	21%*	33.5	1.4%	24.5	1.2%
Estonia	-8%	19	0.8%	12.72	0.6%
Finland	0%*	45.5	2.0%	37.6	1.8%
France	0%*	156.5	6.8%	132.3	6.4%
Germany	-21%*	499	21.7%	453.1	21.8%
Greece	+25%*	74.4	3.2%	69.1	3.3%
Hungary	-6%	31.3	1.4%	26.9	1.3%
Ireland	+13%*	22.3	1.0%	22.3	1.1%
Italy	-6.5%*	223.1	9.7%	195.8	9.4%
Latvia	-8%	4.6	0.2%	3.43	0.2%
Lithuania	-8%	12.3	0.5%	8.8	0.4%
Luxembourg	-28%*	3.4	0.1%	2.5	0.1%
Malta	-	2.9	0.1%	2.1	0.1%
Netherlands	-6%*	95.3	4.1%	85.8	4.1%
Poland	-6%	239.1	10.4%	208.5	10.0%
Portugal	+27%*	38.9	1.7%	34.8	1.7%
Romania	-8%	74.8**	3.2%	75.9	3.7%
Slovakia	-8%	30.5	1.3%	30.9	1.5%
Slovenia	-8%	8.8	0.4%	8.3	0.4%
Spain	+15%*	174.4	7.6%	152.2	7.3%
Sweden	+4%*	22.9	1.0%	22.5	1.1%
UK	-12%*	245.3	10.7%	245.6	11.8%
Total		2298.5	100%	2079.33	100.0%

* Under the Kyoto Protocol, the EU-15 (the group of 15 countries that were EU Member States before 2004) are committed to reducing their collective greenhouse gas emissions to 8 % below levels in a chosen base year (1990 in most cases) during 2008-12. This collective target has been translated into differentiated national targets, marked by (*), through a legally binding agreement (Council Decision 2002/358/EC of 25 April 2002). The 12 Member States that joined the EU in 2004 and 2007 have their own binding national targets under the Kyoto Protocol with the exception of Cyprus and Malta, which have no targets.
** Only for 2007

[25] Taken from European Commission 2008a

The European Commission reduced 15 NAPs by around 290 million tons per year during Phase I, which account for about 15 per cent of the totally allocated allowances. This resulted in about 6.3 billion EUAs, not taking into account the NERs that were approved by the European Commission to be issued to the installations over the whole three-year period of Phase I. During Phase II it reduced 23 NAPs by about 242 million tons per year, which accounts for about 10 per cent.

4.3 Allocation Methodology

In Phase I the Member States had to face several obstacles during the allocation process. Lack of data is considered to have been the biggest problem. Data was available, but only in aggregated form. Data on installation level was needed for the macro allocation, the setting of an overall appropriate cap, and for the micro allocation, that determines which companies receive how many allowances. Buchner et al. explain that the “reason for the constrained data availability was that the inventory data were developed from statistics of aggregate energy use and they did not extend to the level of the installation, which was the mandated recipient of the allowance allocations […].” (Buchner et al. 2007) Since the “Emission Directive” requires that the Member State states in its NAP how many allowances they plan to allocate on installation level, the allocation process consisted of negotiations, discussions and dialogues between the governments of the participating countries and the industries participating in the scheme. The industries had the emission data on installation level, the governments needed them. Buchner et al. describe that the “problem of data availability was compounded by the lack of legal authority to collect the relevant data. When combined with the pressing deadlines for NAP submission, governments had little choice but to rely heavily on voluntary submissions from industry, while they also initiated action to acquire the requisite legal authority. The surprising thing is that the affected firms cooperated as fully and in as good faith as appears to have been the case." (Buchner et al. 2006)

There are different possibilities to allocate the allowances. They can be given

away for free, they can be auctioned or they can be sold at a certain price. Since most of the allowances were to be given away for free, all the while having a significant value, the industries had a monetary interest (e.g. windfall profits as EUAs are a trading currency and stipulate an asset), to get as many allowances as possible and turned out to be strong opponents in the negotiations of the allocation process.
If they are given away for free, grandfathering and benchmarking are two possible allocation modes. If they are not given away for free they can be auctioned or sold. In that case they yield revenues, that can be used e.g. for other environmental policies.

4.3.1 Grandfathering

Article 10 of the “Emission Directive” determines that during Phase I at least 95 per cent of the EUAs have to be given out for free. During Phase II at least 90 per cent of the EUAs have to be given away free of charge. The allocation amount depends on historical emission levels. This allocation method is called ‘grandfathering’. In Phase I 23, over 85 per cent of the Member States chose this allocation mode exclusively. The baseline for the historical emission levels is not specified in the “Emission Directive.” Most Member States chose artificial baselines, calculated from a multi-year period. The average of several years was taken rather than one year to smoothen out unrepresentative output levels and give a picture of recent emission levels. The United Kingdom introduced a drop-minimum rule that allowed companies to leave out an especially emission-poor year, when calculating their baseline.

One of the drawbacks of grandfathering is, that it disadvantages new entrants who have no historical emission data the allocation can be based on, and it puts those at a disadvantage who took early action, i.e. those polluters who polluted less on a voluntary basis before the actual start of the trading scheme, since this has an influence on their historical emission levels, reduces their baseline levels and thus the early actors are worse off. Buchner et al. state that the “limitations imposed by data availability had important consequences in ruling out certain baselines and types of allocation for which an a priori preference may have existed. For instance, Germany had advocated that allocations be based on 1990 emissions. This would have been in keeping with the Kyoto Protocol and with the EU Burden Sharing Agreement and it would have recognised "early action". It soon became evident, however, that data on installation level emissions in 1990 were non-existent and, in 2003, irretrievable in any reliable or meaningful form. Some Member States with better data could choose baselines that extended as far back as 1998 (United Kingdom, Sweden, Denmark), but for most countries, the baseline or reference periods for allocation included only the most recent few years because these were the only years for which installation level data could be easily retrieved. Consequently, baselines that would automatically recognise "early action" were infeasible. If any recognition was given to "early action", it was the subject of special provisions for those who had the data and could make a convincing case. [...The] general pattern was to disregard early action not only because of the data problems but also on account of the conceptual problem of distinguishing "early action" from emission reductions taken for other reasons." (Buchner et al. 2006)

Grandfathering is often criticised for not corresponding with the polluter pays principle. The polluter receives permits depending on his emission level. If he pollutes a lot, he receives many allowances. If he pollutes little, he receives fewer allowances. Critics claim that an installation has no incentive to switch to cleaner technologies, as that would yield fewer permits. If allocation depends on historical emissions, a (high emitting) coal fired plant receives more allowances than a (lower emitting) gas fired plant. This distorts investment decisions towards (environmentally more unfriendly) coal, which cannot have been the intention.

Grubb and Neuhoff note that “free allocation can distort incentives. If installations cease to receive free allowances when they close, the withdrawal of over-compensation creates a perverse incentive to keep inefficient facilities operational.” (Grubb and Neuhoff 2006) Frondel et al. studied the impact of emission trading on electricity prices and energy-intensive industries. They found that grandfathering “implies an increase in electricity prices, irrespective of whether strong or weak competition prevails on electricity markets.” (Frondel et al. 2008) This conclusion may seem surprising, as many observers of the electricity prices accuse the lack of competition for being responsible for the electricity price increases, with the electricity suppliers using the EU ETS as an excuse to increase their prices. When the EU ETS was launched EUA prices started to rise almost immediately, as did the electricity prices. The European Commission projected the increase in electricity prices, but was quick to add that “it is important to distinguish between the target and the instrument of this debate.” Not the EU ETS is responsible for increased prices, but the “implementation of the Kyoto Protocol.” (European Commission 2004b)

Ellerman and Joskow, who see the many disadvantages cost-free allocation has, point out, that in case of the EU ETS it “may have been wiser than often viewed. If nothing else, free allocation facilitates getting a program to price CO_2 emissions up and running quickly, rather than spending years with affected interest groups fighting any program at all.” (Ellerman and Joskow 2008) De Sepibus, who studies the EU ETS in the light of state aid, shares Ellerman’s opinion and writes, the “fact that emission allowances were granted for free was, in particular, justified by the necessity to attract participants and the fact that the scheme rewarded companies surpassing existing standards and thus achieving a net environmental benefit.” Still, “compared to an emission scheme based on auctioning, it does not provide any supplementary incentive effect, while leading to significant distorting effects on the internal market. Assessed in the light of the Commission’s practice with respect to technical standards, the gratuitous allocation of allowances, if considered as amounting to State aid, would thus clearly be judged incompatible with the common market.” (de Sepibus 2007b)

4.3.2 Benchmarking

Another possible allocation method is benchmarking. In this case the EUAs are also given away free of charge. Contrary to grandfathering the allocation amount does not depend on historical emission levels, but is set on grounds of a technical comparison between the installations covered, using the best available techniques (BAT) as a benchmark. The “Emission Directive” defines: “’Best available techniques’ shall mean the most effective and advanced stage in the development of activities and their methods of operation which indicate the practical suitability of particular techniques for providing in principle the basis for emission limit values designed to prevent and, where that is not practicable, generally to reduce emissions and the impact on the environment as a whole."

The Climate Action Network Europe recommends benchmarking for the allocation process of Phase II, since "under the current circumstances, benchmarks constitute a useful second-best alternative to auctioning for those sectors and products for which establishing such benchmarks are feasible." Concerning the benchmarks they specify that "benchmarks should be set on the basis of best available technique (BAT) standards for individual processes and not use the average performance of existing plants." (CAN 2006) Almost all commentators regard benchmarking to be preferred to grandfathering, still it was only little used. The reason is, that allocation based on benchmarks would project far lower emissions than an allocation based on actual historical emissions, which in turn decreases the total amount of allowances allocated to the installations. Allocation based on benchmarks was not accepted by the industries participating in the scheme during Phase I. Neuhoff et al. wrote a study on the impact of the used allocation method on the electricity sector and found that "an allocation based on a purely uniform benchmark creates the fewest distortions for both incumbents and new entrants." They regard free allowance allocation as justified, as the permits "are used to compensate emitters for otherwise reduced profitability due to the introduction of ETS." (Neuhoff et al. 2006)

A de Sepibus survey points out that the reasons benchmarking was omitted in so many cases and finds that it was not due to lack of trying, but due to the sheer complexity as benchmarking is very data-intensive. The development of benchmarks has to take into account many aspects of each production process and for Phase I there was simply not enough time. (de Sepibus 2007a) Buchner et al share de Sepibus' view. "The failure to adopt benchmarking more widely was not because of a lack of trying. Many benchmarks were proposed; but, every time one was tried, the resulting deviations of allocations from recent emissions at the installation level were too great to gain wide acceptance. This points to what is the biggest problem in applying benchmarks: source heterogeneity. If all sources were more or less alike, benchmarking would be easy; but in practice installations differ greatly even within the same sector. [...] An example of the extent to which output heterogeneity led to differentiation is provided by the Netherlands where 120 benchmarks were developed before the concept was abandoned." (Buchner et al. 2006)

4.3.3 Auctioning

When auctioning is the allocation mode of choice, the permits are made available at an official auction.

Advantages of auctioning are no more windfall profits; no need for grandfathering (and the development of NAPs) and benchmarking (and the resulting dealing with the industry lobbies); no more New Entrant Reserves, that have to be considered and lead to uncertainty about the total allowances available; no more competition distortion between Member States where similar installation are allocated different amounts of allowances; rising awareness of the managements of the installations covered if they are more included. Auctioning all EUAs would reduce the complexity of the allocation process by far, since the allowance allocation shares do not have to be broken down to installation level. The companies that require permits have to deal with the allowance acquisition problem themselves without including the governments or the responsible authorities of the Member States in the process. The companies have a certain demand. To meet their demand they can go to the market and buy the number of allowances they require at the market price, which is a function of demand and supply. Stern clearly argues in favour of auctioning and sums up that “in the long run […] auctioning is superior to free allocations in three crucial respects. First, it raises revenue for the government. Giving away that revenue as transfers to firms through free allowances would be a peculiar and inegalitarian use of public money relative to, say, supporting poor old-age pensioners or the disabled, or health and education services. Second, auctioning can hasten adjustment. The longer allocations are given free, the less pressure there is on firms to move quickly. It is true that the marginal incentive of a carbon price should give a strong reason to economise on emissions even if allocations are given free. But that pressure is intensified if weak or no adjustment implies significant losses, rather than profits simply being lower than they might otherwise be. It is likely that shareholders and capital markets would react differently, particularly since losses are more identifiable than the possibility of higher profits. Third, the process of "grandfathering" free allocations gives special privileges to incumbent firms and thus undermines competition by disadvantaging potential entrants into affected industries." (Stern 2009, p.108f)

One disadvantage is that with auctioning the price of CO_2 is no longer an opportunity cost, but a real cost for the industries. This has a negative effect for participating states in worldwide competition, since companies have to pass through their costs of production to the consumers in order to stay in business. The CO_2 allowances are a part of the production costs and thus increase the marginal production costs. If the allowances are given away for free, companies do not have to pass through the costs to the consumers if the price elasticity and competition do not allow it, because they deal with opportunity costs, the costs for foregone profits, and not "classic" real cost. If the allowances have to be purchased, actually increasing the marginal costs, companies have no choice and have to pass through the allowance price to the consumer. Sectors, that face high demand elasticity and sectors that are exposed to strong international competition, will have to adapt to the new situation and may not be able to survive on the market. Frondel et al. found that the impact of auctioning on energy intensive industries is severe, thus "that an abrupt transition to a complete auctioning system may endanger the competitive position of energy-intensive industries in Europe, unless all other major industrial and transition countries are integrated into a global emission trading system." (Frondel et al. 2008)

The EU ETS has differently strong effects in the different Member States, depending on the energy sources. High-emission installations, such as electricity producers using brown and hard coal, suffer from full auctioning, as they have to spend a lot of money on emission allowances. Thus, this theoretically results in switching to low-pollution power plants in the short run and shutting them down completely in the long run, that way, reaching the desired environmental-friendly energy production. It is questionable if it really is that easy. The world resources for gas are lower than the ones for coal. Switching to gas leads to further dependency on other countries, especially Russia, and cannot be the final solution of the problem. The IEA estimates, that the resources for natural gas, which are clustered in only a few countries, will last around 60 years at current production. (IEA 2008) Convery and Redmond give a reason to continue the EU ETS, and state that “because of its vulnerability to energy supply interruptions from the Middle East (oil) and Russia (gas), the EU needs to reduce its dependence on imported fossil fuels. The EU ETS helps achieve this goal by operating at the margin as a pan-EU tax on imports. This makes local alternatives, notably energy conservation and renewables, more commercially viable, which has also made the EU ETS attractive to the renewables lobby.” (Convery and Redmond 2007) Still, it is often argued that it is more likely that the companies will relocate to other countries without strict carbon emission control instead of accepting and paying the high production prices. Bleischwitz et al. draw the attention to this negative effect the EU ETS can have on the energy intensive sector. “Under the assumption that the carbon prices are likely to increase again, those industries have – at least in parts – an incentive to relocate their production outside the EU.” (Bleischwitz et al. 2007) This is explained by the fact that companies do not face the same regulations in other countries and production may turn out to be cheaper elsewhere.

Frondel et al. propose to make auctioning sector dependent, “in addition to ETS-induced electricity price increases, the production cost increases resulting from auctioning may imply a heavy burden for energy-intensive industry sectors such as the cement industry or the copper and aluminium producers. Hence, although the grandfathering of allowances does not create additional incentives to reduce emissions beyond those already reflected in the ETS-induced higher electricity prices, non-electricity sectors should be exempted from the auctioning of certificates as long as all other major industrial and transition countries abstain from serious climate protection measures and reject the integration into a comprehensive global emissions trading system.” (Frondel et al. 2008) Convery et al. on the other hand in their study did not find “empirical evidence demonstrating a correlation between European carbon prices and a loss of competitiveness in the industrial sectors […]. However, these results were obtained in an environment in which allocations were overly generous for the covered industries.” (Convery et al. 2008) Another disadvantage is the transaction costs auctioning yields.

Several questions have to be considered before auctioning can start. How often should be auctioned? Should the auctions only be open within the Member State or to all participating countries of the scheme? Should the auctions of a Member State be coordinated with the auctions of other Member States? Who is in charge? Should national or system-wide auctions take place? If auctioning takes place more often with smaller emission allowance volumes changing their ownerships, smaller bidders are encouraged to participate, as it may be easier to predict prices and the risk is reduced. Also, steady liquidity shots may be preferable to one huge auction at the beginning of the trading period, as this may have a negative effect on market uncertainty concerning the availability of EUAs, increase price volatility and disadvantage new entrants who enter the EU ETS after the EUAs have been distributed by auction. A disadvantage of many auctions, are the higher administrative costs that occur with each auction.

In Phase I the “Emission Directive” allowed for a maximum of 5 per cent of the EUAs per Member State to be auctioned. Only four countries made use of this possibility and set aside a certain number of allowances to be auctioned. The European Commission “considers that the participation in any auction should be open without restrictions to all persons in the Community.” (European Commission 2006a) Thus, any registry account holder listed in the CITL could participate in any of the auction that took place. Denmark auctioned 5 per cent, Hungary 2.5 per cent, Lithuania 1.5 per cent and Ireland 0.75 per cent. This amounted to only 0.13 per cent of total allowances issued, excluding Bulgaria and Romania.

4.3.3.1 Sales in Denmark

In the case of Denmark, 5 per cent of total allowances created accounts for 5.025.000 allowances. Denmark decided – even though initially planned – not to auction, but instead opted for direct sales through agents.

