STUDY

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Climate change legislation and initiatives at EU level

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PROLOGUE

This study reviews the challenges for the EU in reducing greenhouse gas emissions (GHG). It does so by examining the most important policies at the EU level that are meant to achieve, or have a major impact on this objective. It evaluates current performance and puts forward options for reform in the post-2012 regime.

The study focuses on the key community instruments. From the review, we thus deliberately exclude more nationally oriented actions, as well as the global framework for reaching an agreement for the post-2012 regime, with three important exceptions:

- where national actions have important spillover effects in terms of the costs of dealing with climate change for other countries and the Community as a whole,
- where the distribution of powers between the Community and Member States implies that community instruments, including some already in place, are probably much less effective than improved action at the national level,
- where the international framework has important implications for the functioning of the key community instruments.

EXECUTIVE SUMMARY

All EU countries have agreed to reduce emission of greenhouse gases (GHG) by signing the Kyoto protocol. The overall commitment corresponds to a reduction of 8 per cent from 1990 to 2012, though with different commitments between member states. Furthermore, the EU has agreed to make additional commitments after 2012: to unilaterally reduce emissions by 20 per cent relative to 1990 or 30 per cent if a binding, international agreement among main emitters can be reached.

The EU has already initiated a large number of initiatives in order to meet the 2012 target, but given current trends it is still unclear whether these initiatives will succeed in meeting the target. In addition, the EU must decide which initiatives to implement to meet the post 2012 target.

With these perspectives in mind, Copenhagen Economics has been asked to review current and prospective climate policy related initiatives and provide recommendations for future policies.

For policy actions already affecting the commitment period up to 2012, we underline the following three priorities; create a better functioning internal market for energy, take a more selective approach to regulatory energy standards, and use more market based mechanisms to reduce road transport emissions, all with the aim of improving the cost-effectiveness of climate policies.

A more efficient internal market for energy can provide significant and cost-effective CO_2 savings, in particularly by facilitating electricity trade through higher transmission capacity between member states and regions. First, it will boost competition between coal fired power plants leading to a faster replacement of plants with low energy efficiency. Second, it will increase the competitiveness of renewable energy with highly volatile production, e.g. wind and tidal energy as surplus (or deficit) energy is more easily exported to areas with lack of capacity. Third, more inclusion of imported renewable energy in national subsidy schemes could help meet targets for renewable energy at less costs.

A more selective approach to energy standards may also help the EU meet its targets with fewer costs to consumers. First, comprehensive use of labelling requirements as proposed in the EU's action plan on energy savings allows consumers to choose the most energy efficient products and hence reap cost savings and is to be recommended. Second, more care should be taken in imposing minimum efficiency standards. Most of these standards cover products that use energy produced by electricity and heating producers already covered by the EU's Emission Trading System (ETS) that effectively limits total CO_2 emissions from that sector to the level of allowances. In other words, minimum standards imposed on top, may undermine one of the clear advantages of the ETS, namely that cost-savings occur where they are most cost-effective. It is very difficult to ensure that tighter standards imply the same compliance costs across products for the same amount of energy saved. Our recommendation would be to focus the use on minimum efficiency standards for products using energy not produced from central power stations and for products where consumers have little incentive or possibility to act on labelling.

Market based instruments such as taxes are likely the most effective instrument to contain rising emissions from road transportation. This implies that road transport emissions are difficult to control at the EU level with tax instruments being very much in the national domain. Community efforts to promote biofuels and impose legally binding fuel efficiency standards for cars – the two main EU initiatives – are likely to be less cost-effective ways to reduce car emissions.

The former raises concerns about global effects on food prices and net effects on climate; the latter may end up being a highly complex and costly piece of regulation. To underpin more use of market based instruments, the upcoming review of energy taxes could be used to lift minimum rates on petrol and diesel. This will allow Member States to raise their fuel tax rates without seeing hauliers and consumers shifting their fuelling to other countries. Over time, this may present a stronger and more secure contribution to fuel efficiency. The relative merits and complementarities of the two approaches could be reviewed in more detail.

For the period post 2012, we stress two issues, the needed reform of the ETS and the challenges involved in distributing the target reductions among member states.

An improvement of the ETS is strongly recommended. First recommendation is to change the allocation mechanism. The overall amount of allowances is to be determined at EU, not national level, to ensure a more stringent overall allocation of allowances than in the first commitment period. Moreover, allowances should be largely auctioned. The present system of grandfathering allowances has generated substantial windfall profits for power generators. This could have been instead captured by governments and used to support priority goals. Second, energy intensive firms exposed to strong international competition could be assisted by special schemes to avoid these firms moving production and CO_2 emissions elsewhere as a response to higher energy costs. Third, we suggest that aviation, as already proposed by the EU commission as well as some other activities, could be included in the ETS. These recommendations are based upon inclusion criteria spelled out in the report

The distribution of target reductions will constitute a political challenge as in the previous commitment period. Based upon early studies, we suggest that the range of national targets for reductions could be narrower for the post 2012 period than for meeting the 2012 target. This reflects Member States becoming more alike with catching-up of income levels and more equal levels of emissions per capita. These are the criteria previously used to distribute target reductions. However, a key problem may arise from some countries being forced to go from allowed high, positive growth rates of emissions in the present commitment period to target reductions for emissions post 2012. This problem is compounded by some of the same countries already facing problems meeting the targets for the present commitment period. The willingness of some countries to accept higher relative reduction targets than suggested by objective criteria may as in the first commitment period help the EU meet an ambitious overall target reduction.

1. EU CLIMATE OBJECTIVES AND POLICIES

In the context of the Kyoto Protocol, the EU has committed itself to reduction of greenhouse gases (GHG) in 2012 from their 1990 levels to address the challenges of climate change. This agreement is to be renewed in 2012, and the EU Council has already signalled a commitment to further reductions after 2012.

In the sections below, we first describe the level of commitment in reducing greenhouse gases, and how the targets at the national levels were determined for the 1990-2012 commitment (1.1). Second, we measure progress so far in meeting commitments for the EU as a whole and assess whether 2012 targets can be meet (1.2). Third, we present an overview of the EU community policies that are meant to have a major influence of meeting the 2012 targets as well as present the key challenges for the EU post 2012 (1.3).

1.1 Commitment

The EU15 signed up collectively to the Kyoto protocol in 1999, promising to reduce GHG by 8 per cent from its 1990 level, measured as an average in the period 2008-2012. Prior to joining the EU, the EU12 countries have signed up to equivalent reductions; between 6-8 per cent.

The overall EU15 targets were translated into individual targets for each Member State with the target reductions determined by each Member State's relative level of income and energy efficiency as well as industry structure cf. Box 1. The twelve new members of the EU community committed themselves to reductions based upon the same economic logic.

Box 1. Distribution of the target reduction for the EU15 to the Member State level.

The distribution of the overall cut of 8 per cent was based upon two main inputs. First, it took into account objective country specific factors used in so-called Triptych approach. Countries with low relative per capita income and hence larger expected growth are facing fewer cuts in order not to impede their catching-up process with richer countries. Countries with low energy efficiency relative to income level will be facing relative larger cuts though with some allowance for the energy mix and industry structure. So if a country has a substantial share of renewable energy, it will be subjected to lesser cuts. In sum, a rich country with low energy efficiency based largely on fossil fuels will be facing the largest cuts. The group of 'rich but less green 'countries in table below falls largely into this group.

Group of countries	Triptych scenarios	Dutch 1997 proposal	Final agreement 1998
Rich and green:			
AU, DK, FI, DE, NL, SE	-30 to +26	-30 to 5	-21 to 4
Rich but less green:			
BE, FR, IT, LU, UK	-20 to -4	-40 to -10	-28 to 0
Poorer and least green:			
GR, ES, IE, PT	-2 to +21	5 to 15	13 to 25

Source: Ringius (1999), Sijm et al. (2007)

Second, when the Dutch presidency in 1997 presented its proposal it had also factored in more political elements. The 'rich and green' countries had self-imposed stringent climate targets implying a willingness to take a larger share of the overall cut. At the other end, the 'poor' countries were allowed less reductions than the original Triptych studies had suggested. A final agreement was reached in 1998. It respected the overall principle that 'green' countries are rewarded compared to 'less green' countries (less overall cuts).

Source: Ringius (1999), Sijm et al.(2007), EC (2006m) and Copenhagen Economics.

Acting on a proposal from the EU commission, the European Council committed itself in March 2007 to CO_2 reduction targets for the post-2012 period as well as for specific targets for renewable energy[1]. This post-2012 strategy is based upon two sets of options:

A strong, binding international agreement among the main emitting countries is reached. In this case the EU offers to reduce GHG with 30 per cent in 2020 from its 1990 level.

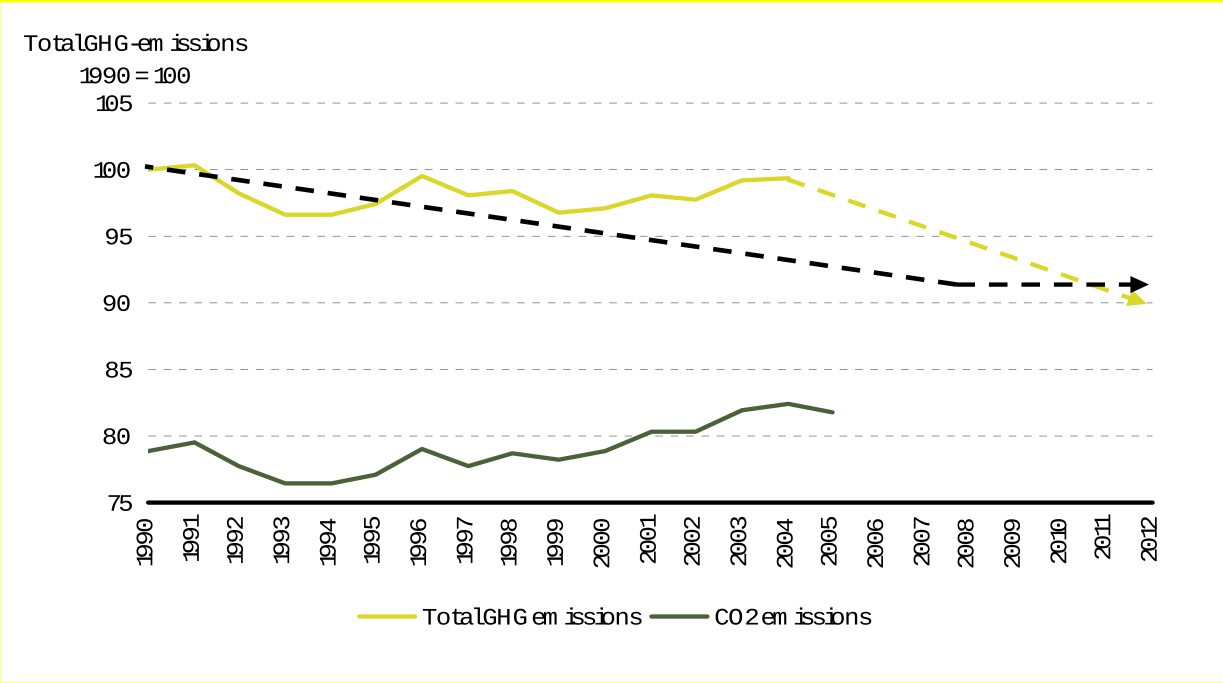
No such agreement is reached. In this case the EU will unilaterally commit itself to a reduction of 20 per cent over the same period.

The post 2012 target of minus 30 per cent are narrowly linked to estimations of what is required at the global level to avoid rises in the world temperature above 2 per cent compared to pre-industrial level[2]. The European Parliament has stressed the importance of the 2 degree Celsius objective, for example in the context of the Nairobi conference on climate change, and even indicated that this may already be too much of an increase[3]. This threshold is based upon climate models predicting significantly adverse impact if the temperate exceeds this level e.g. a melting of the Greenland ice cap.

1.2 Progress

As regards EU15 attainments so far, the total level of Green House Gases has barely moved from its 1990 level cf. Figure 1. For the last year on record 2005, emissions were just 1 per cent below 1990. This implies that future reductions need to be significant. Reaching the promised reduction of 8 per cent for the EU15 corresponds to an annual reduction of 1-2 per cent from 2005 to 2012.

Figure 1. Total GHG and CO_2 emissions by EU15, compared with the Kyoto-target.



Note: For the EU-15, the Kyoto target is an 8 per cent reduction in GHG emissions from 1990 to a 2008 – 2012 average.

Source: EEA(2006a).

[1] Council of the European Union (2007a)
[2] EC (2007b)
[3] EC (2007b)

The figure shows that CO_2 emissions have actually gone up since 1990 (non- CO_2 gases have fallen such that the total emissions of GHG are down by one per cent in 2005). As a result, CO_2 emissions now account for 82-83 per cent of total greenhouse gases against less than 80 per cent in 1990.

The reductions relative to targets have been highly uneven across Member States. A relatively small group of countries (Spain, Portugal, Ireland and Austria) accounting for 12 per cent of the total EU15 emission target, were far behind schedule in 2003, cf. Table 1. At the other end, the new Member States were far ahead schedule.

Table 1. Progress for Member States.

Land group	Progress in 2003 compared to the 2012 target	Share of the 2012 CO_2 target (per cent)
Finland, Portugal, Austria, Spain	Far behind	12
Italy, Ireland, Greece, Luxembourg, Belgium	Behind	18
Netherlands, France, Denmark, United Kingdom, Sweden	Ahead	51
EU10	Far ahead	19

Note: The far behind-countries need to reduce emissions by 19 per cent on average between 2004 and 2012 (gap is over 10 per cent for all). The behind-countries need to reduce by 6 per cent on average (gap between 0 and 10 per cent). "Ahead countries" are ahead by 4 per cent on average (gap between -10 and 0 per cent), compared to the countries approaching the 2012-targte linearly from 1990. The far ahead-countries are ahead by 20 per cent on average (gap between -54.5 and -1 per cent), compared to the countries approaching the 2012-targte linearly from 1990.

Source: EEA (2006).

A recent assessment[4] suggests that Member States meeting their individual targets is not assured. Looking at the EU as whole, the strong over performance of the new Member States may compensate for the substantial gaps in the group of the EU15 countries recently far away from targets.

1.3 Policies

The current uncertainty about the 2012-target being met and the EU's ambition to reach further reductions post 2012, sharpens the interest in the effectiveness of present and future climate policies. As most of EU based initiatives to reduce GHG are linked to specific sectors of industries, we base our review of the instruments on such a sectoral approach. In the following four chapters we describe the sectoral instruments. This is followed by a chapter on the specific challenges for the post-2012 regime, which concludes the study.

The first group of policies is the so-called flexible Kyoto instruments, cf. Table 2 and Table 3. A comprehensive overview of climate policies is provided in Table 4 at the end of this chapter. They target the heavy users of fossil fuels shaded in grey in Table 3: the power industry and the manufacturing industry.

[4] EEA (2007a)

The flexible Kyoto instruments cover the Emission Trading System (ETS), Joint Implementation (JI), and Clean Development Mechanisms (CDM). The underlying rationale behind the three instruments are the same, namely to create a market for saving CO_2 emissions. The ETS was designed by the EU, allowing Member States to trade CO_2 emission allowances among themselves. The ETS commenced its functioning in January 2005. JI affects the wider group of 40 countries[5] who signed up to targets for GHG emission reductions – so-called Annex 1 countries. One country can take credit for financing CO_2 emissions in other Annex 1 country on a bilateral agreement basis. CDM is also targeted at the Annex 1 countries which can finance and get credit for GHG reductions in developing countries.

The heavy energy users are the power industry – refineries and generators of electricity and heating – as well as energy intensive manufacturing industries accounting for 49 per cent of EU CO_2[6] . Emissions from these activities have fallen in recent years in the EU27 but only due to strong energy savings in EU10 countries, cf. Table 2. The Commission has proposed to add the aviation industry to the ETS system from 2010 and the EU council as well as the EU Parliament has endorsed this objective. The general ETS is currently being reviewed but major changes will only be implemented in the post 2012 regime. Therefore, Chapter 2 reviews the functioning of these instruments including the proposal to include aviation to provide input to the suggested changes in the post 2012 regime.

Table 2. GHG emissions: sector/activity.

Sector	CO_2 shares, per cent 2005	Non-CO_2 shares, per cent 2005	Growth in CO_2 emissions. 1990-2005, EU27, per cent
Power industries	35	2	-7
Cement, iron / steel and chemicals	10	4	- 11
Other Industry	4	23	-
Civil aviation (1)	1	-	49
Maritime transport (2)	1	0	-8
Road transport	21	3	27
Residential	11	1	-7
Service industries etc	17	22	-
Agriculture forestry and fisheries	2	45	-14
Totals	**100**	**100**	
Share in total GHG emissions	***84***	***16***	
Sinks (3)	-0.8		

Note: (1) Emission levels include only domestic aviation as international flights are not covered by Kyoto agreement. Domestic aviation accounted for 17 per cent of the total EU27 emissions from aviation in 2005.