The first sale was held in October 2006, when 2.762.000 allowances were made available. The second sale took place in February 2007. Any person, from any country, holding a registry account, could buy allowances. The revenues made from auctioning were used to cover the administration costs of the EU ETS implementation, the proceeds went to the Danish treasury. Pedersen sums up Denmark's auctioning experience and finds that even though due "to the collapse of the ETS market towards the end of the first trading period, some 13% of the allowances were not sold," (Pedersen 2008) the sales were a success, accruing total revenues of around EUR 30.4 million. Fazekas made a study on the auction designs in the EU ETS and writes, that concerning the success of this distribution method of allowances, the Danish authorities are content. The advantage for the market participants was that "price risk was reduced considerably by selling directly compared to auctioning; as changing prices between the announcement and the auction did not constitute a problem. The actual weighted average selling price […] had been higher than the average market price, meaning the average over the period of time during which the broker made the sale. [The average selling price was EUR 6.05 while the average market price at that time was EUR 2.2] It appears that the chosen method with sales using professional agents was clearly better than selling at a flat rate, in effect selling at the average market price." (Fazekas 2008)

4.3.3.2 Auctions in Hungary, Ireland and Lithuania

Hungary, Lithuania and Ireland all opted for the same auctioning style. These countries used a sealed bid uniform-price auction. Sealed bid uniform price auction means, that the companies make a blind, a sealed bid, in which they state how many allowances they want to purchase (quantity), and at what price (unit price). There is one auctioning round, i.e. the bidders submit their bids simultaneously (during a certain period of time) and cannot adjust them later.

Example Sealed Bid Uniform Price Auction (see Figure 11):

> There are 100 EUAs available (Supply curve in the graph).
>
> Company A wants to purchase 80 EUAs at EUR 60 (Bid A in the graph, red circle),
>
> Company B needs 50 EUAs and is willing to pay EUR 30 (Bid B in the graph, blue circle).

First the bids are sorted by the prices the companies are bidding, in our case A-B.

A wants 80 EUAs (100 EUAs are available) and gets 80 EUAs.

B wants 50 EUAs (20 EUAs are available) and gets the remaining 20 EUAs.

The lowest bid that still wins EUAs (where the demand curve meets the supply curve, i.e. where aggregate demand and supply are equal) determines the price, the clearing price (green dot in the graph).

In our case: EUR 30, i.e. A won the bid for 80 EUAs at EUR 30, B won the bid for 20 EUAs at EUR 30.

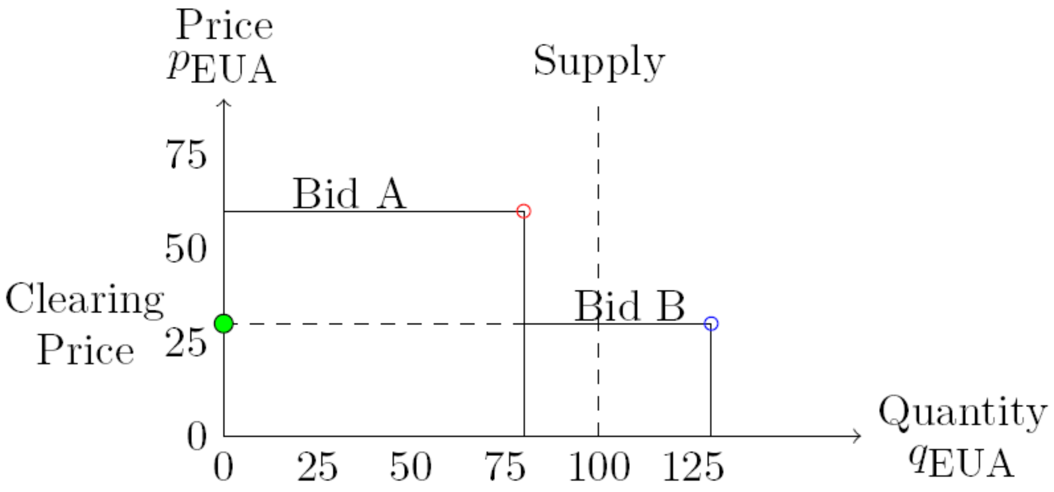


Figure 11 Example Sealed Bid Uniform Price Auction

In the case of Hungary 2.5 per cent of total allowances created account for 2.374.569 allowances set aside for auctioning. Hungary decided to hold two sealed bid uniform price auctions, both of which were implemented on the www.euets.com (Climex Auction Platform) platform. The reason to hold two auctions instead of one was to reduce the risk of auctioning on a low price level day. Due to the high price volatility throughout Phase I, Hungary considered it wise. - The first auction was held on December 11, 2006, when 1.200.000 EUAs were offered, a second auction took place on March 26, 2007 with 1.177.500 EUAs available. The lot size was 1.000 EUAs, with the minimum bid being EUR0.01. In a press release, published on www.euets.com concerning the first auction the results are summed up. “The uniform selling price based on the accepted bids was 7.42 EUR/EUA. The successful sale means revenues of 8.9 million Euros […] for Hungary. Prices during the morning trading were between 6.60 and 6.8. Euros on European spot exchanges. […] Bids for 3.42 million allowances were received, of which the Ministry of Finance accepted 1.197 million in order to maximise revenues from sale." (EUETS Homepage 2006) - The clearing price for the second auction, in March, turned out to be EUR 0.88.

The reason why not all bids for allowances were accepted, was the maximization of the revenues. Using the example from above, one sees, that in case of our example it would also have been reasonable not to accept both bids, as a higher clearing price can increase revenues even if the total volume of EUAs sold, is smaller (Figure 12).

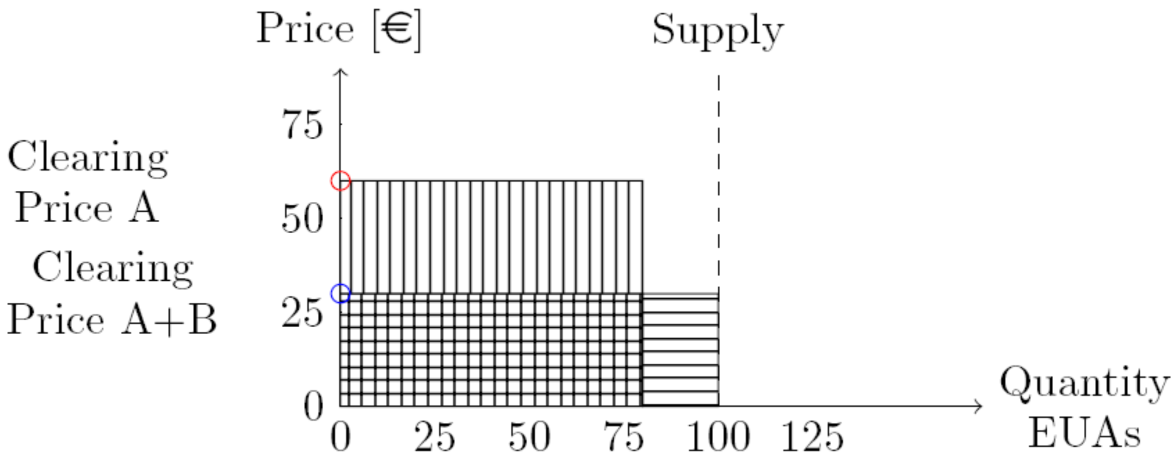


Figure 12 Revenue maximization in sealed bid uniform price auction

- If only A's bid is accepted the clearing price is EUR 60 (red circle in graph), resulting in revenues (vertical lines) of: 80 EUAs * 60 EUR = 480 EUR.
- If A's and B's bids are accepted the clearing price is EUR 30 (blue circle in graph), and the whole amount of EUAs is sold, thus the revenues (horizontal lines) are: 100 EUAs * 30 EUR = 300 EUR

In the case of Lithuania 1.5 per cent of total allowances created account for 552.000 allowances, with the revenues made from auctioning being used to cover the administration costs of the EU ETS implementation. The auction was held on

September 10, 2007 and implemented on the www.euets.com (part of the Climax Alliance) platform, where the procedure is explained in a news update following the auction announcement, "[…] the auctioneer will set a uniform price to all successful bidders, which is the 'clearing price'. For setting the clearing price, the bids will be listed in descending order by price (in case there are bids at the same price, time order will decide on ranking in a way that an earlier bid will be ranked higher). The bids will be marked from the top of the ranked list and their volume will be added up until the level where the sum of the total volume reaches the total number of allowances to be sold. The last marked bid's price will be deemed as the clearing price, and all marked bids will be changed so that the bid price will be made equal to the clearing price." (EUETS Homepage 2006) - By the time Lithuania auctioned, the market price for EUAs was at EUR 0.06. Like Hungary and Ireland, Lithuania used a sealed bid uniform price procedure. The clearing price turned out to be EUR 0.06 with the total offered volume of EUAs being sold. Selling the total amount of offered EUAs at the market price is regarded to have been a success, meeting the expectations, as the price was on a downward trend – steadily moving towards EUR 0. A week before the auction Zegnál quotes Gergely Szabó, analyst at Vertis Environmental Finance that managed the auction, predicted: "'Although there is an oversupply of phase-one emission credits on the market, we expect the auction to be successful' […] 'the price of phase-one emission credits currently hovers around € 7 to € 11 cent and the auction price is likely to be around this level or somewhat lower.'" (Zegnal 2007) The lot size was 1000 EUAs, with the minimum bid being EUR 0.01.

In the case of Ireland 0.75 per cent of total allowances created account for 502.201 allowances, which were to be auctioned along with the allowances remaining in the New Entrant Reserve and allowances returned due to plant closures. In total 1.213.000 allowances were auctioned, accounting for 1.81 per cent of the total allocation. The revenues made from auctioning were used to cover the administration costs of the EU ETS implementation, with the proceeds going to the Irish treasury. Like Hungary, the Irish Government decided to make multiple auctions to reduce the risk imposed by the high market price volatility. The pre-qualification requirement for the first (second) auction was a deposit of EUR 3.000 (EUR 15.000) to reduce the number of bogus bids. The bidders, who lost, were refunded their deposit. Bidders who won, either had their costs deducted from the deposit and where paid back the rest, or had the deposit deducted from the settlement price. Bidders, who won but failed to honour their bids, lost their deposit. Convery and Redmond write, that the Irish Environmental Protection Agency (EPA) “held its first auction on February 7, 2006. A total of 250.000 allowances, divided into lots of 500 allowances, were made available. […] The auction was open to any person holding a registry account. Participants were allowed to submit up to five mutually exclusive sealed bids. Each bid detailed the price per allowance that the individual was willing to pay, together with the number of lots that they wished to purchase at that price. The EPA received 150 individual bids. Five individual bids were successful in the action and were offered allowances at the uniform settlement price of € 26.30. On the day of the auction, allowances were trading at € 26.85 in the brokered market, so there was a close to complete allowance price convergence in the two markets.” (Convery and Redmond 2007) A second auction was held in December 2006, when 963.000 EUAs (252.000 EUAs in accordance with the auctioning percentage stated in the NAP and 711.000 unused EUAs from plant closures) were sold at a clearing price of EUR 6.87 to seven winning bidders. To reduce the complexity and the administrative costs, the batch size was increased to 1.000 EUAs. The announcement of the second auction resulted in a further price drop for EUAs whose price was on a downward trend already. Point Carbon analyses: “While several traders agreed that the auction announcement had been a bearish signal to the market, not many saw how the EPA could have acted differently. ‘It is good that they auction allowances instead of giving them away for free,’ said Seb Walhain of Fortis Bank. He stressed that announcing auctions was good for transparency, a necessity for governments, but pointed out that it was “questionable wisdom” to allow leftovers from the new entrants reserve and closures to be auctioned to a market that has already been documented long.” (Point Carbon Homepage 2009a) In a third and final auction in March 2008 the EPA planned to auction the remaining 345.000 allowances. The deposit was lowered to EUR 2.000; the lot size remained 1.000 EUAs. After the auction any remaining allowances were planned to be retired on June 30, 2008 “in accordance with the procedure established for all pilot phase allowances.” (EPA 2008)

The European Commission would welcome a higher use of auctioning since the allocation trend goes in that direction and experience could be gained. In the Emission Directive the Commission proposes that the auction revenues accrued are used to fight climate change. In Phase II a maximum of 10 per cent of the EUAs can be auctioned. Germany, the United Kingdom, Poland and the Benelux countries have opted for auctioning at various degrees. The remaining countries still hold on to grandfathering, the preferred mode by the industries. In Phase III a minimum of 50 per cent of the EUAs have to be auctioned.

4.3.3.3 New Entrant Reserve

According to the “Emission Directive” new entrant “means any installation […] which has obtained a greenhouse gas emission permit […] because of a change in the nature or functioning or an extension of the installation, subsequent to the notification to the Commission of the national allocation plan.” Thus, a new entrant is an installation that has started its business or extended its output capacity after the NAP has been submitted to the European Commission, i.e. during the trading period. Even though the “Green Paper” proposes a new entrant reserve (NER), the “Emission Directive” does not require a Member State to have one, but just states that the NAP “shall contain information on the manner in which new entrants will be able to begin participating in the Community scheme in the Member State concerned.” The European Commission assesses that “having new entrants buy allowances in the market or in an auction is in accordance with the principle of equal treatment.” (European Commission 2006b) - Still, all Member States have put aside a NER. But the EUA volumes, the allocation methods and the duration of availability of the NERs vary from country to country.

In Phase I, not considering Bulgaria and Romania, about 195 million tons were reserved for new entrants, which accounts for approximately 3 per cent of total allocated allowances. For instance, Malta set aside a generous 26 per cent for new entrants, while Slovakia, being the other extreme, only reserved 0.02 per cent.

Table 6 Number and share of allowances remaining in the New Entrant Reserve at the end of 2007[26]

		Number of allowances left	Share of allowances remaining in the NER
		1 000 EUA	%
AT	Austria	878	89 %
BG	Bulgaria	n.a.	n.a.
BE	Belgium	8 371	110 %
CY	Cyprus	60	100 %
CZ	Czech Republic	186	18 %
DK	Denmark	2 216	74 %
EE	Estonia	204	36 %
FI	Finland	164	7 %
FR	France	11 362	76 %
DE	Germany	61 860	516 %
GR	Greece	3 898	2 %
HU	Hungary	330	60 %
IE	Ireland	225	15 %
IT	Italy	39	0 %
LV	Latvia	950	61 %
LT	Lithuania	0	0 %
LU	Luxembourg	355	91 %
MT	Malta	2 288	100 %
NL	Netherlands	3 005	1 %
PL	Poland	2 450	60 %
PT	Portugal	945	25 %
RO	Romania	nip	nip
SK	Slovakia	0	0 %
SI	Slovenia	4	2 %
ES	Spain	858	9 %
SE	Sweden	1 834	76 %
GB	United Kingdom	5 928	13 %
	EU 27	**108 410**	**16 %**

Notes: n.a.: not applicable; nip: no information provided.

Most countries opted for a “first come first serve” solution. When the reserve is exhausted, operators in need of allowances, have to go to the market. Germany and Italy promised that they would purchase the allowances on the market to cover the demand of new entrants, should the reserve be exhausted. In the United Kingdom, in case of plant closures the allowances that are not issued are added to the NER. In some countries, such as Denmark and Sweden, the allocation is output-based, without consideration of the technologies used. In this case a new coal fired plant is issued the same number of allowances as a new gas fired plant, even though the coal fired plant requires more permits. Other countries, such as Finland and Germany take into account that different technologies used, require different amounts of permits, thus the allocation is emission-based. The allocated amount is based on benchmarks, taking into account BAT. The fate of the surplus

[26] Taken from EEA 2008b

allowances from the NERs is differing as well. Austria and the United Kingdom opted for selling of the exceeding allowances. Belgium and Ireland auctioned their surplus. The other Member States that had allowances left cancelled them at the end of the trading period. The size of the NERs differs greatly from Member State to Member State. As shown Table 5 the EEA calculated, that a total of 108.410 million EUAs were left in NERs of the Member States at the end of Phase I, accounting for 16 per cent of the overall NERs for this period.

4.3.3.4 Plant Closures

In case of plant closures some Member States chose to withdraw the allocated allowances from the installation and add them to the NERs. Other Member States established a “transfer rule”, which allows installation operators to transfer the allowances that were allocated to an installation that is planned to be shut down, to another installation of the same company. The idea is to give operators an incentive to actually shut down inefficient plants, instead of keeping them going, as they have a certain value due to the allowances they have been allocated. Ellerman states, "Some Member States have also developed transfer rules whereby the allowances from a closed facility can be transferred to a new facility under certain well-specified conditions." It is further explained, that "[...] the new entrant provision has no effect on abatement. While the agent receives an endowment that can be considered an offset to emission cost, the agent is still required to pay the full market price for emissions. [...The] only direct effect of a new entrant endowment is to increase output capacity." The transfer rule "allows the owner of a closed facility to transfer that facility's allowances to a new facility, which is thereby not eligible for a distribution of allowances as a new entrant. [...] the timing of the closure and start of the new facility must be within certain defined time periods (for instance, 18 months before or after in the German NAP). Typically, the transfer is calibrated to the capacity of the closing and new facilities. Thus, if the closed facility is larger than the new facility, only the pro rata capacity share of allowances may be transferred. Similarly, if the new facility is larger, all the allowances of the old facility may be transferred and the new facility will be eligible for a new entrant endowment for the amount of capacity that is greater than that of the closed facility." (Ellerman 2006) Buchner et al. add, that “the key point of all of these transfer rules is that they operate only for new facilities within the Member State." (Buchner et al. 2006)

4.4 The CO_2 Market

The CO_2 market is a market that results from the trade of EUAs and project-based emission reduction credits, ERUs and CERs. It came into existence with the different emission targets of the countries, as companies now need permits to emit CO_2. The carbon market is the market for the buying and selling of these credits.

4.4.1 Characteristics of the Market

The CO_2 market in Europe is a very young market. Thus, the main characteristics are immaturity and uncertainty, both of which are main factors driving volatility.

The EU ETS market is an immature market. This is one of the reasons for the high volatility of the CO_2 prices in Phase I. New markets usually take time for real prices to establish. In the beginning only few players were active in the market, most opting for the 'wait-and-see' tactic. But the trading volumes increased steadily over time.