(2) Emissions levels include only domestic marine transportation (excluding fishing vessels) as international maritime transportation is not covered by Kyoto agreement. Domestic maritime transportation accounted for 12 per cent of total EU27emissions from maritime transportation in 2005.

(3) EEA Annex IV (2006) estimate

Source: EEA (2006).

[5] Annex I countries include the EU27, the non-EU OECD countries, as well as Belarus, Monaco, Lichtenstein, and the Russian Federation.

[6] In EC (2006k) coverage of total emissions between 46 and 51 percent is suggested with the uncertainty related both to total emissions as well as precise estimates of CO_2 from included installations.

The second group of climate related instruments targets the demand for and supply of electricity and heating. A key instrument is a directive implemented in 2003 setting minimum targets for the share of renewable electricity, for example wind mills and biomass. Other important initiatives are efforts to reduce CO_2 emissions from coal fired plants for example by way of Carbon Capture and Storage (CCS) and encourage savings of energy from households and firms through e.g. minimum standards of energy efficiency for electrical consumer appliances and insulation of houses.

In addition to these initiatives, new initiatives have recently been adopted, proposed, or will soon be put forward. The EU Commission initiated a review of energy taxation in the context of encouraging the use of market based mechanisms in March 2007 and has proposed a Third Energy Liberalisation Package in September 2007, and is expected to put forward proposals for new and higher energy standards for 14 product categories in the course of 2007-2008.

Table 3. Sectoral climate change policy instruments.

Sector \ Instrument	ETS	CDM and JI	CCS	Renewable electricity	Energy savings	Biofuels	Fuels efficiency standard
Power industries							
Cement, iron steel and chemicals							
Other industry							
Civil aviation	From 2010	From 2010					
Maritime transport	?	?					
Road transport							
Residential							
Service industries etc							
Agriculture, forestry and fisheries							

Source: EEA (2006).

Chapter 3 reviews existing and new measures affecting supply and demand of electricity and heating. As both the ETS and initiatives to save energy directly affect production from power generators, there is a strong interaction between these instruments, with strong policy implications which will be discussed[7].

The third group of policies target road transportation, which accounts for 21 per cent of total emissions, with strong continued growth of CO_2 emissions over the past 15 years. There are two key instruments in play here, the first being the setting of standards for fuel efficiency of cars. The Commission is expected to shortly propose replacing the current voluntary agreements with car manufacturers, with mandatory fuel efficiency standards for the individual manufacturers, setting a cap on grams of CO_2 per kilometre that the average new car may emit by 2012. The second key instrument is the biofuels directive encouraging Member States to increase the share of biofuels in road transport fuels. Biofuels come from biomass and would, ideally, produce less CO_2 than petrol or diesel when used in cars. EU policies in the area of road transportation are reviewed in Chapter 4.

[7] To provide an example: savings of electricity in households from minimum efficiency standards may have little or no short term impact on CO_2 emissions, as reduced demand for energy leads to a lower price of CO_2-allowances, encouraging power generators to increase emissions, thus bringing CO_2 emissions back to its initial level. The lower price of CO_2 allowances will at the same time reduce incentives to sell and develop low CO_2-emitting technologies such as wind mills and more efficient coal fired plants emitting less CO_2 than current coal- fired plants do.

The fourth group of policies discussed in Chapter 5 is less homogenous in nature. We outline what the EU is doing to contain non-CO_2 gases, which accounted for 16 per cent of GHG in 2005. Among the main emitters are: livestock husbandry accounting for 45 per cent of methane (CH_4) emissions, and hydrofluorocarbon (HCF) emissions from air conditioning systems in cars, office buildings and industrial premises. In total, agriculture accounts for 45 per cent of all non-CO_2 emissions.

We also discuss the use of sinks, such as absorption of $CO_{2,}$ by extending the EU area covered by forests. The Kyoto protocol allows the use of sinks to meet the 2012 commitment.

Chapter 6 contains a review of the main challenges in the post 2012 regime. The point of departure is the two main scenarios outlined in March 2007 from the European Council, namely a broad binding agreement with a 30 per cent reduction for the EU and a unilateral 20 per cent reduction, if such an agreement cannot be reached. The focus is on three issues: (1) evaluation of overall costs of reaching reductions; (2) how to achieve a cost-effective approach. Main emphasis is on the reform of the ETS including auctioning and the scope for extending it to new sectors such as marine transport, sinks, and non-CO_2 gases; and (3) burden sharing within Member States based upon some early scenario analysis.

Table 4. Overview of selected policies.

Initiative	Aim	Measurable target	Means	Implementation status			
				Commission proposed	Council	Parliament	Council and Parliament adopted
Chapter 1. EU climate objectives and policies							
Strategy on climate change (Commission Communication)	Implementation of existing policies, preparation of new measures, new research, cooperation, awareness.	8 per cent GHG reduction vis-à-vis 1990 level (Kyoto) Temperature increase limited to 2°C above pre-industrial levels	Coverage of all polluting countries, use of market-based instruments (ETS), promotion of innovation, efficiency in energy use	February 2005 COM(2005) 35	Conclusions from the Council in December 2005	EP decision in November 2005. Adopted texts: P6_TA(2005)043	N/A
Chapter 2. Flexible Kyoto instruments							
ETS directive	GHG trading scheme for cost effective reduction of emissions in line with Kyoto targets	8 per cent GHG reduction vis-à-vis 1990 levels (Kyoto)	Reporting and monitoring of emissions, allowance level capped – trade encourages reductions where economical	October 2001, COM(2001) 581	N/A	N/A	2003/87/EC
Scheme for GHG emission allocation trading (CDM / JI)	Meeting Kyoto emission reduction objectives (Amending Directive 2003/87/EC)	70 per cent GHG reduction vs. 1990 levels (Kyoto objectives)	An option for CERs and ERUs to replace a specified percentage of ETS credits allocated for installations in NAPs	October 2004 Linking directive 2004/101/ EC October 2004	N/A	N/A	September 2004, 2004/101/EC -

Initiative	Aim	Measurable target	Means	Implementation status			
				Commission proposed	**Council**	**Parliament**	**Council and Parliament adopted**
Directive proposal- Including aviation into ETS	Include domestic and international aviation in the ETS to reduce GHG emissions from the sector to decrease climate change impact	75 per cent cap of 2004-2006 baseline corresponding to 165 per cent of 1990 levels. (EP vote 2.10.2007)	Aviation included as sector in NAPs, trade in the ETS, access to CDM / JI to acquire extra credits	COM(2006) 818; SEC(2006) 1684; SEC(2006) 1685	N/A	EP's Environment committee (2.10.2007)50 per cent distributed for free / 50 per cent auctioned Include non-CO_2	N/A
Post 2012 initiatives for the ETS	-	Proposal	-		-	-	-
Chapter 3. Instruments targeting demand and supply of energy							
Directive on promoting Renewables	Increase generation of electricity from renewable	22 per cent of total electricity consumption to come from renewables in EU in 2010	National targets. National subsidiary schemes. Guaranteed network access	November 1997, COM(1997) 599	Resolution in May 2005, PRES(1998)13 6	EP Decision in June 1998, EU-Bulletin 6-1998	2001/77/EC
Action Plan on biomass (directive on renewable energy in electricity generation (2001/77/EC) provides the legal framework for electricity from biomass)	To promote biomass in heating, electricity and transport	12 per cent overall share for renewable energy, a 21 per cent share in the electricity sector and a 5.75 per cent share for biofuels in 2010	See means for the promotion of renewables	December 2005, COM(2005)62 8	Conclusions from the Council in June 2006, IP/2006/756/	EP decision in March, May and December 2006, adopted texts: TA/2006/116/, TA/2006/222/ and TA/2006/604/	N/A

Initiative	Aim	Measurable target	Means	Implementation status			
				Commission proposed	Council	Parliament	Council and Parliament adopted
Framework Directive on labeling	Enable the harmonization of national measures on the publication, particularly by means of labeling and of product information, of information on the consumption of energy and of other essential resources, thereby allowing consumers to choose more energy-efficient appliances	N/A	N/A	COM(1991)285 Final To increase the informational value of the EU labeling scheme, the Commission will revise, beginning in 2007, the Directive to enlarge its scope	September 1992, 1992/75/EEC	Adopted in cooperation with the EP	September 1992 1992/75/EEC
Eco-Design Directive	Directive that establishes a framework for the setting of Community ecodesign requirements for energy-using products with the aim of ensuring the free movement of those products within the internal market.	N/A	N/A	COM(2003)456 Final	N/A	N/A	July 2005, 2005/32/EC

Initiative	Aim	Measurable target	Means	Implementation status			
				Commission proposed	Council	Parliament	Council and Parliament adopted
Directive on Energy End-Use Efficiency and Energy Services	Provide the necessary indicative targets as well as mechanisms, incentives and institutional, financial and legal frameworks to remove existing market barriers and imperfections that impede the efficient end use of energy	9 per cent indicative overall energy savings target by 2016. This target covers therefore all legislation related to energy efficiency	A project on white certificates; EuroWhiteCert project analyses the potential advantages of a white certificate scheme and ways to cope with difficult aspects, including interactions/integration with other certificate trading schemes (e.g. RES) and markets (e.g. carbon).	COM(2003)739	N/A	N/A	April 2006, 2006/32/EC
Directive on the Energy Performance of Buildings	To promote the improvement of the energy performance of buildings within the Community	The savings potential in the buildings sector is estimated to 28 per cent	Minimum performance requirements for new and renovated buildings (kWh/m²)	May 2005, COM(2001)226	N/A	N/A	December 2002, 2002/91/EC
Directive on the Promotion of Cogeneration (CHP)	Enhance cogeneration of heat and power (instead of producing heat and power as separate processes)	N/A	Harmonising calculation methods and guarantees of origin, improved metering and establishment of norms	July 2002, COM(2002)415 Final	N/A	N/A	February 2004, 2004/8/EC

Initiative	Aim	Measurable target	Means	Implementation status			
				Commission proposed	Council	Parliament	Council and Parliament adopted
Third liberalization package	To ensure a competitive electricity and gas market at the EU level	N/A	Effective separation of supply and production activities from network operation. Further harmonisation of the powers and enhanced independence of the national energy regulators. Establishment of an independent mechanism for cooperation among national regulators. Creation of a mechanism for transmission system operators to improve the coordination of networks operation and grid security, cross-border trade and grid operation. Greater transparency in energy market operations.	COM(2007) – Draft status	N/A	N/A	N/A

Initiative	Aim	Measurable target	Means	Implementation status			
				Commission proposed	Council	Parliament	Council and Parliament adopted
Chapter 4. Instruments targeting road transportation							
Voluntary agreement between Commission and ACEA, JAMA, KAMA	Improve fuel efficiency in passenger cars	Average of new cars sold in the community: 140g CO_2/km in 2008 for ACEA, in 2009 for JAMA and KAMA	Technological development, consumer demand	June 1998, COM(1998)348 Final	N/A	N/A	Decision from the EP and EC in June 2000, Decision no. 1753/2000/EC
Biofuels directive	Increase market share of biofuels	Market share of 5.75 per cent in EU in 2010. Not mandatory for Member States	Member States can use tax exemptions (via energy tax directive) and obligatory mix of biofuels with petrol and diesel.			Directive 2003/30/EC of 8 May 2003	
Legislative frame-work on fuel efficiency	Improve fuel efficiency in passenger cars	120g CO_2/km in 2012 by the total new strategy, but this legislative framework 130g CO_2/km	Latest by mid 2008 an EU legislative framework to reduce CO_2 emissions from passenger cars and light duty vehicles will be presented.	There is currently no proposal. In COM(2007)19 the Commission stated that it will present a proposal by late 2007 or mid 2008	N/A	2007/2119(INI)	N/A

Initiative	Aim	Measurable target	Means	Implementation status			
				Commission proposed	Council	Parliament	Council and Parliament adopted
Proposal on differentiated car tax	Reducing CO_2 emissions from new cars.	N/A	Apply a tax scheme, which is directly or indirectly CO_2 related in order to provide for significant reductions in the average CO_2 emissions from new cars	COM(2005)261 final	N/A	N/A	N/A
Amending Directive 98/70/EC as regards specification and monitoring of road transport fuels.	The main reasons for reviewing the Directive stem from evolving fuel and engine technology and the growth in use of biofuel.	Further progress on vehicle pollutant emissions; The evolution of the CO_2 and cars strategy; – The development of alternative fuels.	Proposed instrument: Directive. Other means would not be adequate because to provide certainty fuel quality must be governed by binding legislation	COM(2007)/18	N/A	N/A	N/A
Directive on measures to be taken against air pollution by emission from motor vehicles	Give the consumer easier access to information on fuel efficiency in new cars	N/A	Information will be given via fuel economy labels, posters and promotional materials	December 1992, COM(1992)575	N/A	N/A	March 1994, 1994/94/EC

Initiative	Aim	Measurable target	Means	Implementation status			
				Commission proposed	Council	Parliament	Council and Parliament adopted
Directive restructuring the Community framework for the taxation of energy products and electricity	Reduce distortions of competitions between Member States and use energy more efficient	N/A	N/A	March 1997, COM(1997)30 Final	October 2003, 2003/96/EC	N/A	N/A
Chapter 5. Instruments targetting Non-CO2 emissions And sinks							
Regulation on certain fluorinated greenhouse gases	Reduce the emissions of the fluorinated greenhouse gases covered by the Kyoto Protocol	23 million tones of CO_2e by 2010	Bans on applications of certain gases, recovery, labeling and reporting	August 2003, COM(2003)492 Final	Regulation from EC and EP by May 2006, (EC) No. 842/2006	Regulation from EC and EP by May 2006, (EC) No. 842/2006	N/A
Directive for the landfill of waste	Reduce adverse effects of landfill of waste on water, groundwater, soil, air, human health	Prevent use of certain types of waste in landfill	Bans on use of certain type of waste in landfill, traceability of waste	March 1997, COM(1997)10 5 Final	April 1999, 1999/31/EC	N/A	N/A
Action plan for organic food and farming	An information-driven expansion of the market for organic food, efficiency improvement of support to organic farmers and improvement of EU's norms for producing and importing / exporting organic farming products	N/A	A variety of actions, including commercial campaigns, regulative changes and strengthening of R&D in organic farming	June 2004, COM(2004) 415	Conclusions from the EC in October 2004, see: PRES/2004/286/	EP decision in March 2005, adopted texts: TA/2005/72/	N/A

2. FLEXIBLE KYOTO INSTRUMENTS

As part of the Kyoto agreement, the signing partners allowed the use of flexible instruments to facilitate abatement of CO_2 where it is most cost-efficient. There are three flexible instruments.

The EU designed the ETS allowing Member States to trade CO_2 emission allowances among themselves; we cover the ETS in section 2.1. The EU Commission has proposed to include aviation in the wider ETS from 2011; this proposal is reviewed in section 2.2.

The wider group of 40 countries[8] who signed up to targets for GHG emission reductions – so-called Annex 1 countries – were allowed to undertake JI: one country could take credit for financing CO_2 emissions in other Annex 1 countries, on a bilateral agreement basis.

Furthermore, Annex 1 countries could finance and get credit for GHG emission reductions in developing countries provided that the reductions could be verified not to have occurred in the absence of intervention such as the CDM. JI and CDM are reviewed in section 2.3.

Finally, section 2.4 provides conclusions on the functioning of these mechanisms as input to the upcoming review of the ETS and the post-2012 regime.

2.1 The EU Emission Trading System

Accounting today for up to 50 per cent of total CO_2 emissions[9], emissions from highly energy intensive industries within the EU15 have, as a whole, gone up in the recent decade. Increases from electricity and heating of 7-8 per cent have more than offset declines in emissions from manufacturing industries. Because the EU12 countries started off with very low levels of energy efficiency and having thus been able to achieve substantial savings of energy, they have ensured that the EU25, as a whole, has reduced emissions from electricity and heating and manufacturing.

To encourage abatement of CO_2 in energy intensive industries, the EU implemented the ETS in 2005. The aim of the ETS is to create the same marginal incentives to save CO_2 emissions across the EU, so as to obtain savings where they are most cost-effective. It does so by creating a system where the total amount of allowances is fixed for the EU as a whole. If firms need more CO_2 to expand production, they will, at the margin, have to buy an allowance in the market. If they can achieve savings of fossil based energy, they can sell the allowance on the market, and there is only one price for the EU as a whole. See Box 2 for a further description of the ETS.

In practice, the design of the ETS implies that change in demand or supply for fossil fuels in the EU have zero effect on CO_2 emissions from the ETS covered industries. The development of CO_2 emissions from the covered industries is purely determined by the total amount of allocated allowances.

[8] Annex I countries include the EU27, the non-EU OECD countries, as well as Belarus, Monaco, Lichtenstein, and the Russian Federation.

[9] See EC(2006k) providing estimates of coverage between 46 and 51 per cent.