Bleischwitz et al. explain the hesitation of becoming an active player in the market, "In the beginning, energy companies that are used to trading in the energy market and also leading in factoring costs, were active in the market. Accordingly, a lot of companies, especially smaller players, did not have a thorough understanding of the market and allowances were rather perceived as licences to produce and not as an economic asset with opportunity costs." (Bleischwitz et al. 2007) The economical concept of opportunity costs tries to price profits that were not realized because of missed opportunities/alternatives. In emission trading the opportunity cost of one allowance used for production is the cost the allowance would yield on the market. By using the allowance, the company cannot realize the alternative – the selling, and thus has a foregone profit, the opportunity cost. Buchner et al. note that, with the launching of the EU ETS on January 1, 2005, "[…] a real or opportunity cost was imposed on the emissions of virtually all stationary industrial and electricity generating sources within the European Union." (Buchner et al.

2007) In an interview of ENDS Europe with Abyd Karmali, the president of the Carbon Markets and Investors Association, he analyses: “As time goes by, market participants have developed a thorough understanding of the drivers underpinning the market. Their strategies are far more refined now than in previous years, which ought to result in a more stable trading environment. The much larger number of participants, higher volumes and liquidity are strong factors in favour of intra-day price stability.” (ENDS Europe Homepage 2009)

Another characteristic of the market is uncertainty. On the one hand uncertainty about the total available EUAs. Some Member States had problems with the tight deadline to submit their NAPs, which state how many allowances a state intends to allocate. The EU ETS was launched on January 1, 2005. However, the last NAP, the plan of Greece, was only approved on June 20, 2005. This delay (amongst others) caused uncertainty regarding the total amount of EUAs that would be available on the market. This uncertainty was increased by the fact, that it was unclear what would happen with the surpluses left in the NERs; whether they were to be made available to other participants on the market or if they were to be cancelled. The Member States had different opinions on this subject and dealt differently with the surpluses. Another cause for uncertainty were the CDM credits. In 2004 the “Linkage Directive” was agreed on by the European Parliament and the Council of Ministers. It allows Member States to buy additional permits from outside the EU ETS for compliance. Even though the CDM credits were permitted from 2005 onwards and the demand given, the supply was limited. Due to the tight schedule of bringing the emission market into existence and CDM projects having a considerable lead time, they were not available when the market was ready for them. Knowing the total supply ex ante is crucial the stability of the market. - On the other hand, uncertainty about the rules of the system in future trading periods. Bleischwitz et al. state, “Some companies fear that emission reduction efforts could be sanctioned (by possible changes) in the next allocation plan, so they refrain from reducing emissions in the current period.” (Bleischwitz et al. 2007)

Efficiency of a market depends highly on the accessibility of information of the players. Since reliable information is not easy to acquire, the market suffers from high price instability. With accessible, verified emissions data and increased market experience the problems with the high price volatility of Phase I should be reduced. Also the permission of banking of EUAs to future phases should have a stabilizing effect on the market.

4.4.2 The Players

The market consists of a small number of large buyers and sellers. Therefore individual trades can have strong effects on the prices. Convery and Redmond made a study on the market and price developments in the scheme and found it very difficult to get data, as few market participants were willing to disclose information. They contacted three exchanges and seven brokers who “indicated that there were approximately twenty companies that were active in the EUA market in January 2005” and that “the majority of these companies were large energy suppliers and large banks, especially German banks.” (Convery and Redmond 2007)

Table 7 Allocated EUAs and number of participants[27]

Size classification (tCO_2/year)	Number of participants (% of total)	annual emission allocations (% of total)
<5.000	14%	0,4%
5.000-10.000	17%	1%
10.000-25.000	26%	4%
25.000-50.000	15%	4%
50.000-100.000	9%	6%
100.000-250.000	8%	10%
250.000-500.000	4%	14%
500.000-1.000.000	4%	24%
>1.000.000	3%	36%

In Table 6, that uses annual data from NAPs of Phase I, one can see, that the number of small participants is large compared to bigger installations. On the same hand, the annual emission allocation of those small participants is small. This means that a small number of large installations account for the bulk of the total annual emissions. In their study, Graus and Voogt find, that “nearly a quarter of the total amount of installations covered in the scheme together is responsible

[27] adapted from Graus and Voogt (2007)

for only 0.2% of actual emissions covered by the scheme.” (Graus and Voogt 2007)

4.4.3 CO_2 Markets in Europe

Mansanet-Bataller et al. sum up the CO_2 markets in Europe as follows: “EUAs can be traded in spot markets such as Powernext (Paris), Energy Exchange of Austria (EXAA, Vienna), NordPool (Oslo) and European Energy Exchange (EEX, Leipzig). There is also a pan-European platform called Climex Alliance where it has been possible to trade spot contracts since July 2005. Furthermore, in NordPool, European Climate Exchange (ECX/IPE, London) and EEX, it is also possible to trade derivatives contracts with EUAs as the underlying commodity.” The above-mentioned Climex Alliance are The Netherlands’ New Values, Spain’s SENDECO2 and Hungary’s Vertis Environmental Finance. (Mansanet-Bataller et al. 2006)

During Phase I there were – apart from CERs – two tradable assets available in the market, Phase I EUAs and Phase II EUAs. Trading possibilities include over-the-counter (OTC) and organized markets trades. Also, one has to differentiate between spot contracts and future contracts. Spot markets are cash markets, referring to the fact, that goods are sold and delivered simultaneously. Goods are bought and delivered immediately. The contracts are effective the very moment they are made. Future contracts are agreements to buy a certain quantity of a certain good at a certain price at a certain time in the future. The delivery of that good is also set in the future. In other words, it is a contract that states what, how much, when and at what price, is to be bought or sold, and how, when and where the delivery will take place.

Mansanet-Bataller and Pardo observed that “there is a huge similarity in the trends of Phase I OTC forward prices, spot and futures prices. The similar trend between figures can also be confirmed with a cross correlation analysis in prices […] and returns […].” Further on, the “positive and significant correlation coefficients indicate that all markets are strongly correlated and all of them incorporate the information in a very similar way.” (Mansanet-Bataller and Pardo 2008)

In practice the allowances are traded either through brokers, through exchanges or through bilateral trades. Over-the-counter transactions through brokers are the most frequent ones.

An aspect hindering the functionality of the EU ETS were the technical problems with the registries, which were not accessible for a long time. The tight deadlines to establish a multinational emission trading scheme with national trading registries for every Member State were an obstacle for many participating countries. Still, even critics comment most positive on the feat. Especially the electronic linking to the ITL, constituted a problem during Phase I. This was a considerable draw-back, since functioning infrastructure is a fundamental condition for a project the size of the EU ETS, and resulted in high price volatility for Phase I EUAs, as can be seen in Figure 13.

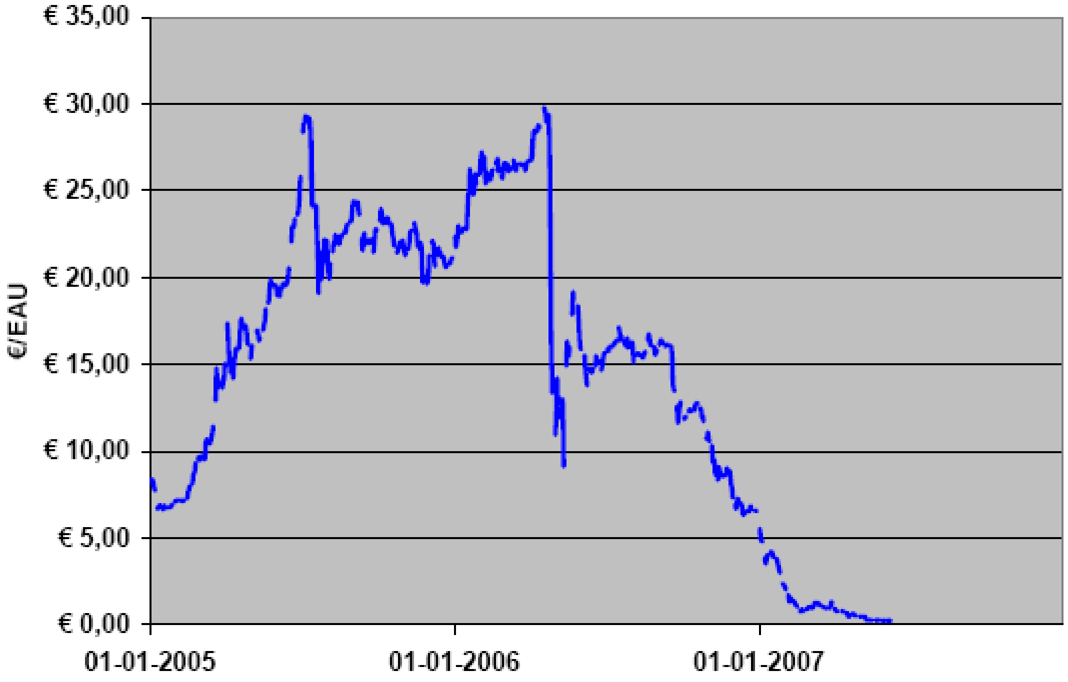


Figure 13 Price Developments 2005-2007[28]

Allowance trading started in 2003, on a forward basis. Little volumes were traded then. When spot trading started in 2005 the market started to grow exponentially.

[28] Taken from the EEX Homepage 2009

As can be seen in Table 7 in 2005 there was a total surplus of approximately 4 per cent of allowances, in 2006 the surplus was 2 per cent, in 2007 1 per cent. In 2005 Austria, Ireland, Italy, Spain and the United Kingdom were the only Member States where verified emissions were higher than the allocated allowances would have permitted. In 2006 Denmark, Ireland, Italy, Slovenia, Spain and United Kingdom were short and in 2007 Denmark, Greece, Ireland, Italy, Slovenia, Spain and the United Kingdom. - Either the above mentioned Member States did not deal with the EU ETS and the necessity to adapt carbon emissions, or they were the only countries who allocated reasonable amounts of allowances to their installations, i.e. an (overall short) amount that led to a price encouraging emission reduction.

The considerable surplus of allowances for Phase I had consequences for Phase II. The European Commission required tighter emission budgets for Phase II from all Member States. This led to an increase in the price for Phase II EUAs starting from March 2007.

Figure 14 shows the verified emissions of the sectors covered by the scheme per year and in aggregated form over the whole trading period. It is very easy to see that combustion installations are responsible for the bulk of the CO_2e emissions. Another thing that becomes visible is that the verified emissions increased each year during Phase I. One reason can be that, due to the anticipated deficit of EUAs, and uncertainty reigning the market, the companies were careful with their emissions. Once it became clear that scarcity was not an issue, they returned to their business-as-usual emission levels.

Table 8 Number of installations, allocated allowances and verified emissions per Member State and trading year[29]

	Number of installations	Allocated allowances (1 000 EUA)			Verified Emissions (kt CO_2)			Difference between allocation and verified emissions (%)			
		2005	2006	2007	2005	2006	2007	2005	2006	2007	2005–2007
Austria	216	32 413	32 649	32 649	33 373	32 383	31 751	– 3	1	3	0
Belgium	341	58 310	59 952	60 429	55 363	54 775	52 795	5	9	14	10
Bulgaria	0	–	–	0	–	–	0	–	–	n.a.	n.a.
Cyprus	13	5 471	5 612	5 899	5 079	5 259	5 396	8	7	9	8
Czech Republic	414	96 920	96 920	96 920	82 455	83 625	87 835	18	16	10	15
Denmark	399	37 304	27 908	27 903	26 476	34 200	29 407	41	– 18	– 5	3
Estonia	50	16 747	18 200	21 344	12 622	12 109	15 330	33	50	39	41
Finland	626	44 666	44 618	44 620	33 100	44 621	42 541	35	0	5	11
France	1 100	150 412	149 967	149 776	131 264	126 979	126 635	15	18	18	17
Germany	1 942	493 482	495 488	497 302	474 991	478 017	487 004	4	4	2	3
Greece	153	71 162	71 162	71 162	71 268	69 965	72 717	0	2	– 2	0
Hungary	254	30 236	30 236	30 236	26 162	25 846	26 837	16	17	13	15
Ireland	121	19 237	19 238	19 240	22 441	21 705	21 246	– 14	– 11	– 9	– 12
Italy	1 044	216 150	205 050	203 255	225 989	227 439	226 369	– 4	– 10	– 10	– 8
Latvia	102	4 070	4 058	4 035	2 854	2 941	2 849	43	38	42	41
Lithuania	110	13 499	10 577	10 318	6 604	6 517	5 999	104	62	72	80
Luxembourg	15	3 229	3 229	3 229	2 603	2 713	2 567	24	19	26	23
Malta	2	2 086	2 167	2 286	1 971	1 986	2 027	6	9	13	9
Netherlands	405	86 452	86 388	86 477	80 351	76 701	79 875	8	13	8	9
Poland	869	237 558	237 558	237 543	203 150	209 616	209 618	17	13	13	15
Portugal	265	36 909	36 909	36 909	36 426	33 084	31 226	1	12	18	10
Romania	244	–	–	74 343	–	–	69 605	–	–	7	7
Slovakia	190	30 471	30 487	30 487	25 232	25 543	24 517	21	19	24	21
Slovenia	99	9 138	8 692	8 246	8 721	8 842	9 049	5	– 2	– 9	– 2
Spain	1 066	172 161	166 186	159 717	183 627	179 700	186 534	– 6	– 8	– 14	– 9
Sweden	763	22 289	22 484	22 846	19 382	19 889	15 348	15	13	49	24
United Kingdom	1 105	206 072	206 005	215 875	242 515	251 151	256 569	– 15	– 18	– 16	– 16
EU-27	**11 908**	**2 096 444**	**2 071 741**	**2 153 048**	**2 014 017**	**2 035 608**	**2 121 647**	**4**	**2**	**1**	**2**
EU-25	11 664	2 096 444	2 071 741	2 078 704	2 014 017	2 035 608	2 052 042	4	2	1	2
EU-15	9 561	1 650 248	1 627 234	1 631 391	1 639 169	1 653 323	1 662 586	1	– 2	– 2	– 1
EU-10	2 103	446 196	444 507	447 314	374 848	382 284	389 457	19	16	15	17
EU-2	244	–	–	74 343	–	–	69 605	–	–	7	7

Notes: Exact numbers show small variations through time, due to new entrants, closures, corrections and other reasons. The table provides verified emissions for all installations with open or closed accounts in CITL, as of 06 October 2008 (i.e. including new entrants and closed installations). As the CITL is constantly receiving information (including corrections of verified emissions data, new entrants and closures), aggregations carried out after 6 October 2008 might give a different result. Bulgaria and Romania only entered the EU ETS in 2007, data for Romania are for 2007 only; the Bulgarian registry was still not operational at the time of writing and no data was available. Belgium: Verified emissions include installations which Belgium opted to exclude temporarily from the scheme in 2005. United Kingdom: Verified emissions for 2005 do not include installations which the United Kingdom opted to exclude temporarily from the scheme in 2005 but which will be covered in 2008 to 2012 and are estimated to amount to some 30 Mt.

Source: Community independent transaction log (CITL) (6 October 2008) ([10]).

([10]) The data contained in the CITL is undergoing constant change due to, e.g. installations entering or leaving the EU ETS, addition of missing information, correction of emission reports, inaccurate data in national registries and court decisions on allocation decisions. CITL data may deviate from actual allocations because the NAP tables, which form the basis for the data in the CITL, do not track all changes in allocation., e.g. in cases of new entrants, capacity extensions and closures (no changes for the whole period) and only partly in cases of corrections in allocation. Further cases of deviations between the CITL and actual allocations are – in some cases - installations which after allocation turned out to never have been obliged for participation, installations 'assembled' and split. In most cases these differences are small and will have no significant effect on the overall analysis. However, in specific cases differences may be of larger scale.

[29]Taken from EEA 2008b

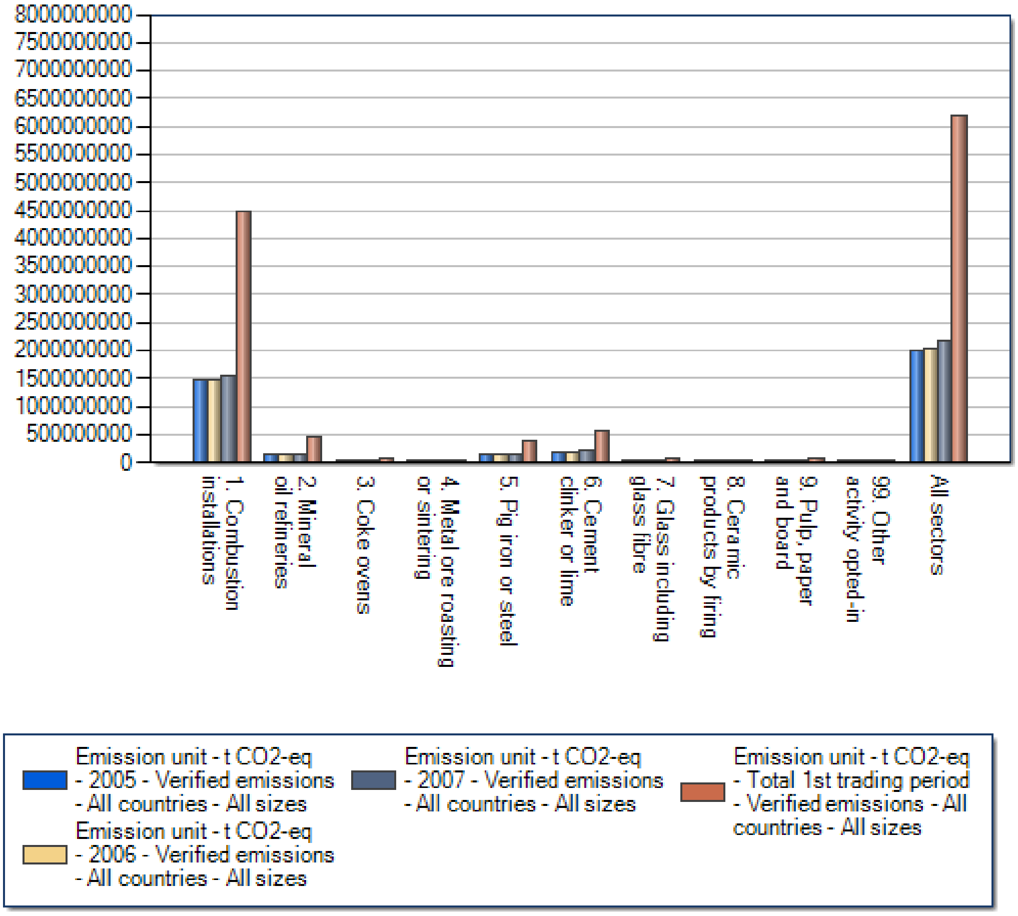


Figure 14 Greenhouse gas emissions by sectors 2005-2007[30]

Even though many obstacles had to be dealt with during Phase I, there was a very active market for the EUAs. Tritignon and Ellerman (2008) calculated a table showing the amount of allowances surrendered in the Member State in which they were issued and the amount of allowances that were surrendered in a Member State other than that in which they originated. One can see that the main share of a Member State's issued allowances is surrendered in the Member State of origin, which comes as no surprise, as the Member States issue the allowances to the installations covered by the scheme, which have a certain demand themselves, they are likely to meet before they enter the market, selling their surplus

[30] Taken from EEA Homepage 2009c

allowances. Especially in the first two years, when market uncertainty was very high, few participants entered the market. As can be seen in Table 8 the share of cross border surrender increased steadily over the years of Phase I.