Box 2. Key features of the ETS and link to national actions to deal with climate change.

The EU ETS caps emissions for major stationary emitters of CO_2, such as energy generation, minerals, oil refineries, iron ore extraction and steelmaking, as well as the pulp and paper industries, collectively accounting for about 50 per cent of the EU's CO_2 emissions[10] [11]. Transport – a major CO_2 emitter – is not covered although the aviation sector is to be included from 2011. The ETS was implemented with effect from 1 January 2005 based upon the adopted directive 2003/87/EC.

Each year, ETS participants are allocated an amount of allowances by Member States, as specified in their National Allocation Plans (NAPs), giving the right to emit 1 tonne of CO_2 per year. By the end of April each year, participants must report their emissions and surrender a corresponding amount of allowances. Should the allocated amount be sufficient, the participants can sell a potential surplus at market value. Otherwise, they will have to cover the shortage from other participants who have a surplus. Since the amount of allowances is fixed in the system, participants selling allowances must reduce their emissions, while buyers pay the price for retaining emissions. In this manner, emission reductions take place where they are most economically efficient.

The first NAP covering the years 2005-2007, set emission levels against the base year 1997, incorporating a penalty of 40 € / tonne CO_2 for non-compliance. A minimum of 95 per cent of allowances were to be distributed for free via grandfathering, with the option of auctioning the remaining 5 per cent by Member States willing to do so.

NAP II (base year 2005) will encompass the years 2008-2012, the share distributed via grandfathering declining to a minimum of 90 per cent, while the share that can be auctioned increasing to 10 per cent. The penalty fine shall increase to € 100.

Member States have some discretion as to how many allowances they allocate. However, each additional unit of allowances emitted at the national level automatically requires that country to emit one unit less in other sectors such as transportation. Compliance with the national target for CO_2 requires that the sum of *initially granted allowances*, measured in CO_2 plus actual emissions from other sectors is within the national cap. At the same time, *actual emissions* from ETS covered sectors are irrelevant for compliance with the national target.

Participants in the ETS also have the option of transferring extra allowances from the CDM and JI into the ETS, provided by the Linking Directive 2004/101/EC. Under these two schemes, the participants can undertake projects to reduce CO_2 emissions outside the scope of the ETS, in exchange for a corresponding amount of allowances. The attractiveness of CDM and JI lies in the fact that it may be less expensive to reduce a tonne of CO_2 outside of the ETS, while the contribution to the global emission reduction objective is identical.

The EU has launched a review of the entire ETS primarily with the aim of improving the efficiency of the ETS in post-2012 regime. It is expected that the EU Commission presents its proposal at the end of this year.

Source: Copenhagen Economics, Directive 2003/87/EC, EEA(2006), EC(2006k).

The experience so far shows both the potency of the ETS to deal cost-effectively with the need to cut CO_2 and the shortcomings.

First, the system is now up and running with prices of allowances traded in the EU as a whole, which should be seen in the context of it being by far the largest ever created market-based system to deal with GHG emissions, and above the scope of the pioneering schemes in the US[12]. *Second*, the system also works well in the sense that the price of CO_2 allowances is reflected in electricity prices with close to full pass-through[13].

[10] The ETS covers CO_2 emissions only. The coverage of CO_2 emissions by the ETS is uneven across countries: in some countries the ETS covers less than 1/3 of CO_2 emissions, while in others more than 2/3.
[11] Directive 2003/87/EC
[12] Grubb et al. (2006)
[13] IEA (2007f)

Notice that the pass-through of prices has occurred *despite* extensive use of grandfathering, with over 95 per cent of allowances being given free of charge to emitters of CO_2 based upon their historical emissions; see Box 3 for a further explanation.

Second, the shortcomings, which can be categorised in two main groups:

- The allocation mechanism
- More technical issues

Box 3. Grandfathering, pass-through and national price regulation in the electricity industry

Generators of electricity can sell surplus allowances if they cut production and have to buy if they increase it, so changing production levels means lower or higher costs. These changes of costs are not substantially affected by grandfathering. They will receive exactly the same amount of free allowances irrespective of the extent to which they increase or decrease incrementally their CO_2 emissions. So grandfathered allowances can be seen as a lump sump payment consisting of the value of free allowances being unconnected to actual CO_2 emissions.

As a result, changes in the prices of allowances have been reflected largely in changes in electricity prices. This is also a direct result of the EU's electricity market being nearly completely closed off to non-EU competition14. Some countries such as Italy, France, Spain, and Ireland have somewhat muted the intended impact of the ETS at the national level by having price cap regulation at the wholesale or retail level. The caps have prevented the costs from buying emission allowances to be passed on to consumers.

The result is lower energy prices in these countries and correspondingly higher energy prices in the remaining EU countries. Less pass-through of prices to consumers in parts of the EU means more demand for energy in these same countries, pushing up the prices of emission allowances for the EU as a whole. Higher costs of allowances are subsequently passed on to consumers in the form of higher energy prices. The implication is that consumers in countries without price caps end up paying for such regulation. This is a clear example of how strongly the common market created by the ETS leads to spillover effects between countries from national regulation.

Source: Copenhagen Economics.

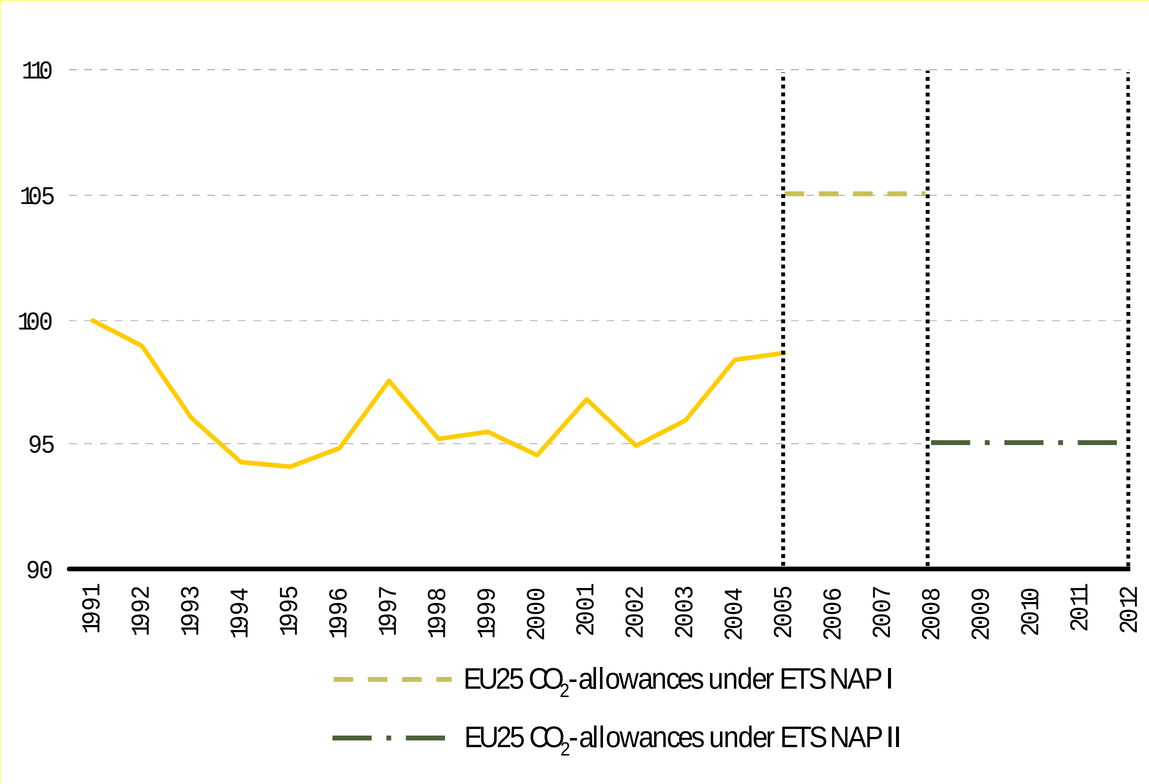
2.1.1 Allocation mechanism

We identify four weaknesses in the allocation of the allowances[15].

First, too much of the overall 'tightness' of system has been left to the discretion of Member States . The total sum of allowances is thus a result of decisions taken in 27 Member States, each facing pressure from emitters in the ETS-covered sector to receive as many allowances as possible. Total allowances in the first allocation period 2005-2007 (NAP I) were perhaps 5 per cent above emissions in 2004, thus, implying no reduction for that period cf. Figure 2. In the subsequent allocation period 2008-2012 (NAP II), final results should lead to reductions in emissions, but only 5 per cent lower than in the base year for EU's overall commitment (1990). This can be seen against an overall required reduction of 8 per cent.