Table 9 Cross Border Surrender of EUAs[31]

Million EUAs (% of total)	2005	2006	2007
Surrendered in Member State of origin	1,611 (97.9%)	2,300 (96.4%)	1,879 (88.9%)
Surrendered in another Member State	34 (2.1%)	85 (3.6%)	235 (11.1%)
Total	1,645	2,385	2,114

4.5 Determinants of CO_2 Prices

What factors influence the carbon prices? Springer (2003) and Christiansen et al. (2005), cited in Alberola et al. (2008a) identify economic growth, energy prices, weather conditions and policy issues as the main factors influencing the price of carbon. In a Memo the European Commission states, that "the price of allowances is determined by supply and demand and reflects fundamental factors like economic growth, fuel price, rainfall and wind (availability of renewable energy) and temperature (demand for heating and cooling) etc. A degree of uncertainty is inevitable for such factors. The markets, however, allow participants to hedge the risks that may result from changes in allowances prices." (European Commission 2008b)

4.5.1 Price of Energy and Abatement Options

The IEA estimates that fossil fuels will account for around 80 per cent of the world's primary energy mix by 2030, with an average increase of the primary energy demand of 1.6 per cent per year. The estimates of proven oil reserves will supply the world with oil for around 40 years at current consumption. The natural gas reserves will last around 60 years at current consumption. (IEA 2008)

[31] adapted from Tritignon and Ellerman (2008)

As can be seen in Figure 15, the price of fuel has a strong effect on the price of the EUAs.

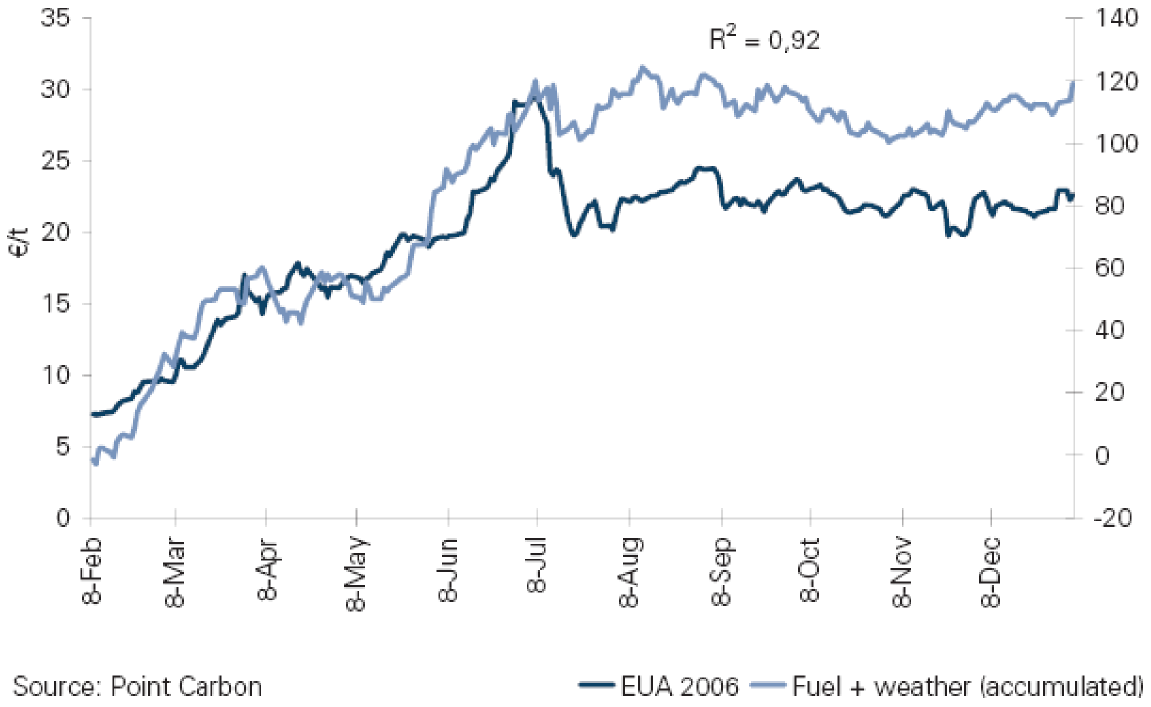


Figure 15 Correlation of Fuel Prices and EUA Prices in 2005[32]

Especially gas prices compared to coal prices play an important role, as it is the easiest way to reduce emissions. Gas prices increased considerably in 2005 and 2006 making the switching from coal to its cleaner substitute, gas less attractive. Lowrey, cited in Mansanet-Bataller et al. (2006), writes "if the price of gas increases relatively to the price of coal, then the cost of switching from gas to coal increases and – other things being equal – the demand for coal will increase. Therefore, the demand for carbon allowances to cover that generation will also rise, leading to a resultant increase in emission allowance prices." (Lowrey 2006) Coal emits more CO_2, thus requires more EUAs. If gas is expensive and coal comparably cheap, the demand for coal rises and correspondingly the demand for emission allowances increases.

[32] Taken from Point Carbon (2006a)

Example Gas Fired Plant vs. Coal Fired Plant

Assume

p_C ... price for one unit of output from a coal fired plant

p_G ... price for one unit of output from a gas fired plant

p_{EUA} ... price of one unit EUA

a_C, b_G are the indicators of the amount – percentage or multiple – of EUAs one unit of output requires, depending on the efficiency rate of the plant and the emission factor (a_C and b_G vary from installation to installation).

Without a price on carbon output generation with a coal fired plant is cheaper than output generation with a gas fired plant:

$p_C < p_G$

With a price on carbon the formula changes, as one output unit from a coal fired plant emits more than one output unit of a gas fired plant.

$a_C > b_G$

$p_C + a_C * p_{EUA} > p_G + b_G * p_{EUA}$

This is only true, if p_{EUA} is sufficiently high. In that case the coal fired plant becomes more expensive, giving an incentive to switch to gas.

Delarue et al. made a study on the short-term abatement motivations in the European power sector through fuel switching in the years 2005 and 2006 when the CO_2 price increased and found that “a CO_2 price [treated as additional cost for the fuels depending on their carbon content] of 20 Euros is not high enough to encourage much fuel switching at the assumed fuel prices [daily fuel prices were used]. However, the picture for a EUA price of 40 euro/ton is quite different. In this case, a relative constant abatement of about 10 kton/hour can be noticed throughout the entire load spectrum.” Concerning the geographical distribution of the abatement, they find that “the bulk of the abatement occurs in the UK with Germany in second place but well behind. The reason is not that coal-fired emissions are more in the UK than in Germany, but there is more gas-fired capacity. Both countries have large coal-fired generating capacity […].”(Delarue et al. (2008)

Duerr explains that windfall profits, which have been responsible for price increases of energy in recent years, were not the main factor. “Political discussion heated up exponentially when the spiralling price effect hit the European electricity and gas markets in the spring of 2005. CO_2 costs, however, can only explain a third of this price increase. The major reason for the surge of energy prices is the looming price of oil. Oil defines the reference price for other fossil resources, such as natural gas and coal. In 2005, gas prices, following oil, climbed to new price heights, resulting in increased capacity use of coal fired plants in the UK. Since these emit substantially more CO_2 the European carbon market saw an unforeseen additional demand for CO_2 certificates from the UK.” (Duerr 2007)

McGuinness and Ellerman made a study on CO_2 abatement in the United Kingdom power sector and found that "prior to 2005, the average costs of generating electricity from coal and natural gas were relatively close, but from 2005 on a significant separation developed to the disadvantage of gas-fired electricity except for a brief period of early 2007. [...The] inclusion of a carbon price in 2005 had a much greater effect on the cost of coal-fired generation than on that of natural gas. Nevertheless, for considerable periods of time, and especially in late 2005 and early 2006, the relatively high carbon prices were not enough to compensate for the still greater increases in natural gas prices. This change in the price of natural gas relative to that of coal largely explains the increase in coal-fired generation in the UK in 2005 and 2006 notwithstanding a significant carbon price." They calculated that "an increase of 0.1 in the ratio of the relative cost of coal to gas is associated with a five percentage point increase in utilization across gas plants and a six percentage point reduction in utilization across coal plants." They found, that the price on carbon did as a matter of fact lead to abatement, "[...] while the coal generation increased under the EU ETS in 2005 and 2006, as a result of high gas prices, the counterfactual suggests that these increases would have been substantially larger absent the EU ETS." They conclude, that "the estimates [...] provide clear evidence of abatement through fuel switching in 2005 and 2006. Taken together, they suggest that in 2005 between 13.2 and 21.2 million tons of CO_2 were abated as a result of load shifting from coal to CCGT [gas-fired combined cycle gas turbine] plants and between 13.7 and 20.7 million tons of CO_2 were similarly abated in 2006. These estimates represent roughly 8-12% of the counterfactual in both years." (McGuinness and Ellerman 2008)

Concerning abatement options, switching from coal to gas is only one possibility. An installation can also invest in improvements in itself, e.g. the technologies it uses. These abatement costs are independent of the market price for EUAs, but depend on an installation's overall abatement potential, its efficiency rate, its used technology, i.e. it depends on how "green" an installation already is, and on the development level of the country in which the installation is set. A heavily polluting installation may have low abatement costs for a certain amount of emission reduction, as it has more possibilities to invest in its own technologies used. Of course the abatement cost, so to say the costs of internal emission reduction, increase if the abated emission quantity increases, and at some point they are infinite when no further abatement is possible at all, always depending on the point in time considered, as technological progress may offer new abatement options. Abatement costs can be (one-time) investments in the installation that reduce the installation's CO_2 emissions and thus lower its overall demand for emission allowances. Simply put, if an installation emits less, it requires fewer permits to emit. Abatement costs, if the abatement is seen as a project to make the company greener, consist of fixed costs and possibly variable costs. To be able to make a decision, whether or not a certain abatement possibility pays, i.e. is cost-effective, the costs are split to a yearly level and depreciated over the time period the reduction brings a benefit.

Example Abatement Costs:

> An investment, that yields an emission reduction of 1 tCO_2 per year, costs EUR 100. The installation expects lowered emissions for 10 years through the investment, because after 10 years the technology may be too old and replaced anyway. Thus, the abatement costs per year are EUR 10 (EUR 100/10 years). These costs are compared to the actual and expected future market price for emission allowances at a given time. Then, an investment decision is made. This in turn means that the market price has to be sufficiently high to encourage abatement.

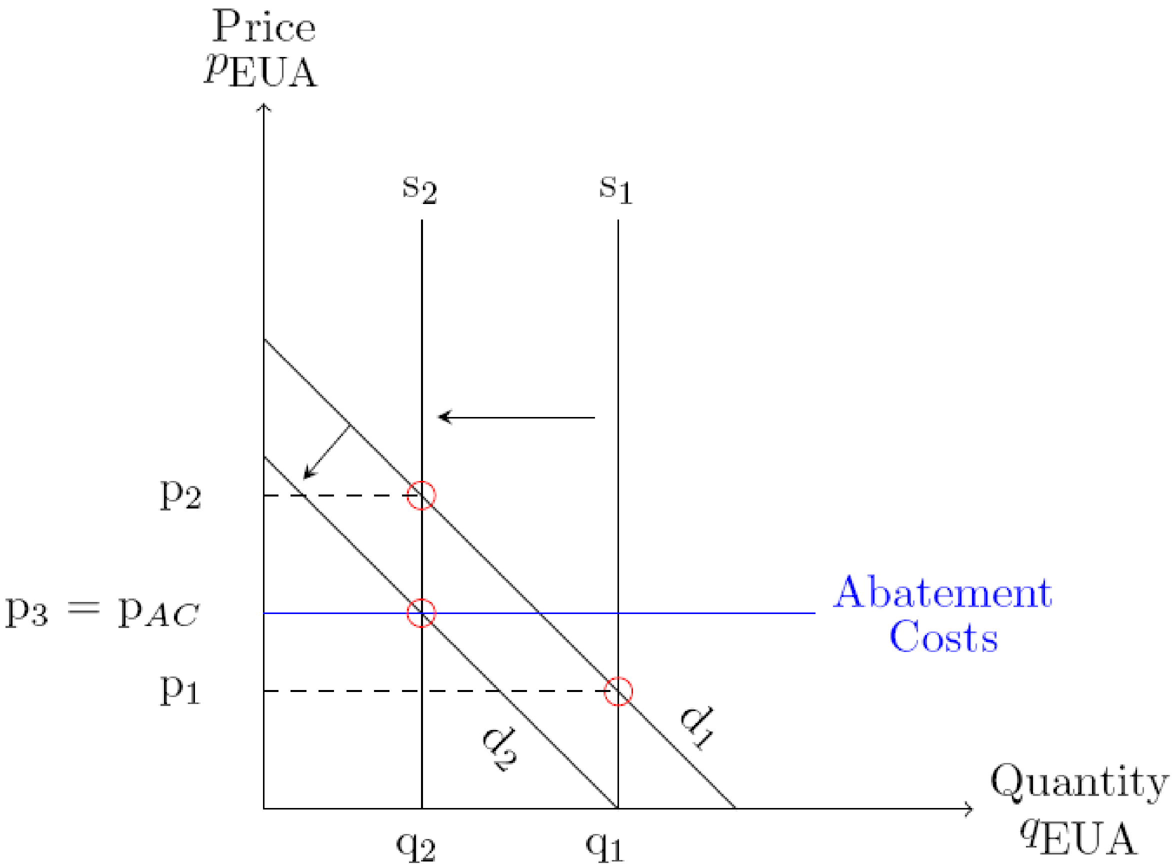


Figure 16 Cost-effectiveness of abatement

Figure 16 shows that a certain market price of permits, p_{EUA}, is necessary that a company chooses to abate. In the graph an average level of abatement costs at a certain time is assumed, as these costs vary greatly from country to country and installation to installation and depend on the time of the possible investment.

1. d_1, s_1, $p_1 < p_{AC}$

At first we have a certain aggregated demand curve d_1 and a supply curve s_1. The supply curve is the fixed amount of credits issued by the Member States. s_1 and d_1 meet and form a market price, p_1, at a quantity q_1. For simplification the market price is assumed to be linear. Price volatility is not taken into account, neither are price speculations and the companies' decisions when to buy and sell. To encourage abatement the price for credits has to be higher than the costs of abatement, p_{AC}. As $p_1 < p_{AC}$ abatement would not be cost-effective, i.e. it is cheaper to emit more and to buy additional credits, than to invest in emission reduction. Thus, companies will choose not to abate.

2. d_1, $s_2 < s_1$, $p_2 > p_1$, $p_2 > p_{AC}$

Assume now, the supply is reduced to s_2. The scarcity in the market lets the market price jump up to p_2. In this case the abatement costs, p_{AC}, are smaller than the market price of emissions, p_2, encouraging and maybe resulting in abatement.

3. d_2, s_2, $p_3 < p_2$, $p_3 = p_{AC}$

Abatement reduces emissions, thus, decreases the demand for emission credits. This shifts the demand curve, d_1, down/left to d_2, where a new market price, p_3, forms, that is equal to the costs of abatement, p_{AC}.

A company makes an abatement decision by comparing the abatement costs, p_{AC}, for a certain quantity of emissions with the costs for the same quantity of EUAs, which depend on the market price of the EUAs, p_{EUA}.

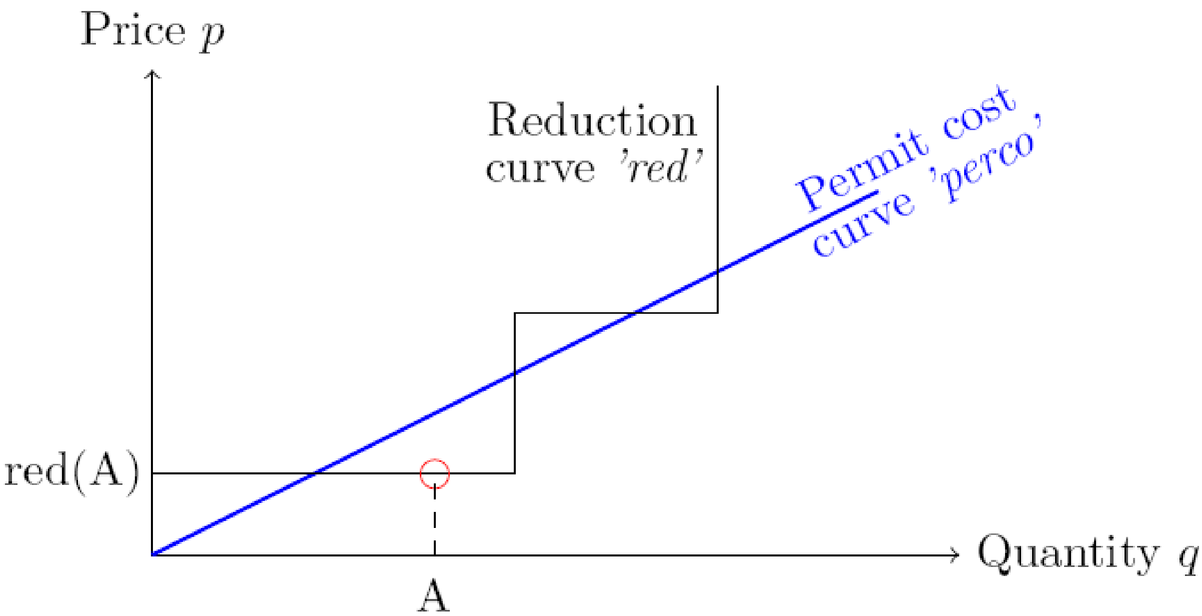


Figure 17 Abatement vs. Emission Decisions

Figure 17 shows two curves, the reduction curve, “red”, and the permit cost curve, “perco”:

Each installation has an individual reduction curve, which is a function of q_{AC} and p_{AC} and has a positive slope, i.e. the more is reduced the higher the costs. As the different investment possibilities have different (step-fixed) costs and yield different abatement quantities, it may be reasonable to assume a step-by-step slope.

The permit cost curve gives the aggregated costs for emission permits, p_{EUA} that have to be spent for a certain emission quantity, q_{EUA}. It is a linear function whose slope is the market price for EUAs, $p_{EUA.}$

Upon deciding whether to abate or to emit a company looks at the costs of p_{EUA} and p_{AC} at any quantity A.

The abatement of A emission units has a price, red(A), A*p_{AC}. The costs that would occur if the A emission units were emitted and thus required permits are perco(A), A*p_{EUA}. Which option is cheaper?

As we assume a step-by-step slope a company will want to maximize the amount of reduced emissions at a certain price, after having chosen abatement.

In the graph it means that the company will want to maximize A (red circle) so that red(A) < perco(A), shifting the abated quantity to the right as far as possible without increasing the price.

4.5.2 Total Supply of Allowances

The total amount of allowances granted in the NAPs has a substantial effect on the price of the EUAs. During Phase I the total supply of allowances was never entirely clear to the market participants. Trotignon and Ellerman explain that “the allocations to installations reported in the CITL understate the total number of allowances allocated to the installations in some instances, and overstate the number in others.” The reason for this is that apart from the NER and the optional auctioning percentage, “not all allowances as approved by the Commission were distributed. Installations in several Member States, especially in the United Kingdom, exercised the opt-out provision and the allowances authorized for them were cancelled. EUAs forfeited under the closure provisions, as well as any unclaimed in the new entrant reserve were annulled in some Member States, but sold in others. As a result, neither the approved Member State totals nor the sum of the allocations to installations as reported in the CITL reflects the total number of allowances available for compliance.” (Tritignon and Ellerman 2008) This further means, that the total supply of allowances for Phase I was not known until after the end of Phase I.

The important role the overall supply of allowances plays could be experienced, when the NAPs of Phase II were approved by the European Commission. After the verified overallocation of Phase I the Commission found that the verified emission reports of the first trading year, 2005, were the most reliable, accessible data on actual emissions on installation level. Thus, they became the baseline for the European Commission’s assessment of the Phase II NAPs. Consequently, the Commission reduced the number of allocated allowances for Phase II more than anticipated. "The Commission completed its assessment of NAPs for the 2008-2012 period with a final set of decisions taken in late October 2007. The cap for the new period represents a reduction of almost 140 million allowances compared to verified emissions in 2005 from installations covered by the EU ETS, i.e. a cut of 6.8%, while still taking account of additional installations included in 2006/2007 and those that will be added in 2008." (European Commission 2007b) In a Memo it is summed up that "for the second trading period EU ETS emission have been capped at around 6.5% below 2005 levels to help ensure that the EU as a whole, and Member States individually, deliver on their Kyoto commitments." (European Commission 2008b) Following these decisions, the price of the EUAs reacted instantly with an increase.

Another aspect is that by September 2005, nine months after the launch of the EU ETS, only eleven (of the 25) registries had been opened, accounting for about half of the allocated allowances. This had a negative effect on the liquidity in the market, as Eastern European countries, which later turned out to be long, could not participate in the market yet.

4.5.3 Supply of Additional Credits

In general CERs are cheaper than EUAs, even though the price of CERs reacts very similarly to those of EUAs, (especially) from 2008 on. The main reason, why CERs are not as expensive as EUAs, is uncertainty. During Phase I it was uncertain when the infrastructure for the CERs was going to be ready. Also the overall supply level of CERs was unknown. These additional uncertainty factors had a lowering effect on the CER prices, since fewer market participants were willing to invest in such a highly uncertain asset. Still, offering this additional, slightly cheaper emission permit, in turn, has a lowering effect on the price of the EUAs. With the infrastructure in place and trading experiences gained, the prices of EUAs and of CERs (and from 2008 also from ERUs) are expected to assimilate more and more – with the EUAs remaining slightly higher, as the use of CERs has been limited (starting in Phase II) according to the percentage fixed in the NAPs of each Member State. Broadening the market has a positive effect for the participants. A larger market is more stable and thus reduces price volatility. With higher market liquidity, uncertainty for the players is reduced. Higher market confidence makes long-term investment decisions easier.

Ireland, Finland and the Netherlands rely on these flexible mechanisms of the Kyoto Protocol to a substantial degree. The European Commission therefore limited the share of CDM and JI credits made available to the Member States, since a high percentage relocates the measures against climate change to other countries, all the while not guaranteeing the success of the projects.

During Phase I linkage did not play a central role. At first, there was demand for CERs until the end of April 2006, but no supply. When there was finally supply in the end of 2007, there was no more demand. CDM and JI projects have a year-long lead time. The “Linkage Directive” was only issued in 2004; too short for projects to be chosen, approved and certified. Also, the registry link that finally enabled the use of CERs was not in place until 2007. The ITL, that supervises trades from all Kyoto Flexibility Mechanisms (Emission trading credits – EUAs, JI credits – ERUs and CDM credits – CERs) linked to the CITL (which only supervises the EUAs, thus making the use of CER credits, even though it would have been allowed, impossible until then) on November 14, 2007. At that time, the EUA price was already down to zero and with it the demand to purchase additional credits. Thus, no project based credits were surrendered 2005-2007. CERs finally became available in the end of 2007. As CERs are credits from outside the system, they do not fall under the banking restrictions. At that time EUAs for Phase II had a value of around EUR 20, while Phase I EUAs had none. Thus, all CERs that could have been used in Phase I were banked for Phase II. The amount that can be banked is limited to 2.5 per cent of the Member State's Kyoto target for CERs and 2.5 per cent for ERUs.

The high demand in the beginning of the first trading phase showed that CERs would become increasingly important in the near future. The European Commission has added a twelfth criterion to its Annex III of the "Emission Directive", that have to be taken into account for the development of the Phase II NAPs, concerning the supplementary of CDM and JI credits and published new guidelines on how the Annex III criteria were to be interpreted. The European Commission (2006a) limited the overall amount of CDM and JI credits, deciding that no more than "half of the effort undertaken by a Member State, taking into account government purchases, is made through the Kyoto flexible mechanisms" and elaborate on the calculation of the exact amount, that in "practical terms the Commission assesses consistency with supplementary obligations based on the following formulae:

> A = base year emissions – emissions allowed under Kyoto target
> B = greenhouse gas emissions in 2004 - emissions allowed under Kyoto target
> C = projected emissions in 2010 – emissions allowed under Kyoto target
> D = 50% of Max (A, B, C) – annual average government purchase of Kyoto units
> Maximum allowed limit (in %) = (D/annual average cap) or 10%"

This means that Member States may, additionally to their domestic measures, buy 50 per cent project based credits. If the government buys many credits, fewer are available for the private sector. To avoid that the government excludes the private sector completely from the additional credit system, the European Commission decided that installations were allowed to use flexmex credits by up to 10 per cent in addition to the allowances they were allocated. If an installation wants to use more than the 10 per cent limit, the Commission, upon deciding if increasing the limit is reasonable, takes into account the Member State's "path to Kyoto". The reason for the European Commission's decision to limit the level of allowed CERs and ERUs is obvious. If there was no limit, the Member States would import as many credits as they needed to cover their entire shortage. Without shortage the price for EUAs would be too low to encourage abatement.

Table 10 lists the project-based credit limits as stated in the NAPs of the individual Member States for Phase II.

Point Carbon analysed that with the present solution the import of credits "will not be enough to cover the entire short in the EU ETS [because …] the limits are per installation level. Thus for the full import potential to be realised, each installation across the EU ETS would have to submit imported credit for compliance. With so many diverse installations (and companies) across all sectors and countries, there is reason to believe that the full import will not be realised." (Point Carbon 2007) Of course the credits will reduce the need for internal abatement, but not to the extent it would have without the limit.

Table 10 Credit limits of the Member States in Phase II, all in Mt/year[33]

COUNTRY	NAP	EC decision	Reduction [Mt/%]	Credit limit
AUT	32.8	30.7	2.1 (6 %)	10.0 %
BEL	63.3	58.5	4.8 (8%)	8.4 %
BGR	67.6	42.3	25.3 (37%)	12.6 %
CYP	7.1	5.5	1.6 (23%)	10.0 %
CZE	101.9	86.8	15.1 (15 %)	10.0 %
DEU	482.0	453.1	28.9 (6%)	22.0 %
DNK	24.5	24.5	0.0 (o%)	17.0 %
ESP	152.7	152.3	0.4 (0.3%)	20.0 %
EST	24.6	12.7	11.7 (48%)	0.0 %
FIN	39.6	37.6	2.0 (5%)	10.0 %
FRA	132.8	132.8	0.0 (0%)	13.5 %
GBR	246.2	246.2	0.0 (0%)	8.0 %
GRC	75.5	69.1	6.4 (8%)	9.0 %
HUN	30.7	26.9	3.8 (12%)	10.0 %
IRL	22.6	22.3	0.3 (1.3%)	10.0 %
ITA	215.2	201.6	13.6 (6%)	15.0 %
LTU	16.6	8.8	7.8 (47%)	20.0 %
LUX	4.0	2.5	1.5 (38%)	10.0 %
LVA	7.7	3.4	4.3 (56%)	10.0 %
MAL	3.0	2.1	0.9 (30%)	-
NLD	90.4	85.8	4.6 (5%)	10.0 %
NOR	15	15	0.0 (0%)	20.0 %
POL	284.6	208.5	76.1 (27%)	10.0 %
PRT	35.9	34.8	1.1 (3%)	10.0 %
ROM	97.6	75.9	21.7 (22%)	10.0 %
SVK	41.3	32.6	8.7 (21%)	7.0 %
SVN	8.3	8.3	0.0 (0%)	15.8 %
SWE	25.2	22.8	2.4 (10 %)	10.0 %
TOTAL (EU28)	*2348.4*	*2103.4*	*245 (10.4 %)*	*n.a.*

4.5.4 Banking and Borrowing

Banking of allowances means saving allowances in one year for the requirements in a later period, borrowing means using allowances for the requirements in one

[33] Taken from Point Carbon (2008)

period from a later period. EUAs are issued annually, i.e. 2006-EUA can either be used in 2005 (borrowing) or it can be used in 2007 (banking). Banking and borrowing are allowed within Phase I.

At the end of each trading period the (surrendered as well as unused) allowances of that period are cancelled. In case of banking, EUAs from trading period 1 are re-issued as EUAs for trading period 2. Companies have to return the amount of EUAs for a certain year (A) by April 30 of the following year (B). The EUAs for the following year (B) are already allocated on February 28 of that year (B). Permits allocated for the following year (B) can thus easily be used to meet the demand of emission allowances for the previous year (A). This possibility of borrowing, during these overlapping time horizons when EUAs for both phases are valid, is intended to smooth out unusual extremes, e.g. exceptional weather conditions.

Kruger et al. explain one of the advantages of banking, stating that banking “tends to put a lower bound on prices in each periods, as sources see future value in saved allowances and will therefore choose to hold on to them rather than selling them at an unusually low price or using them when relatively inexpensive abatement options remain available.” (Kruger et al. 2007)

By prohibiting banking between the phases the learning and trial phase was given special emphasis as such, since the two phases were EUA-wise completely disconnected. The Member States were put on track of the Kyoto targets and could acclimatize to their new environment, an environment in which carbon has a price. In the end, it was independent of the Kyoto compliance period and the market had time and opportunity to gain experience and develop slowly.

It is often criticized, that by prohibiting banking, (the anyhow low) market stability was further lowered, since the investors could not build up confidence. Without banking the allowances expire with the end of each commitment period, meaning they are valid only a limited duration and after the expiration, at the end of the period, they become worthless.

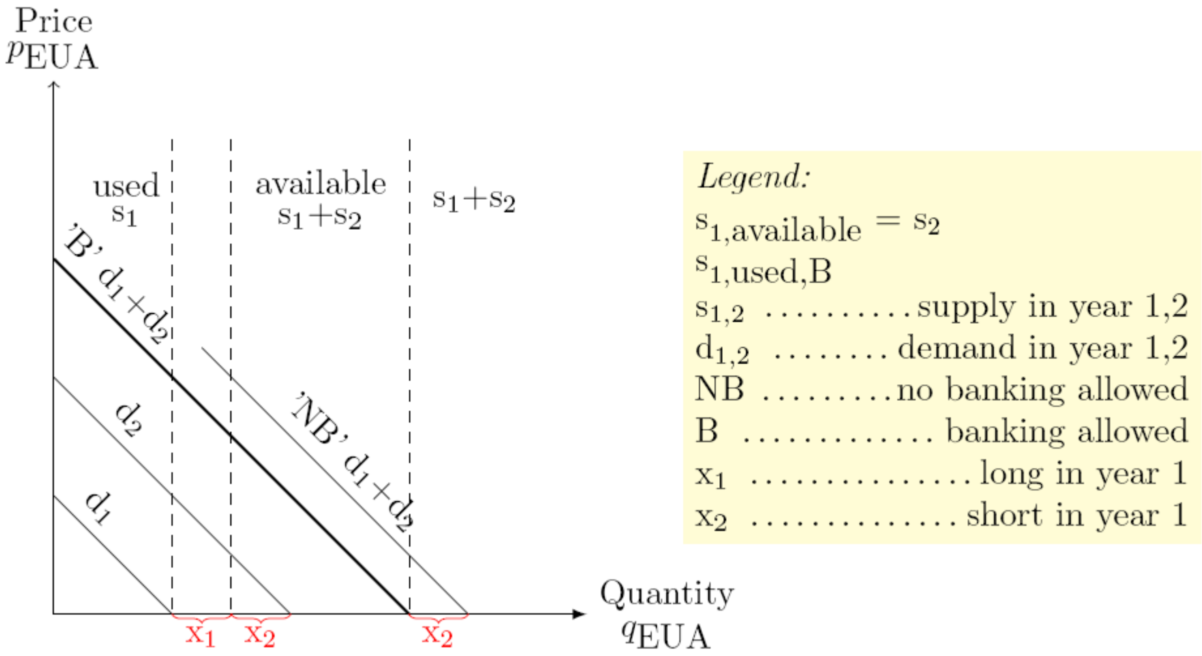


Figure 18 Banking

Figure 18 visualizes banking.

Looking at two years we have two individual supply curves, s_1 and s_2. This is the amount of credits available in the market each year.

Assume the demand in year 1, d_1, is lower than s_1 (e.g. due to cheap abatement options), i.e. the market is long (x_1).

In the case of banking only $s_{1,used}$ is emitted and the surplus (x_1) is saved for the second year.

In the case that banking is not allowed and the market is long the company has no incentive to invest in cheap abatement possibilities as it is still cheaper to emit. In that way, x_1 is not saved.

Assume now that in the second year the demand, d_2, doubles (e.g. due to economic growth). The supply, s_2, is the same as the year before and the market is short (x_2).

In the case of banking the aggregate supply of both years, s_{1+2}, suffices to meet the aggregate demand for both years, d_{1+2}. In the case of no banking the market is short (x_2).

Banking and borrowing between Phase I and Phase II was principally allowed, but for each Member State to decide. It was prohibited in all Member States apart from

France and Poland that allowed for restricted banking from 2007 to 2008, even though the European Commission did not prohibit banking explicitly from Phase I to Phase II. But the Commission left the Member States no real incentive to allow this measure. The banked amount had to be deducted from the 2008-2012 target, reducing the cap for Phase II, because Phase I was a learning phase, while Phase II is the Kyoto compliance phase. The reason for this is that banked allowances obviously increase the total number of allowances available during the Kyoto phase. If the market is flooded with allowances from the previous phase, reaching the Kyoto targets is jeopardized. For this reason I find the prohibition of banking in this special case very reasonable. By not allowing allowances from the earlier phase enter the Kyoto phase, it was stipulated very clearly that the "trial phase" was over. The companies had their chance to adapt and to get accustomed to the new situation, whether they made use of this possibility or not. Now, in Phase II, the learning-by-doing is over. The consequences of the mistakes that were made during Phase I (overallocation, problems with the registries, etc.) are swept away. Only the experience gained remains. It is a new beginning. From March 2007 on the price for Phase I EUAs was little above EUR 0 and in the end the market was long. Letting these excess allowances enter the Phase II market would have been very questionable. Of course one can argue that the price would never have decreased so sharply, but still I believe the prohibition was justified for the sake of the Kyoto targets.