[14] See inter alia IEA (2007f) and Neuhoff et al. (2006).
[15] The assessment is based upon a wide range of studies with consistent messages about the weaknesses of the present ETS. Examples are IEA (2007f), Grubb et al. (2006), Neuhoff et al. (2006), Neuhof et al. (2007), House of Commons (2007b)

Figure 2. EU25 CO_2 emissions and ETS CO_2 emission caps according to adopted NAP.



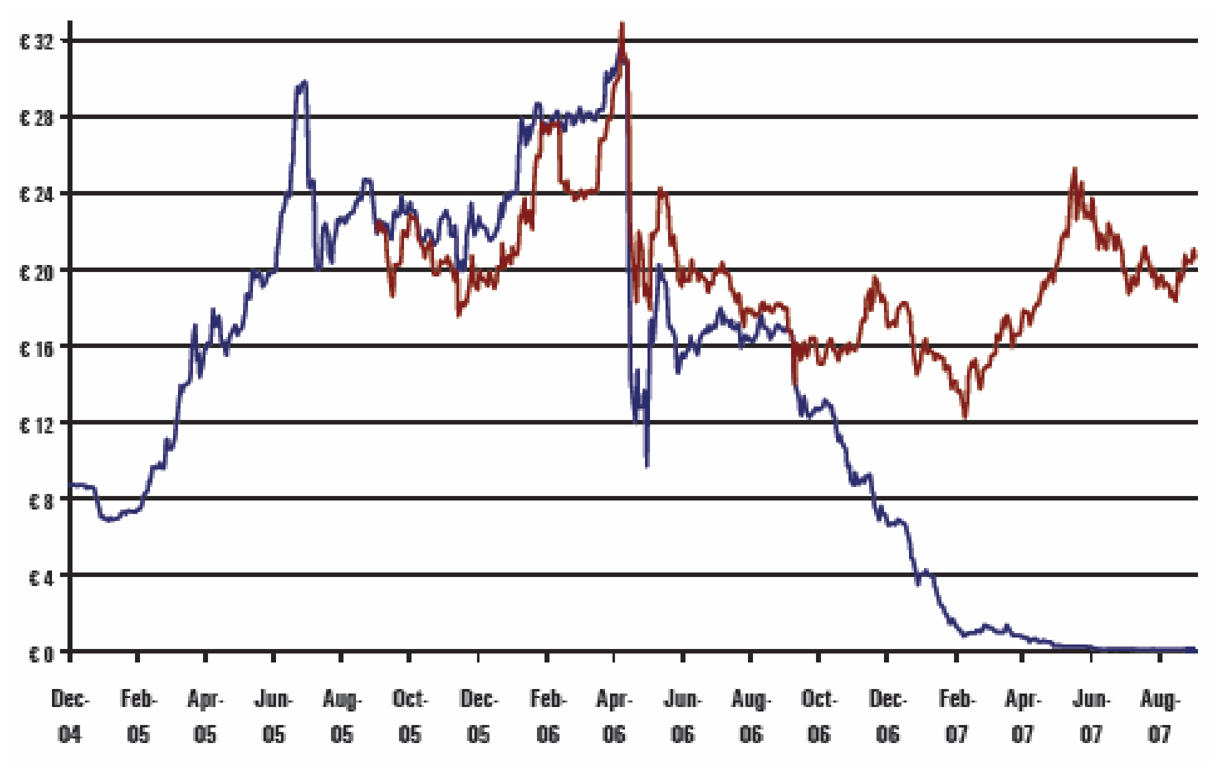
Note: The Portuguese NAP for phase II has not yet been adopted as per 17th of September 2007. For phase I Portugal got allowances for 116.6 Mt of CO_2. The allowances for Portugal have been reduced with the average EU24 reduction.

Source: EU Commission and EEA(2005).

The generous provision of allowances in 2005-2007 and tighter allowances in 2008-2012 are reflected in the prices of allowances. Since mid 2006, the prices for allowances have moved towards zero, suggesting that firms as a whole have received so many allowances that the ETS gradually lost its bite over this period, cf. Figure 3.The sudden drop of prices in mid 2006 was indeed triggered by new information about a higher than expected supply of allowances from a group of Member States, suggesting that the market would be less tight than expected in the start of the first allocation period[16]. By contrast, the price of allowances for 2008 is, as of September 2007, trading just below 20 € / tonne suggesting that firms expect the market to be tighter.

[16] IEA (2007f)

Figure 3. Prices of CO_2 allowances, 2004-2007.



Note: The graph shows daily bid-offer close EUA Dec 2007 prices from Dec 2004 (blue line) in the OTC market and EUA Dec 2008 from Sept 2005 (red line).

Source: Point Carbon (2007).

A second weakness about the allocation process is the relatively short allocation periods in conjunction with uncertainty about the future tightness in the market for allowances, i.e. uncertainty about prices. Decisions to produce and invest in industries producing and using energy are often based on very long term calculations with plants having a life-time of several decades. Future developments in energy markets are uncertain in any case, but firms will find it easier to plan ahead if the main lines in energy policy were clearer.

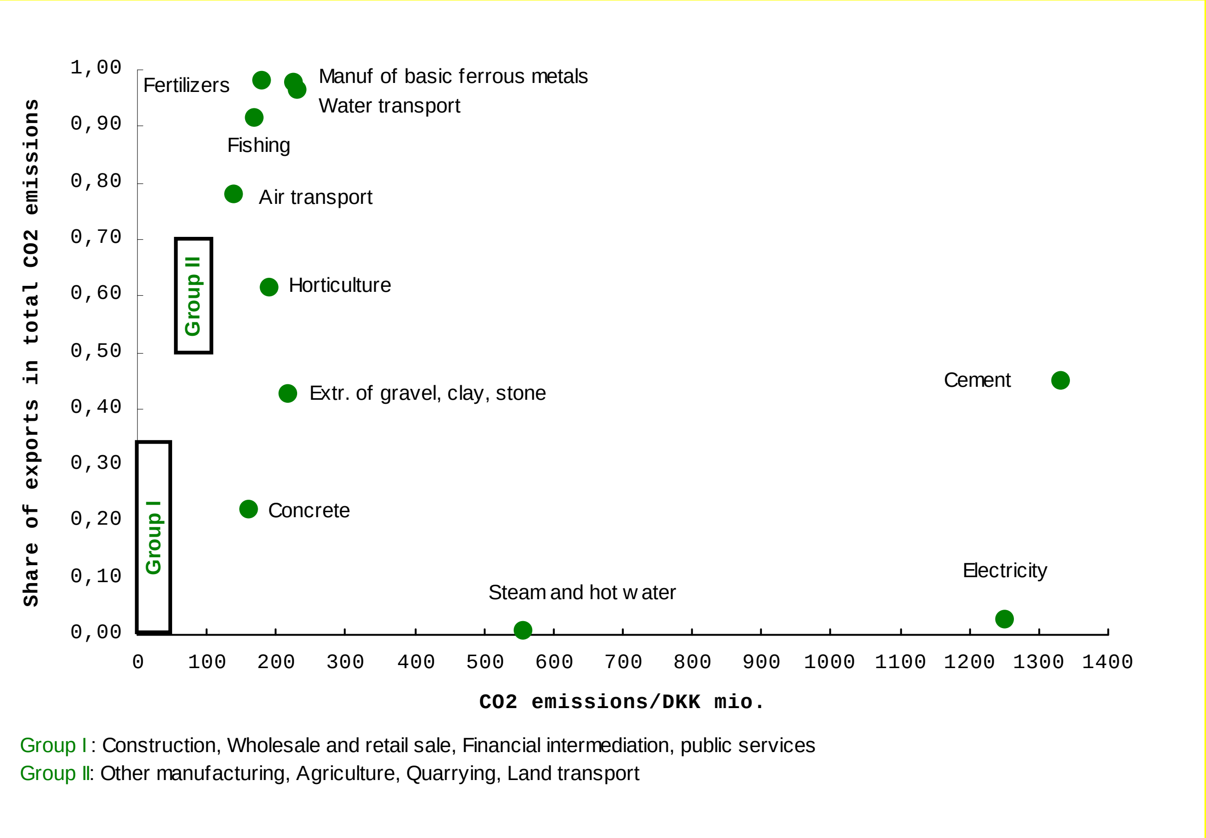
A third weakness is the recourse to grandfathering, which becomes more and more problematic as time goes by. When the system was being introduced, grandfathering was perceived as a helpful instrument to overcome resistance to a more market based system and offered some compensation to industries, which may unexpectedly see demand for their products fall as new policies are implemented. But, as a permanent method of allocation, grandfathering creates a number of problems.

It may trigger non-productive strategic behaviour among firms. Providing firms with free allowances in 2013 based upon historic emissions prior to 2002, in other words more than a decade away, will increasingly be seen as a non-credible option. Instead, expectations may rise that a system of updated grandfathering may be used with allowances based upon emissions in the period running up to 2012. This will undermine the ETS, as firms will see present and future emissions not only as costs in terms of having to buy allowances, but also giving them benefits in the form of more free allowances in the next allocation period.

It has also created substantial windfall profits to generators of electricity and heat. Almost completely shielded from non EU competition, power generators have largely passed on the costs of buying allowances to consumers while at the same time benefiting from the value of free allowances (as discussed in Box 3).

Finally, it does not solve the problems with international competitiveness that traded and energy intensive industries such as cement and steel are facing, cf. Figure 4. These industries have a high CO_2 intensity, meaning that they require a lot more energy or tonnes CO_2 to produce a million DKK worth of value added than other industries. At the same time, they are all highly trade intensive, meaning that their exports account for a much larger share of value added than in other industries. Giving these trade and CO_2 intensive industry, allowances based upon *past* behaviour/emissions do not really affect their incentives to place their *future* production within Europe.

Figure 4. Trade and CO_2 intensity of industries in Denmark.



Note: Trade intensity: ratio of value added from exports to total value added in production

CO_2 intensity: CO_2 emissions per value added in production, tonne / DKK million.

Source: Copenhagen Economics and Statistics Denmark (2006).

A fourth weakness consists of two built-in mechanisms that couple the granting of allowances to firms with their actual CO_2 emissions. Most countries have set aside a reserve for new entrants with allowances linked to their likely emissions of CO_2. This creates an incentive to enter the market and emit CO_2. The argument for this rule is that it ensures fair competition between incumbents who receive free allowances and new firms who would alternatively have to buy them. However, as described above, receiving free allowances is not an incentive at the margin to produce more; it is just a transfer of funds based upon past behaviour, so it does not materially improve the ability of established firms to compete against new entrants. Moreover, all but three countries have prohibited firms to retain their grandfathered allowances if they close their CO_2 emitting plants[17].

[17] Neuhoff et al. (2006)

In other words, to keep their allowances, firms need to continue production from plants with historic CO_2 emissions, which is an indirect subsidy to firms with high CO_2 emissions. The consequence is not higher final CO_2 emissions but a higher price of CO_2 allowances and a slower withdrawal of plants that would otherwise leave the market to more competitive EU firms.

2.1.2 Technical issues

We have also identified two significant issues relating to more technical aspects of the ETS.

First, many smaller suppliers are not covered by the ETS. The chosen system for administrating the whole ETS is a so-called "downstream system". This means that the individual physical emitters of CO_2 are chosen as administrators of the system, implying that they need to record purchases of fossil fuels, the on-going consumption of energy inputs and to keep records that allow inspection and verification. As this is perceived to carry substantial compliance costs, smaller operators are exempted which implies that perhaps 5 per cent of electricity and gas consumption in the ETS covered sectors is not covered[18].

This requires Member States to implement other policies to cover this gap in order to meet their national CO_2 target; and it creates potential distortions of competition between exempted and non-exempted firms. The use of an upstream administrative system with the very large distributors of oil, gas, and coal made responsible has earlier been advocated to increase coverage and reduce compliance costs[19].

It would be useful to review the options for combining upstream systems for small operators with downstream systems for larger operators as a part of the entire ETS review.

Second, transparency is too low, which affects the formation of expectations. The drop in prices of CO_2 allowances (in April 2006 cf. Figure 3), which reflected a substantial nearly over-night change in market expectations about both level of emissions in the sector and the supply of allowances, shows the need for more transparency. The price of allowances can be a cost-effective indicator of longer term incentives, but much less so if it is overly fluctuating due to lack of, or wrong information.

2.2 ETS to be extended with aviation

Aviation is one of the fastest growing sources of GHG. Its share of CO_2 emissions in 2004 of 1 per cent underestimates its effect on climate change by a factor of at least two, as high altitude emissions are more damaging to the climate than 'earth' emissions. In addition, NO_x emissions are also important. So, aviation's share of total GHG may approximate 3 per cent. Emissions from EU related aviation have grown by 87 per cent over the last 15 years with no sign of levelling of. The directive proposal sets forth emission ceilings at the level of average emissions from both domestic and international aviation in the years 2004-2006, cf. Figure 5.

The high and growing share is driven by a range of factors. Liberalisation of air transport has lowered prices substantially, thus boosting the demand, while income growth has lead to more than proportional increase in tourism[20]. At the same time, air travel and air fuels have benefited from tax treatment.

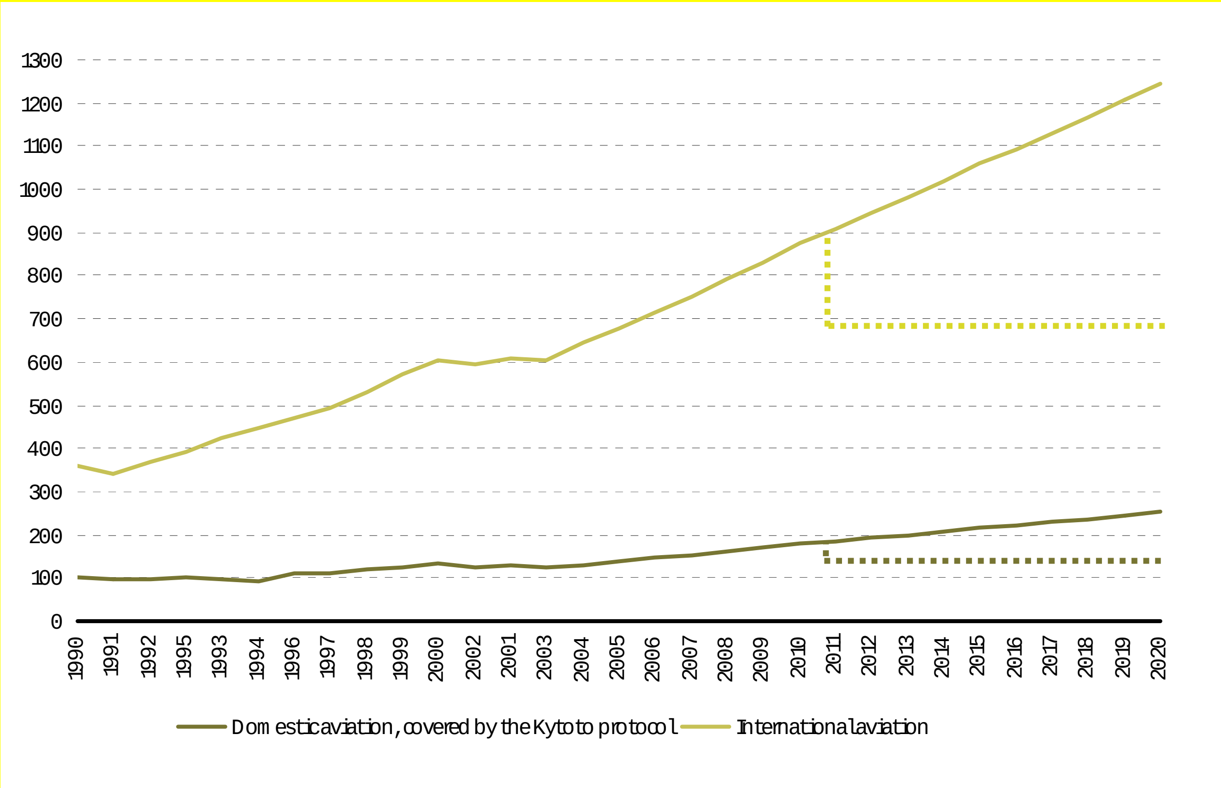
[18] This estimate is based upon Danish sources where the exemption of smaller emitters may lead to 7-8 per cent of electricity generated emissions to fall outside the ETS. Denmark has relatively many small decentralised plants producing heat and electricity and suggesting that the EU average may be around 5 per cent.

[19] IEA (2004). The point is that the link between buying for example oil to be used in industrial production processes and actual emissions is nearly one-to-one. So instead of asking many small buyers to verify their purchase and use of fossil fuels and match that with the buying of allowances, this process could be transferred to the few and very *large* sellers of oil, gas etc.