Banking is allowed from Phase II to Phase III. This will reduce price fluctuations that occur due to the ending of one trading phase. Trotignon and Ellerman found that the "timing of the volume of compliance trading […] provides strong evidence that operators have engaged in borrowing [during Phase I]" and that "whether intended or not, borrowing to meet 2005 and 2006 compliance requirements turned out to be a very profitable move by those engaging in it. It was nevertheless a speculation on future EUA prices, especially for the 2005 compliance year when EUA prices were hitting all time highs shortly before the April 2006 surrender deadline and at least some analysts were predicting still higher prices to come." (Trotignon and Ellerman 2008)

4.5.5 Economic Growth and Expected Emissions

Forecasts of the GDP rates affect the permit prices. In case of optimistic projections, existing installations are expected to emit more, as they are expected to produce more. New installations will start to emit as they start their productions. With increasing output, the demand for energy rises, as do emissions. The growth rates are included in the allocation formula and may have been one reason for the overallocation of permits in 2005. Economic growth has an upward effect on the prices of EUAs. With expected economic growth, the expected emissions increase, due to the higher production level. This causes an increase in demand for EUAs. Vice versa it can be said that in times of declining economic growth, when companies produce less and thus emit less, they are in need of fewer allowances for themselves. Should they then try to sell their excess allowances in the market; the prices will – in theory – be low, with reduced demand and increased supply. This can presently be seen. Due to the economic slowdown there has been a price drop for Phase II EUAs.

4.5.6 Climate Conditions and Temperature

Do weather extremes have an influence on the price of CO_2 allowances? Since a considerable share of the installations covered in the EU ETS are in the heat and power sectors, it is plausible, that the weather does play a role. The summer of 2005 was above-average hot and the winters of 2004/2005 and 2005/2006 were below-average cold. Did the weather influence the price of EUAs? Different studies have dealt with this question.

The idea behind this assumption is that extreme weather conditions lead to abnormally high energy use. On extremely cold days, energy consumption increases due to increased use of heating. On extremely hot days, energy consumption increases due to increased use of cooling, such as air conditioning. Mansanet-Bataller et al. confirm this assumption in their study. “The impact of these variables on the CO_2 returns is positive, which means that the prices of CO_2 increase with extremely hot and cold days.” (Mansanet-Bataller et al. 2006) In a study on the price fundamentals of EUAs Alberola et al. found that “forecasting errors on temperatures seem to matter more than temperatures themselves during extremely cold events when one tests for the influence of climatic events on CO_2 price changes” and point out “that these concluding remarks only hold for extremely cold days and not for extremely hot days.” (Alberola et al. 2008b)

Apart from weather extremes it seems reasonable to assume, that wind and rainfall can have an influence on the EUA prices as well, since they give the possibility of substitution to renewable energy production. Mansanet-Bataller et al. tried to find a connection between the price of EUAs and rainfall, stipulating that dry days would increase the price, while rainy days would lower the price, due to the given substitution possibility through hydro energy, which is cleaner and would thus lower the amount of needed permits. The results show that “the rainy days and the dry days do not have significant influence on the CO_2 returns.” (Mansanet-Bataller et al. 2006)

4.6 Price Volatility

Lack of maturity of the EU ETS market caused the high volatility of the CO_2 prices in Phase I. Firstly, new markets require a certain time for their real price discoveries. Secondly, the high level of uncertainty on different aspects of the market has a negative effect on the investment decisions. Volatility is considered in investment calculations and makes decision making for long-term investment difficult. High volatility reduces confidence in the market. Still, it is not uncommon and no reason to call the whole EU ETS a failure. Stern writes that “in the US market for tradable sulphur dioxide allowances, which originated in the late 1980s, it took several years for prices to stabilise, with the price for an avoided tonne of SO_2 fluctuating from lows of $70 to highs of $1,550. Over time, players became accustomed to the system, policy rules became clearer and financial intermediaries entered the picture, all of which contributed to greater price transparency. Once a degree of certainty emerged, the SO_2 markets took off, with emissions declining strongly over time.” (Stern 2009, p.107)

In the case of the EU ETS the price volatility can be seen in Figure 18. The yellow line shows the price for Phase I EUAs.

Figure 18 Prices of EUAs and traded volumes 2005-present[34]

4.6.1 2005

The lack of transparency on the actual volume of trading and the scarce data on verified emissions and emission allowances, caused high volatility. The sudden development of the skyrocketing oil price had a negative effect on the EUAs, since it in turn affected the gas price, which in turn became less attractive than coal, which requires more EUAs. Figure 19 shows the volumes and prices for EUAs during the first year of the EU ETS.

In January 2005 the power sector, foreseeing a shortage almost instantly started buying allowances; only projections were available, no verified emission data. Other participants in the market, especially those who later turned out to be long, were not willing to sell their surplus allowances quite yet, either due to lack of information on actual emissions (wait-and-see attitude) or because they saw no incentive to participate in the market, having sufficient EUAs themselves and no motivation to generate profits by selling surplus allowances. Thus, with a high demand and little willingness to sell, the price soared up. Mainly Eastern European companies had long positions. These companies, unfortunately, could not participate in the market, as they faced problems with the provision of their national registries.

[34]Taken from the Point Carbon Homepage 2009

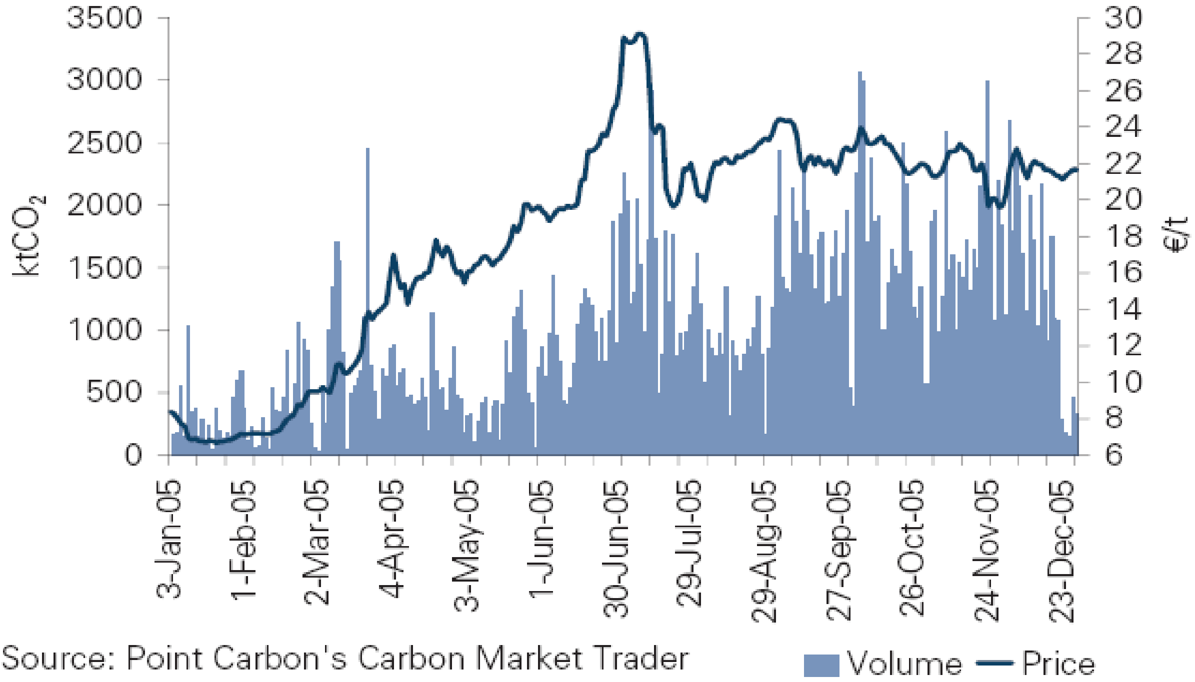


Figure 19 Volumes and prices in 2005[35]

Another reason for the high prices is, that the winter of 2005 was below-average cold and that gas prices reached a historical high. The demand for electricity was high, and along with it, the demand for EUAs.

After a steady increase in the first half of 2005, this led to a rather stable price for EUAs during the second half of the year.

Point Carbon "estimates that the international carbon market in 2005 transacted a total of 799 Mt CO_2-equivalents worth approximately € 9.400 million. […] In total, the brokered and exchanged market did 262 Mt CO_2, corresponding to €5.4 billion. Brokers did 79% of this volume, whereas the ECX was by far the largest exchange, with 63.4% of the exchanged volume." They argue that even though the value of the market increased by 2500% compared to 2004, "and now involves players in close to 150 countries, it is still early days. Traded volumes compared to the underlying volume are still far below what we can observe in other markets." (Point Carbon 2006a)

35 Taken from Point Carbon (2006a)

4.6.2 2006

In 2006 the traded volumes increased considerably as the deadline to surrender the EUAs for the first trading year inched closer, reaching a peak in April for the time being, as companies needed to acquire their missing EUAs. By April 30, 2006 the companies had to surrender their permits for the previous calendar year, 2005. The data would then nationally be aggregated and reported by the Member States to the European Commission that would publish the emissions data and the surrendered EUA information, in aggregated form, on May 15, 2006. Figure 20 shows the price development and the traded volumes of EUAs in the second year of the EU ETS.

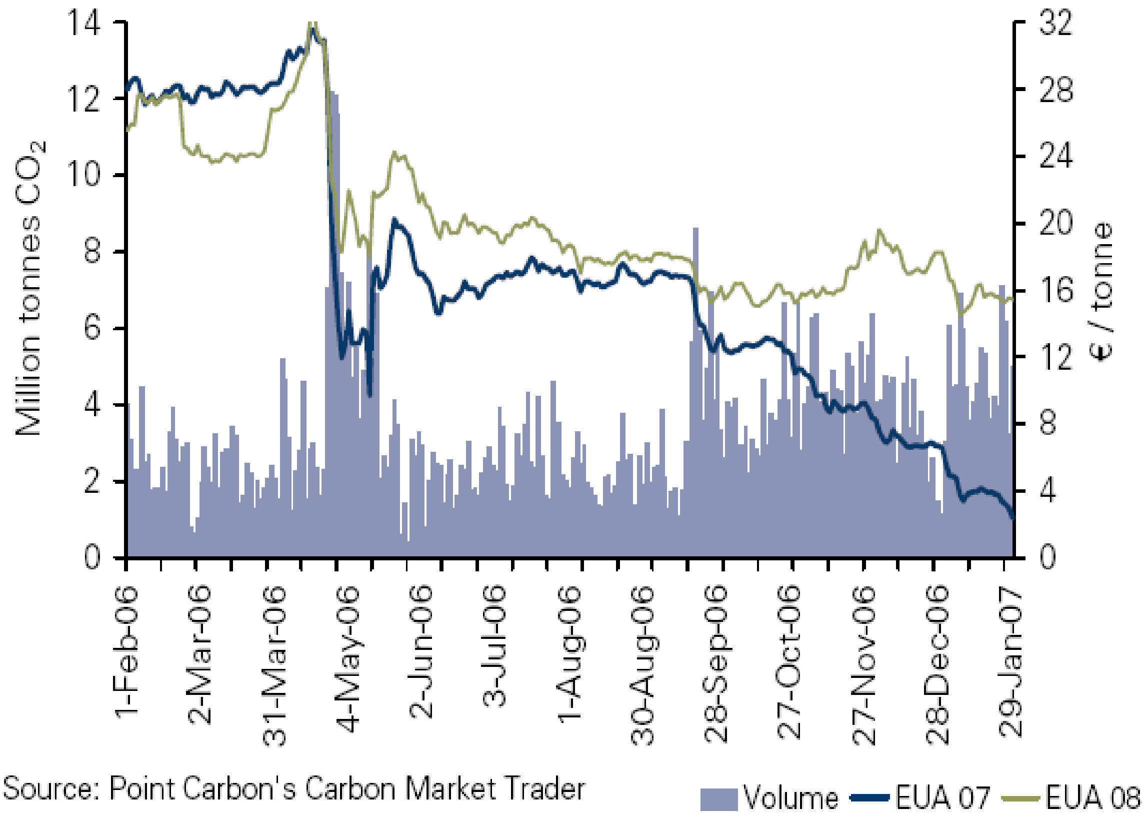


Figure 20 EUA Prices and traded volumes in 2006[36]

In the end of April, within a week, EUA prices soared down in a sudden drop from over EUR 30 to under EUR 10, because the verified emission data for the year

[36] Taken from Point Carbon (2007)

2005 had leaked into the market when several Member States officially pre-released their verified emission data. Convery and Redmond explain “between April 24 and May 2, five Member States (the Netherlands, Czech Republic, France, Sweden, and Belgium [Walloon Region]) released information showing that their overall 2005 position was long.” (Convery and Redmond 2007) As a consequence the European Commission asked the remaining Member States not to pre-release their emission data early, but the damage was done. On May 15, 2006 the European Commission officially released the verified emission data from all member states, except Cyprus, Luxemburg, Malta and Poland. It became clear that, instead of the anticipated deficit and scarcity reigning the market, there was a considerable over-allocation of emission allowances, with an allowance surplus of about 4.6 per cent. The participating sectors had emitted 63.3 million tonnes CO_2 less than they would have been allowed to emit. Only six countries (Austria, Italy, Ireland, Greece, Spain and the United Kingdom) were short of allowances.

On the whole, in 2006 the average prices were higher than expected. In 2005 the market was long, i.e. there were more emission allowances available than the verified emissions would have needed. The same was to be expected for the year 2006 and 2007; still the price did not decrease to zero just yet. After the drop, prices quickly recovered. They did not reach the April 2006-peak (ever again until the present), but stabilized at little over EUR 15 until September 2006.

One reason for the relatively high prices could be that the players, the active trading participants, had an incentive to keep the prices high. Depending on the price elasticity of customers, the companies can pass through their production costs. They receive the permits for free. On the market the permits can be sold at a certain price, the market price – which is in any case over zero (the price the permits were allocated for). This balance/difference gives the opportunity costs, which can be added to the initial price for the customers.

Oberndorfer analysed stock market effects of the EU ETS and the “results suggest that EUA price increases (decreases) positively (negatively) affect stock returns from the most important electricity corporations covered by the EU ETS. In this respect, the electricity corporations considered are up-valued in case of a EUA appreciation and down-valued in situations where the price of EU Emission Allowances falls." (Oberndorfer 2009)

Another reason for the high prices in 2006, as stated in a press release from Point Carbon, "is that there is a lack of sellers in the carbon market. While the market might be fundamentally oversupplied, primarily within the industry sectors, one has reasons to believe that the volumes have in general not been made available. The power sector, which has an immediate demand to cover its production, has had to purchase allowances at whatever the prevailing price has been." (Point Carbon 2006b)

In Figure 20 one can see that the traded volumes decreased to pre-April 2006 levels after the settlement of the first trading year. On the whole, the traded volumes increased steadily over time. The price for Phase II-EUAs followed the price for Phase I-EUAs closely until September 2006, when the Phase I-EUAs started to lose their value, while Phase II-EUAs climbed up again following a certain trend.

Point Carbon found "that the international carbon market in 2006 saw a total of 1.6 billion tonnes of carbon dioxide equivalent (CO_2e), worth approximately € 22.5 billion in transaction. […] In total, the brokered and exchanged market saw 817 Mt CO_2 changing hands, corresponding to € 14.6 billion. Brokers did 71 per cent of this volume, whereas the ECX took over 75 per cent of the volume carried on exchanges. […] the direct bilateral market (company-to-company, not through brokers or exchanges) doubled in size from 100 Mt in 2005 to 200 Mt in 2006, with a value of € 3.6 billion. The total volume in the EU ETS in 2006 was just over one billion tonnes CO_2, worth €18.1 billion." (Point Carbon 2007)

4.6.3 2007

Interestingly, the release of the verified emission data for 2006 in April 2007 had no effect on the EUA prices. The reason is that expectations for 2006 were based on verified emissions of the year before. Uncertainty on the actual magnitude of aggregate emissions was considerably lower than the year before. In September

2006 the price for Phase I EUAs started its steady decline from around EUR 15, to EUR 4 in January 2007, and close to EUR 0 by March 2007, where it remained throughout the year (Figure 18). The reason for this value is of course, that the verified emission data showed, that no shortage would occur. In combination with the prohibition to bank allowances, the EUAs for Phase I became worthless with the end of the trading period. - At that time the price of Phase II-EUAs was around EUR 25. Point Carbon estimated that the "EU ETS saw a traded volume in 2007 of 1.6 Gt [1 Gt = 1 billion tonnes] and a value of € 28 billion." (Point Carbon 2008)

4.7 Investment Decisions

In a trading scheme each company faces the question how to minimize its emission costs. Depending on different factors the objective and the constraints have to be differentiated. Looking at the possibility of whether or not linking and banking are allowed, four scenarios occur.

Assumptions:

- the only linking credits that can be used are CERs. The rules for ERUs are the same as for CERs though, thus the formulas could easily be amended to include ERUs.
- all companies to be price takers, i.e. we consider the market price for EUAs and CERs to be given.
- abatement costs are costs that occur through realizing investment possibilities that make an installation i "greener".
- selling of credits is not allowed. The players can only buy and use or buy and bank credits for themselves.

Table 11 lists the abbreviations used in the formulas.

Table 11 List of Abbreviations used in the formulas

List of Abbreviations, that are used in the formulas:

Abbreviation	Explanation	Unit
$d_{t,i}$	expected emissions of an installation i ("demand")	[t CO_2/year]
$i = 1 \dots I$	installations covered by the EU ETS	[-]
$p_{AC,t,i}$	expected abatement costs in an installation i at time t. $p_{AC,t,i} = f(y_{t,i}$ as every installation has an individual abatement cost function.	[€]
$p_{CER,t}$	expected market price of one unit CER at time t (assumption: companies are price takers).	[€]
$p_{EUA,t}$	expected market price of one unit EUA at time t (assumption: companies are price takers).	[€]
$q_{AC,t,i}$	maximum quantity of emissions that can be abated in an installation i. "abatement potential" of installation i	[t CO_2/year]
$q_{CER,t}$	available quantity of CERs on the market at time t ("supply")	[t CO_2/year]
$q_{EUA,t}$	available quantity of EUAs on the market at time t ("supply")	[t CO_2/year]
r_{MS}	maximum percentage of actual emissions that may be accounted for by using project based credits. Member states can set the percentage within agreed limits.	[-]
s	auxilary variable for a time period from $1 \leq s < t$.	[-]
$t = 1 \dots T$	duration of a trading phase.	[-]
$x_{t,i}$	quantity of EUAs bought and used in year t	[t CO_2/year]
$\overline{x}_{t,i}$	quantity of EUAs bought and banked in year t for use in year $t+1$	[t CO_2/year]
$\overline{x}_{t-1,i}$	quantity of EUAs bought and banked in year $t-1$ for use in year t	[t CO_2/year]
$y_{t,i}$	quantity of tons of CO_2 abated in year t	[t CO_2/year]
$z_{t,i}$	quantity of CERs bought and used in year t	[t CO_2/year]
$\overline{z}_{t,i}$	quantity of CERs bought and banked in year t for use in year $t+1$	[t CO_2/year]
$\overline{z}_{t-1,i}$	quantity of CERs bought and banked in year $t-1$ for use in year t	[t CO_2/year]

Table 12 Variable Explanation

	t=1	t=2	t=3
x, z	bought t_1 used t_1	bought t_2 used t_2	bought t_3 used t_3
overline x, z	bought/banked t_1 used t_2	bought/banked t_2 used t_3	bought/banked t_3 used t_4

Table 12 wants to give an overview of the variables x and z. Each column refers to the year in which the credits were bought. The first line are x and z which are bought and used in the same year. The second line are overline x and overline y, referring to the fact that they are bought in one year and used in the next.

4.7.1 No Linking No Banking

Objective

$$\sum_{i=1}^{I}\sum_{t=1}^{T}\left(x_{t,i} \times p_{\mathrm{EUA},t} + y_{t,i} \times p_{\mathrm{AC},t,i}\right) \rightarrow \min \tag{1}$$

Subject to

$$\sum_{i=1}^{I} x_{t,i} \leq q_{\mathrm{EUA},t} \quad \forall \quad t \tag{2}$$

$$\sum_{t=1}^{T} y_{t,i} \leq q_{\mathrm{AC},i} \quad \forall \quad i \tag{3}$$

$$x_{t,i} + y_{t,i} = d_{t,i} - \sum_{s=1}^{t} y_{s,i} \quad \forall \quad t,i \tag{4}$$

$$x_{t,i}, y_{t,i} \geq 0 \tag{5}$$

In the case that neither linking nor banking are allowed, each installation i has the objective (1). Each installation can choose between actual emission and emission abatement. As we assume that the companies are price takers, we consider the market price as given. The price for abatement differs from installation to installation. The total costs that occur are minimized. (2) is a quantity constraint, requiring that the total amount of emissions “paid for” in EUAs is not to be greater than the total supply of EUAs available in the market. As EUAs are valid only one year this constraint has to be applied each year separately. (3) is a constraint concerning the abatement quantity. It states that the amount of emissions that are saved through abatement over the years cannot be greater than the maximum possible abatement quantity, i.e. the total abatement potential, of each installation i. (4) requires that the total expected emissions are accounted for one way or the other, either through emission credits or through emission abatement. (5) is a simplification that prohibits the selling of the credits.

4.7.2 No Linking Yes Banking

Objective

$$\sum_{i=1}^{I}\left(x_{t=1,i} \times p_{\mathrm{EUA},t=1} + y_{t=1,i} \times p_{\mathrm{AC},t=1,i}\right) + \\ + \left[\sum_{i=1}^{I}\sum_{t=2}^{T}\left[x_{t,i} \times p_{\mathrm{EUA},t} + y_{t,i} \times p_{\mathrm{AC},t,i}\right] + \\ + \quad \overline{x}_{t-1,i} \times p_{\mathrm{EUA},t-1}\right] \quad \rightarrow \quad \min \qquad (6)$$

Subject to

$$\sum_{i=1}^{I}(x_{t,i} + \overline{x}_{t,i}) \quad \leq \quad q_{\mathrm{EUA},t} \qquad \forall \quad t \qquad (7)$$

$$\sum_{t=1}^{T} y_{t,i} \quad \leq \quad q_{\mathrm{AC},i} \qquad \forall \quad i \qquad (8)$$

$$\overline{x}_{t-1,i} + x_{t,i} + y_{t,i} \quad = \quad d_{t,i} - \sum_{s=1}^{t} y_{s,i} \qquad \forall \quad t,i \qquad (9)$$

$$\overline{x}_{0,i} \quad = \quad 0 \qquad (10)$$

$$\overline{x}_{t,i}, x_{t,i}, y_{t,i} \quad \geq \quad 0 \qquad (11)$$

In the case that linking is prohibited, while banking is allowed, the objective (6) looks a bit different than in the “no linking no banking” case. In year 1 there are no banked credits from the year before that can be used. Thus, the installation faces the same decision as in the first scenario, to either pay for actual emissions by buying EUAs or to reduce its emissions through abatement. Starting from the second year, the installation can again decide between buying EUAs and reducing its emissions, or it can use the EUAs it banked in the year before. On the whole each installation will want to minimize its total costs. If a company believes that the price for EUAs will increase it may decide to buy credits in the present year for the next year by banking these credits. Constraint (7) states that the total number of EUAs bought in year t (independent of whether they are used in the same year or banked for the next year) cannot exceed the total available amount of EUAs in the market in the same year. (8) is the same as (3), limiting the abatement quantity. It states that the amount of emissions that are saved by an installation through abatement over the years cannot be greater than the total abatement potential of that installation. (9) states that the used credits (the ones that were banked from the year before and the ones that were bought this year) and the year t's abated emission quantity has to be equal to the installation's total expected emissions minus the emission reductions that were made in previous years (as these emission reductions are made in one year but also lower the emissions for years to come). This constraint is valid for all years t and all installations i. (10) stipulates that in the first year there are no banked credits from the year before. (11), like (5), prohibits the selling of credits.

4.7.3 Yes Linking No Banking

Objective

$$\sum_{i=1}^{I}\sum_{t=1}^{T}\left[x_{t,i} \times p_{\mathrm{EUA},t} + y_{t,i} \times p_{\mathrm{AC},t,i} + z_{t,i} \times p_{\mathrm{CER},t}\right] \to \min \qquad (12)$$

Subject to

$$\sum_{i=1}^{I} x_{t,i} \leq q_{\mathrm{EUA},t} \qquad \forall \quad t \qquad (13)$$

$$\sum_{t=1}^{T} y_{t,i} \leq q_{\mathrm{AC},t,i} \qquad \forall \quad i \qquad (14)$$

$$\sum_{i=1}^{I} z_{t,i} \leq q_{\mathrm{CER},t} \qquad \forall \quad t \qquad (15)$$

$$z_{t,i} \leq r_{\mathrm{MS}} \times \left(d_{t,i} - \sum_{s=1}^{t} y_{s,i}\right) \qquad \forall \quad t, i \qquad (16)$$

$$x_{t,i} + y_{t,i} + z_{t,i} = d_{t,i} - \sum_{s=1}^{t} y_{s,i} \qquad \forall \quad t, i \qquad (17)$$

$$x_{t,i}, y_{t,i}, z_{t,i} \geq 0 \qquad (18)$$

In the case that linking is allowed and banking is prohibited, the objective function (12) looks like (1) but has to be extended for the newly opened possibility of “paying” for the emissions with CERs. (13) and (14) are quantity constraints as before, limiting the supply of EUAs and the maximum possible abatement quantity. (15) restricts the total quantity of CERs, requiring that the amount of emissions “paid for” in CERs is not to be greater than the total supply of CERs available in the market. (16) limits the amount of CERs that may be used by an installation, by stating that the emission quantity paid for in CERs, must not exceed a certain percentage – which is up to each Member State to decide and stated in the NAP of the Member State – of the installation’s actual emissions in a year t. (17) requires that the total expected emissions are accounted for either through emission credits (EUAs, CERs) or through emission abatement. (18) is again a simplification that prohibits the selling of the credits.

4.7.4 Yes Linking Yes Banking

Objective

$$\sum_{i=1}^{I}\left(x_{t=1,i} \times p_{\mathrm{EUA},t=1} + y_{t=1,i} \times p_{\mathrm{AC},t=1,i} + z_{t=1,i} \times p_{\mathrm{CER},t=1}\right) +$$

$$+ \left[\sum_{i=1}^{I}\sum_{t=2}^{T}\left[x_{t,i} \times p_{\mathrm{EUA},t} + y_{t,i} \times p_{\mathrm{AC},t,i} + z_{t=1,i} \times p_{\mathrm{CER},t}\right] + \right. \tag{19}$$

$$\left. + \quad \overline{x}_{t-1,i} \times p_{\mathrm{EUA},t-1} + \overline{z}_{t-1,i} \times p_{\mathrm{CER},t-1}\right] \quad \rightarrow \quad \min$$

Subject to

$$\sum_{i=1}^{I}(x_{t,i} + \overline{x}_{t,i}) \leq q_{\mathrm{EUA},t} \quad \forall \quad t \tag{20}$$

$$\sum_{t=1}^{T} y_{t,i} \leq q_{\mathrm{AC},i} \quad \forall \quad i \tag{21}$$

$$\sum_{i=1}^{I}(z_{t,i} + \overline{z}_{t,i}) \leq q_{\mathrm{CER},t} \quad \forall \quad t \tag{22}$$

$$z_{t,i} + \overline{z}_{t-1,i} \leq r_{\mathrm{MS}} \times \left(d_{t,i} - \sum_{s=1}^{t} y_{s,i}\right) \quad \forall \quad t,i \tag{23}$$

$$\overline{x}_{t-1,i} + \overline{z}_{t-1,i} + x_{t,i} + y_{t,i} + z_{t,i} = d_{t,i} - \sum_{s=1}^{t} y_{s,i} \quad \forall \quad t,i \tag{24}$$

$$\overline{x}_{0,i}, \overline{z}_{0,i} = 0 \tag{25}$$

$$\overline{x}_{t,i}, \overline{z}_{t,i}, x_{t,i}, y_{t,i}, z_{t,i} \geq 0 \tag{26}$$

In the case that linking as well as banking are allowed the objective (19) looks similar to (6) but it is extended with the project based credits. In year 1 there are no banked credits from the year before that can be used. Thus, the installation's decision is to either pay for actual emissions (using EUAs or CERs) or to reduce its emissions. Starting from the second year, the installation can again decide between buying emission credits (EUAs or CERs) and reducing its emissions. Additionally it can use EUAs or CERs it banked the year before. On the whole, each installation will want to minimize its total costs, as before. Constraint (20), like (7), states that the total number of EUAs bought in year t (independent of whether they are used in the same year or banked for the next year) cannot exceed the total available amount of EUAs in that year. (21) limits the possible abatement quantity, depending on the installation's total abatement potential. (22) states that the total number of CERs bought in year t (independent of whether they are used in the same year or banked for the next year) cannot exceed the total available amount of CERs in that year. (23) limits the total amount of CERs (banked from the previous year or bought that very year) that may be used by an installation to "pay" for emissions in a year t, by stating that the emission quantity paid for in CERs, must not exceed a certain percentage of the installation's actual emissions in a year t. (24) states that the sum of all used emission credits (the ones that were banked from the year before and the ones that were bought this year) and the abated quantity has to be equal to the installation's total expected emissions minus the emission reductions that were made in previous years but still have an effect in year t. This constraint is valid for all years t and all installations i. (25) states that in year 1 no banked credits from the year before are available. (26) prohibits the selling of credits.

5 Problems of the ETS

5.1 (Over)Allocation and a Lack of Transparency

As mentioned above there was an overall surplus of emission certificates on the market during Phase I. There are two possible explanations for this: Either, the EU ETS was such a success that many installations switched to cleaner fuels. Or (which is regarded to be the more likely option), there was an overallocation of EUAs. Whatever the reason, observers agree, that if not for the lack of emission data, the credit surplus would have been prevented (at least to some extent).

One of the huge advantages of having a learning phase, such as Phase I, is the possibility to gain more reliable emission data on the level required. For the assessment of the NAPs for Phase II the European Commission used the verified emission reports of the year 2005 that were published in April 2006. As already mentioned, these data of the emissions became the new baseline for the future cap setting processes of the European Commission.

The problem with overallocation is that no reasonable price will form. If everybody has sufficient allowances, why spend money on abatement? Stern argues that to "hold concentrations below 500ppm [parts per million] CO_2e successfully, an approximate 30 Gt [1 Gt = 1 billion tonnes] cut in annual flows is necessary by 2030. In a well-functioning market this would require a price of around € 40 per tonne of CO_2e […]. The current price on the EU ETS (summer 2008), the beginning of Phase 2 of the scheme, covering the period 2008-12, is around € 25. As ambitions are tightened and we move into Phase 3 (2012-20), a price in the region of, or higher than, € 40 per tonne is quite likely." (Stern 2009, p. 105) Concerning the price drop in April 2006 due to the overallocation, Stern writes that there are "simple and clear lessons to be learned from this experience. Total allocation and the cuts they embody must be transparent and clear. And if prices are to drive substantial reductions, then these reductions must be embodied in the allocations. In other words, if allocations of rights to emit are too high, then reductions in emissions and prices will both be too low – pretty basic economics." (Stern 2009, p.108)

It is often criticised, that the allocation process in Phase I was characterized by a dearth of transparency. It is argued that the information used by the Member States for the development of their NAPs was more of a guess than verifiable data. Since the governments had no choice but to include the affected industries in the dialogues concerning emission data and the industries had a strong interest to obtain as many (free) EUAs as possible, the overall overallocation was a consequence.

5.2 Windfall Profits

Windfall profits are profits companies make due to unpredictable, favourable changes and developments in the market. The industries receive their permits free of charge. Since they have a value above zero (all trading platforms require a minimum tick of at least EUR 0.01), the companies priced-in the certificates at their value, the market price.

Especially the energy producing sector, with its characteristic monopolistic structure, is able to use the low price elasticity of their consumers, by passing through the gained opportunity costs and thus increasing their profits. These profits are called windfall profits.

Price increases depend mainly on the elasticity of demand and the company's exposure to international competition. If the demand is highly elastic, i.e. very flexible, and if the company is exposed to international competition, the consumers will buy the offered product somewhere else, i.e. when one company increases its prices, the consumer will buy the product from a different company that offers the product cheaper. In this case the possibility of windfall profits is reduced.

Not only the ability to pass through costs has an influence on competition, also the opportunity to prevent and mitigate carbon emission plays an important role. If a company does not have abatement possibilities, it is more exposed to competition. Abatement refers to the reduction of greenhouse gas emissions, either in quantity or in intensity. The electricity industry is considered to be the big winner in this case due to their monopolistic structure of the market. "Electricity companies can pass through the costs of permits (so called opportunity costs in case of free allocation) to their electricity consumers and thus the higher the permit price and the higher the proportion of permits allocated for free, the higher the profits. Similarly, traders favour high prices since they receive a share of the transacted volume. In addition lower prices might have a negative impact on future allocations for 2008-2012, which are negotiated currently," Betz (2006) explained in 2006.

Ellerman states that "in the short-run, electricity demand is famously inelastic and it is not too much of an exaggeration to represent short-run demand as a vertical line that moves back and forth along an upward-sloping supply or dispatch curve, according to temperature, time of day and other vagaries of electricity demand." (Ellerman 2006) Grubb and Neuhoff estimate that "in countries with liberalized power markets, generators have passed through most of the opportunity costs, as expected, with aggregate profits totalling billions of euros." (Grubb and Neuhoff 2006) Sijm et al. calculated that empirical and model findings showed that "with confidence of about 80 percent, we can say that these [CO_2 cost pass through] rates are within the interval of 60 and 117 percent [for wholesale power markets] in Germany and between 64 and 81 percent in the Netherlands [in the years 2005 and 2006]." But one must not forget, that "besides the CO_2 cost pass through the rising peak and load prices in the Netherlands over this period [January to September 2005] – from about 52 to 80 €/MWh – are largely due to other factors, especially the rising gas prices." They conclude, that "looking at the overall picture […] market participants in Germany have fully passed through the opportunity costs of CO_2 allowances in the spot market," leading to windfall profits between €5.3 and 7.7 billion. (Sijm et al. 2006)

There have been discussions to establish governmental measures to reduce windfall profits by introducing e.g. a windfall profit tax, but up to now this has not happened. As soon as the free (grandfathering and benchmarking) allocation methods are history, so will the windfall profits, since the companies then have to buy their allowances on the market at the market price with no value transfer they can use as additional gain. These additional profits of the companies seem unfair towards the consumers, but Frondel et al. note that "price increases of electricity are even desirable from an economic and environmental perspective, as this induces consumers to reduce their demand for electricity." (Frondel et al. 2008) This view, that energy consumption prices should be higher, is shared by the IEA, which believes that "removing subsidies on energy consumption, which amounted to a staggering $310 billion in the 20 largest non-OECD countries in 2007, could make a major contribution to curbing demand and emission growths." (IEA 2008)

5.3 High Complexity and Low Harmonisation

In a Memo the European Commission calls the attention to the need for further harmonisation, as it argues that "besides underlining the need for verified data, experience so far has shown that greater harmonisation within the EU ETS is imperative to ensure that the EU achieves its emissions reductions objectives at least cost and with minimal competitive distortions. The need for more harmonisation is clearest with respect to how the cap on overall emission allowances is set." (European Commission 2008b) Since the European Commission offered guidelines for the development of the NAPs instead of rules, each country has its own way of allocating. This, it is argued, harms competition between the 27 Member States. There are no standardized rules on new entrants, transfers and closures. The high complexity of the different set of rules – not only between the Member States, but also within them – makes it difficult for all involved in the market.

A higher degree of harmonisation concerning the definitions of the installations and sectors covered by the scheme, as well as the allocation procedure would reduce the complexity of the scheme. This in turn would reduce the administrational costs of the authorities in charge. Lack of harmonisation across the Member States covered, also leads to competition distortions, as installations that fall under the EU ETS in one Member State, may not be obliged to participate in another. Ellerman and Joskow argue that harmonisation is difficult to achieve and “unlikely since differences in national circumstance, such as those between the West and East European member states, will likely lead to some differentiation of national burdens and resulting differences in allocations to individual installations.” (Ellerman and Joskow 2008)

5.4 High Transaction Costs

Participating operators are confronted with high transaction costs. These transaction costs are costs for monitoring, reporting and verification of emissions, registry fees, broker fees, administrational fees, and so on. The registry-related fees include an opening and a yearly maintenance fee, a fee for the allocation decision and a fee for the permit issuance and updating.

The Member States have freedom of choice regarding the level of charges and fees they impose for the use of the EU ETS. The revenues are used to recover the costs of the EU ETS. The EEA found that in 2007 “many Member States substantially increased the fees and charges for the use of the national registry” compared to the year before. (EEA 2008b) The participating companies thus not only have to deal with the costs for the actual EUAs as additional costs, but also with charges and fees for the use of the EU ETS. These charges and fees differ greatly between the Member States. Open Europe calculated the administrational costs and found, that especially compared to a tax, the administration of a trading scheme is very complicated and pricey. "The estimates in the UK Government's preliminary Regulatory Impact Assessment suggest that this administrative burden [additional costs for monitoring staff, compliance activities, emission verification costs,…] is costing firms and public sector bodies approximately £62 million [around EUR 91 million] a year in the UK." Open Europe concludes, that "even a back-of-the-envelope calculation suggests that the EU's ETS is far from being the most cost effective way to reduce net carbon emissions. Adding up simply the transfer cost and the administrative cost suggests a cost to the UK economy of £530 million [around EUR 779 million] a year (without including the knock-on costs of higher energy prices)." (Open Europe 2006)

Some Member States suggested rethinking the inclusion of small installations in the EU ETS, as those are especially exposed to the heavy burden of administrational costs for using the scheme, while not contributing to a significant emission reduction.

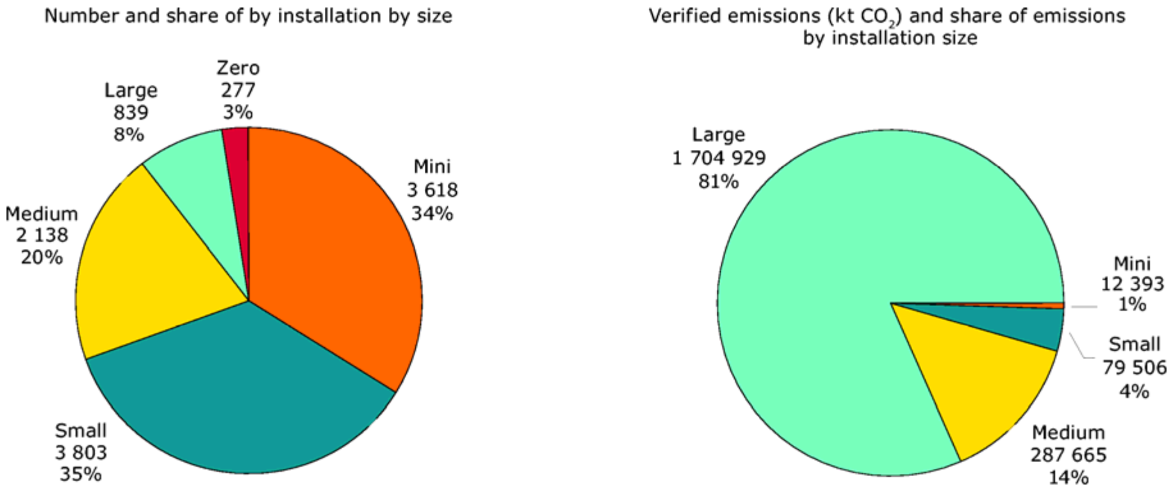


Figure 21 Share of number of installations and emissions by size of installation (kt CO_2), average 2005-2007[37]

[37] Taken from EEA Homepage 2009d

Figure 21 shows the share of number of installations and emissions by size of installation (kt CO_2 [1kt=1000t]), average 2005-2007. The installations are rated according to their emission outputs:

- zero: emitters with verified zero emissions
- mini: emitters below 500 tonnes CO_2/year
- small: emitters of 500 to 50.000 tonnes CO_2/year
- medium: emitters of 50.000 to 500.000 tonnes CO_2/year
- large: emitters over 500.000 tonnes CO_2/year

Lowering the threshold level of emissions to relieve small installations by excluding them from or giving them the possibility to opt-out of the trading scheme as a whole may be the wrong measure. This step would jeopardize the emission goals. It might be more preferable to apply lower administration tariffs for smaller installations or to develop a reimbursement system for installations under a certain threshold. Buchner et al. deal with the sensibility of the 20 MW threshold and find that “while the inclusion of small installations required more time and effort than would appear to be justified by their emission or abatement potential, the alternatives are not obvious. The problem with any size threshold is that it has the potential to create a competitive disadvantage for covered installations and a perverse incentive to downsize in order to avoid regulation. And the higher the threshold, the greater these problems are likely to be." (Buchner et al. 2006) - The European Commission has forbidden opt-outs starting from Phase II.

5.5 Short Trading Periods

Another problem is that the trading periods are regarded to be rather short. Phase I has a duration of three years (2005-2007) and Phase II has a duration of five years (2008-2012). For investment decisions this is considered to be very short, when the EUA are seen as an asset of the company, especially in the industries that participate in the trading scheme. The European Commission is against an expansion of the trading periods to at least a decade, as suggested by the industries. It maintains that an expansion would lead to a stand-still of climate change policies because all action against climate change would be postponed to the end of the trading period. Lessons and experiences would have to wait accordingly longer. Due to the tight deadlines of the Kyoto targets this is unacceptable for Phase I and Phase II. As for Phase III, the European Commission wants to encourage long-term emission reductions, and thus proposed that the subsequent Phase, Phase III, will run for eight years, 2013-2020.

5.6 Narrow Scope

The inclusion of further greenhouse gases and sectors covered by the scheme are frequently discussed. Especially the inclusion of transportation and civil aviation, two sectors that are responsible for high percentages (about 18 per cent transportation, 2 per cent aviation of total EU-27 greenhouse gas emissions) of CO_2 emissions, with an increasing tendency, are only a question of time.

The European Commission's works on including aviation in the scheme, for instance, started in the end of 2005 (European Commission 2006c). Civil aviation will be included in the scheme by 2012. The "Aviation Directive" states that for the remainder of Phase II, the calendar year 2012, "the total quantity of allowances to be allocated to aircraft operators shall be equivalent to 97% of the historical emissions." (European Parliament 2008) This means that from January 1, 2012, all flights which arrive at or depart from airports in EU ETS participating countries will need EUAs to cover their emissions.

It is also proposed to include "installations undertaking the capture, transport and geological storage of greenhouse gases; CO_2 emissions from the petrochemicals, ammonia and aluminium sectors; nitrous oxide emissions from the production of nitric, adipic and glyoxylic acid; and perfluorocarbon emissions from aluminium production" from 2013. These measures would extend the coverage of EU's total greenhouse gas emissions from 40 per cent to 43 per cent. (European Commission 2008a)

5.7 State Aid

The low degree of harmonisation (different allocation methods used, the different definitions of who is to participate in the scheme, the different allocation rules, etc.) automatically leads to competition distortions, which can be seen as state aid. Criterion 5 of Annex III of the “Emission Directive” prohibits state aid, as it declares that the NAP “shall not discriminate between companies and sectors in such a way as to unduly favour certain undertakings or activities in accordance with the requirements of the [European Community] Treaty, in particular Articles 87 and 88 thereof.” In Article 87(1) of the European Community Treaty state aid is prohibited: “Save as otherwise provided in this Treaty, any aid granted by a Member State or through State resources in any form whatsoever which distorts or threatens to distort competition by favouring certain undertakings or the production of certain goods shall, in so far as it affects trade between Member States, be incompatible with the common market.” Article 87(3)c makes an exemption to the state aid rules concerning environmental aid. If “the development of certain activities [is facilitated] without affecting trading conditions to an extent contrary to the common interest” the exemption is allowed. What exactly is meant by that has to be decided individually for each case. The “Guidance Paper”, published in 2004, does not clarify what has to be considered, but just provides a curt: “normal state aid rules will apply,” when dealing with the subject. In 2005 the European Commission illustrated in a Communication that “state aid should only be used when it is an appropriate instrument for meeting a well defined objective when it creates the right incentives, is proportionate and when it distorts competition to the least possible extent. For that reason, appreciating the compatibility of state aid is fundamentally about balancing the negative effects of aid on competition with its positive effects in terms of common interest.” (European Commission 2005c) De Sepibus offers a detailed analysis on this topic and sums up: “The Commission’s assessment of the NAPs with respect to the rules on State aid is, without doubt, unsatisfactory. Poorly reasoned and stressing the provisional character of its decisions, the Commission’s practice upset many stakeholders.” (de Sepibus 2007b)

5.8 *Hot Air*

Many Eastern European countries offer very cheap abatement possibilities. The reason is that today these countries are below their Kyoto target due to their economic collapse in the 1990s that occurred after the fall of the Soviet empire. They now have many surplus emission allowances they can sell, since they do not need them for themselves, so-called “hot air”. If these hot-air-permits enter the market, they will drive down the price and jeopardize the functionality of the system, since scarcity is a necessity for the price to stay at a level that promotes mitigation. Duerr explains hot air as “ironic expression for emission allowances from countries considered over equipped with emission rights. This is because the national emissions of all Annex B countries under the Kyoto Protocol were calculated based on 1990 levels. When the Eastern European economies collapsed in the 1990s, their emission levels dropped sharply. As a result, many of these countries hold a considerable surplus of emission rights. Russia and Ukraine, in particular, hold hundreds of millions of unused emission allowances. Fears abound that if these countries put their rights on certificate markets, supply would vastly outnumber demand and result in a price crash for emission certificates. This would severely damage the emission trading system as it works only under the assumption of scarcity.” (Duerr 2007)

6 Summary

On January 1, 2005 the EU ETS was launched. It is a multinational emission trading system helping participating countries to reach their Kyoto targets. The first three years after its implementation was Phase I, a learning phase offering a trial-and-error approach for the following compliance period. Despite its weaknesses and the many obstacles and problems along the path from development to realization, most critics agreed that it is a success. Buchner et al. state “within less than five years, the EU ETS evolved from being an innovative but controversial idea to an indispensable instrument of European climate change policy.” (Buchner et al. 2007) Ellerman and Joskow have praise for the EU ETS that ”has evolved from being an engaging possibility in the 2000 Green Paper to being what is now regularly characterized as the flagship of the European Climate Change Program.” (Ellerman and Joskow 2008)

When the idea of a cap-and-trade system with cost-free allowance allocation first arose, opponents claimed that taxes were better measures, as they are direct costs per emitted unit, while the EU ETS gave heavily air polluting companies permission to emit. When the “Emission Directive” was issued, it was criticised, that the scheme did not limit, “cap”, the total amount of allowances it would grant, but that the Member States had to make sure for themselves to move within the limits the criteria in Annex III of the “Emission Directive” set. As a consequence, the “Emission Directive” was amended for future trading phases. In a Memo the European Commission writes that the final text of the amended “Emission Directive” differed a bit from the proposal. Nevertheless, had the "climate and energy trends agreed by the 2007 Spring European Council been maintained and the overall architecture of the Commission's proposal on the EU ETS remains intact. That is to say that there will be one EU-wide cap on the number of emission allowances and this cap will decrease annually along a linear trend line, which will continue beyond the end of the third trading periods (2013-2020)." (European Commission 2008b)

An often discussed topic is the sensibility of the prohibition of banking, the saving of emission credits for the future, during Phase I. While it did have a negative effect on price stability (as the credits became worthless with the termination of the trading period), I believe that in the case of the EU ETS it was justified. Due to the lack of verified emission data, the release of saved credits would have had a devastating effect on the current prices. According to several studies a price of EUR 40 per emission allowance would be needed to motivate abatement. With an already low market price, the increase in supply (by letting unused credits from the former phase enter the market), would have forced down the prices even further.

One of the main topics found in the literature on Phase I is the lack of data and experience that caused uncertainty among the players, resulting in high price volatility and (in the beginning) reserved market participation. Accessibility of information has an influence on the efficiency of the market and the Member States had to cope with many imponderables. The allocation process was full of unanswered questions concerning the rules of the system and irregularities that were only intensified by the tight deadlines. But I believe that exactly these tight deadlines brought the necessary impetus for action.

Without a doubt there are many controversial points and the EU ETS still has an optimisation potential, but on the whole I believe that the challenge of getting a trading system of its size up and running in such a short time period, should not be underestimated. After many years of consulting and evaluating, something is finally being done. A fact the IEA (2008) acknowledges, as it writes: ”It is within the power of all governments, of producing and consuming countries alike, acting alone or together, to steer the world towards a cleaner, cleverer and more competitive energy system. Time is running out and the time to act is now.”

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Annex

Deutsche Zusammenfassung

Am ersten Jänner 2005 wurde der Handel mit Emissionszertifikaten begonnen. Es handelt sich um ein multinationales System das den am Emissionshandel teilnehmenden Staaten helfen soll, ihre Kyoto-Verpflichtungen zu erfüllen. Die ersten drei Jahre nach der Implementation war Phase I, eine Lernphase zu Versuchszwecken für die folgende Verpflichtungsphase. Trotz seiner Schwächen und der zahlreichen Herausforderungen und Probleme im Lauf von der Entwicklung zur Realisierung sind sich die meisten Kritiker, dass es ein Erfolg geworden ist.. Buchner et al. sagen “innerhalb von weniger als fünf Jahren hat sich der Emissions-Zertifikatehandel der EU von einer innovativen, aber kontroversiellen Idee zum einem unverzichtbaren Instrument der europäischen Klimapolitik entwickelt.” (Buchner et al. 2007) Ellerman und Joskow loben den Emissions-Zertifikatehandel der EU mit den Worten, als ”.. hat sich von einer ambitionierten Möglichkeit im Green Paper des Jahres 2000 zum Flaggschiff der europäischen Klimapolitik entwickelt.” (Ellerman and Joskow 2008)

Als die Idee eines Cap-and-Trade Systems mit kostenlosen Emissionsquoten erstmals vorgestellt wurde, haben seine Gegner Emissionssteuern als die bessere Maßnahme erachtet, weil diese direkte Kosten pro Emissionsmenge wären, während die Emissionszertifikate Unternehmen mit großen Emissionen diese Emissionen de facto zugestehen. Als die Emissionsdirektive in Kraft trat wurde kritisiert, dass sie die zugestandenen Emissionen nicht limitierte (“cap”), sondern den Mitgliedsstaaten Freiheiten bei der Festsetzung der Limits im Rahmen der Grenzen des Annex III der Emissionsdirektive einräumte. In der Folge wurde die Emissionsdirektive für künftige Handelsperioden erweitert. Ein Memo der Europäischen Kommission besagt, dass der endgültige Text der erweiterten Emissionsdirektive vom ursprünglichen Vorschlag ein wenig abgewichen war. Trotzdem seien die Klima- und Energietrends, die in der Frühlingssitzung 2007 des Europäischen Rates festgelegt wurden, und das gesamte Konzept des Vorschlages der Kommission zur Emissionsdirektive erhalten geblieben. Das heißt es wird eine europaweit gültige Limitierung der Emissionsquoten geben und das Limit wird bis über das Ende des dritten Handelszeitraumes (2013-2020) hinaus jährlich einem linearen Trend folgend reduziert. (European Commission 2008b)

Ein häufig diskutiertes Thema ist das Verbot des Bankings, d.h. das Ansparen von Emissionszertifikaten in Phase I für spätere Perioden. Zwar hatte das Verbot einen negativen Effekt auf die Preisstabilität, weil die Zertifikate am Ende der Handelsperiode wertlos wurden. Meines Erachtens ist diese Haltung im Falle des Emissionshandels gerechtfertigt. Wegen dem Mangel an verifizierbaren Emissionsdaten hätte die Ausgabe von angesparten Zertifikaten zu einem Preisverfall geführt. Auf Grundlage mehrerer Studien wäre ein Preis von EUR 40 pro Emissionseinheit notwendig gewesen, um eine Reduzierung der Emissionen zu motivieren. Bei einem bereits anfänglich niedrigen Marktpreis wäre durch die Erhöhung des Angebots durch die Akzeptanz von ungenutzten Quoten aus früheren Perioden der Preis weiter verfallen.

Eines der bestimmenden Themen in der Fachliteratur ist, dass in Phase I mangelnde Erfahrung und fehlende Datengrundlagen zu Unsicherheiten bei den Marktteilnehmern geführt haben, die zu einer hohen Volatilität des Preises und zur Zurückhaltung bei der Teilnahme am Markt geführt haben. Der Zugang zu Informationen hat die Effizienz des Marktes beeinflusst und die Mitgliedsstaaten hatten mit Unwägbarkeiten umzugehen. Viele Fragen über die Regen der Verteilung der Zertifikate waren unbeantwortet und Inkonsistenzen wurden durch die eng gesetzten Termine verstärkt. Ich bin aber überzeugt, dass gerade dieser Termindruck die Sache vorangetrieben hat.

Zweifellos sind viele Aspekte des Europäischen Handels mit Emissionszertifikaten kontroversiell und das gesamte System kann noch vielfach optimiert werden. Dennoch muss anerkannt werden, dass ein System von beachtlicher Größe in sehr kurzer Zeit auf die Beine gestellt worden ist. Nach vielen Jahren der Beratung und der Bewertung wurde endlich Initiative ergriffen. Dies betont auch die IEA (2008) wenn geschrieben wird: "Es liegt in der Macht der Regierungen, sowohl von produzierenden als auch konsumierenden Ländern, in Einzelaktivitäten oder in gemeinsamem Handeln, die Welt zu einem saubereren, klügeren und kompetitiveren Energieversorgungssystem zu leiten. Die Zeit wird knapp und es ist jetzt Zeit zu handeln.”

Lebenslauf

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