[20] Copenhagen Economics (2007)

Air travel is VAT-exempt while neither fuels for domestic nor international flights are taxed, lowering thus at the margin the cost of air transport relative to other modes of transport, while reducing incentives to increase fuel efficiency in air travel.

Figure 5. CO_2 emissions from aviation, EU27- 2006-2020.



Note: For the period 2006 – 2020 the emission projection is based on SEC(2006) 1684. Solid lines represent the reference growth scenario, while dotted lines indicate the proposed emission ceiling. We distinguish between domestic(currently included in the Kyoto target) and international (currently excluded from Kyoto) aviation. The ceilings from the directive proposal shall apply to both domestic and international aviation.

Source: EC(2006d) and the EEA (2006).

The beneficial tax treatment reflects both the highly mobile nature of air transport, as well as institutional restrictions on Member States' ability to tax air transport. Isolated taxes at the national level can easily be avoided by fuelling outside national borders. The EU directive 2003/96/EC prevents Member States from taxing internal flights and IATA agreements limit Member States' rights to tax air fuels on international flights.

The proposed EU directive on aviation aims at overcoming these economic and legal barriers and to make use of economic instruments to abate emissions from aviation. The directive covers all flights to and from EU destinations. It thus covers intra-EU and extra-EU destinations, in addition to domestic flights already covered by the Kyoto agreed total emission reduction, see Box 4. In contrast, emissions associated with flights between Member States, as well as those leaving and entering EU borders are outside the Kyoto agreement, but the coverage will, of course, be an important contribution to actual global CO_2 abatement. The basic logic of the scheme is simple. Air operators are already under strong obligations to report fuel use associated with flights to and from EU airports for safety and other reasons. Their emissions are then based upon this verified fuel use.

Box 4. Proposed EU Directive on Aviation.

The EU Commission has proposed to include CO_2 emissions from aviation in the ETS:

- From 2011, emissions from 'intra-EU' flights, including purely domestic flights
- From 2012, also emissions from flights to and from the EU

The total number of allowances is to be determined by reference to average emissions from aviation in the years 2004-2006[21], and the allocation methodology in 2011 and 2012 to be harmonised across Member States:

- A fixed percentage of the total quantity of allowances will be allocated free of charge on the basis of a benchmark to aircraft operators which submit an application (the earliest application relating to 2008 data). For the period 2011- 2012 this percentage will correspond to the average percentage contained in the NAP II.
- The remainder is to be auctioned by Member States including auctioning in their national allocation plans.
- Post-2012 allocation methods is to been in the context of the general review of ETS-
- The details of how auctioning will work such as appropriate design and timing will be set out in a Commission Regulation. Auctioning proceeds should be used to mitigate and adapt to the impacts of climate change and to cover administrative costs."[22]

The Council: The directive proposal was first discussed by the Council on February 20, 2007. On the 8th of June, Transport Ministers adopted Council Conclusions on the position to be taken by EU Member States at the ICAO Assembly in September 2007 in relation to the inclusion of aviation in the European emissions trading scheme. The Council supported the inclusion of aviation, incl. international aviation, in the ETS recognising the potential of this mechanism to mitigate climate change. It urged the ICAO to continue its efforts; simultaneously reserving a right to 'keep all options open in this essential policy area'[23] should there be no progress. The EU environment ministers will discuss the directive proposal further at their meeting within the Council in December 2007, when a first reading is expected, with further readings, thereafter, in years 2008-9.[24]

The European Parliament: In October 2007, the Environment Committee of the European Parliament took a vote on the directive proposal. In terms of the emissions target, MEP's proposed 75per cent of the 2004-2006 baseline, corresponding to a 65per cent increase over the 1990 levels. Furthermore, MEP's proposed that 50 per cent of aviation emissions to be auctioned against the implied 2-3 per cent in the Commission proposal.

Source: COM(2006) 81,. EFTE (2007).

To maximise both the economic and operational efficiency of the system, the directive proposes to nearly[25] fully incorporate aviation into the overall ETS, rather than creating a separate system. This enhances *economic efficiency in the air transportation sector* because air operators, at the margin, will find the same marginal costs of emitting more CO_2 as other traders within the ETS. It enhances *operational efficiency* because a small scheme for aviation alone might become too unstable and expensive to run.

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[21] In a vote of October 2, 2007, MEPs proposed an emission cap of 75 per cent of the 2004-2006 baseline, corresponding to a 65 per cent increase over the 1990 levels.

[22] COM (2006) 818 final

[23] Council of the European Union (2007b)

[24] Ladefoged (2007)

[25] By nearly is meant that air operators will be allowed to buy allowances from non-air operators but not the other way around. This ensures that potential strong efforts to reduce fuels from air operators, and hence creation of a "surplus" of allowances relative to need cannot be exploited by non air operators. This could end up in a situation where the price for CO_2 allowances for air operators could be lower than for example steel industry. However, the impact assessment estimates that air operators will be net buyers from other sectors so that some of the emission reductions coming from this proposal will in fact be reaped by firms in the "normal" ETS.

The impact assessment of the proposal suggests that air operators will find it difficult to avoid having to buy allowances by fuelling outside EU. In principle, a London flight to Beijing in China could be redirected to take a stop in Dubai “en route”, refuel and then escape having to buy allowances to cover fuel for the last leg on the trip: Dubai-Beijing. However, the geographical boundaries of the EU suggest that such leakage would be limited: in the concrete example the additional costs of putting in the pit stop in Dubai more than outweigh the expected costs of buying fuel allowances[26]. As the proposal covers all flights, irrespective of the country flag of the carrier, it should also be neutral in terms of competition.

On allocation mechanisms, the directive differs from the ETS. We note three provisions of particular importance:

- New entrants to the market will have to buy allowances in the market. In the standard ETS, the Member State can set aside allowances for new entrants, effectively providing them with a subsidy to set up new plan producing CO_2 (and the more the CO_2 you produce the more allowances you get see section 3.1).
- Free allocations are to be based upon industry benchmarks for fuel efficiency so that operators which have invested in efficient airplanes etc. are not punished by way of a lower level of allowances, in contrast to the standard ETS.
- The proceeds from auctioning are earmarked to “mitigate” the costs of climate change. This proposed provision is problematic from at least two angles. First, any public funding to such purposes should be based on their own merit with the levels not determined by the more or less accidental levels of the price of CO_2 allowances and the travel activity. Second, given the continued expected fluctuations of the price of CO_2 allowances, such revenues will be very volatile thus providing an unreliable source for such expenditure.

2.3 Joint Implementation and Clean Development Mechanisms

The Kyoto Protocol allows the signing parties to trade in savings of GHG. For countries signing up to specific targets (Annex 1 countries), The Joint Implementation (JI) mechanism, outlined in Article 6 of the Protocol, allows them to work together to meet their targets. For example, Japan (through the government or a company) could invest in an emissions reduction project in Russia, and then use the credits to offset its national reduction target. The project does not affect Russia’s reduction target, but Russia does benefit from savings of energy.

Most important at the global level is the Clean Development Mechanism (CDM)[27]. It allows industrialised countries to earn emissions credits from their investments in emission-reducing projects in developing countries. To earn credits under the CDM, the project proponent must prove and have verified that the greenhouse gas emissions reductions are real, measurable and additional to what would have occurred in the absence of the project (article 12 of the Kyoto Protocol).

[26] However, the pit stop may become profitable, above a certain (high) threshold price for allowances (Frontier Economics (2006)).

[27] The JI mechanism has received much less interest than CDM and has also generated much less credits so far and have also lost some if its potential relative to what was expected, not the least because a very substantial part of host countries for JI projects have now become members of the EU. But also the administrative procedures for starting JI have been more slow so that JI account for a smaller part of the global carbon market than CDM (an overview is provided of these issues in OECD/IEA(2006b)).

The basic rationale for the CDM is that abatement of GHG in developing countries can be achieved at lower costs than in developing countries. Thus, on the margin, one Euro spent on abatement might save more CO_2, or other GHG in India than in Germany. Developing countries are in a process of expanding energy use and building up the necessary infrastructure, providing a good opportunity of transferring best practice and technology to countries that may on their own not prioritise energy efficiency. Moreover, given lower energy prices due to low taxation and no commitments to reductions, there ought to be more "low hanging fruit" in terms of emissions savings than in the EU and other developed countries.

The experience so far can be considered a success in terms of its sheer volume. Globally, CDM is expected to provide 17 per cent of developed countries' emission reductions by 2012 with rapid rise in projects since the inception of the program[28]. Also, in the agreed NAP II, Member States have got acceptance from the Commission for total JI/CDM credits equivalent to 12 per cent of the overall cap of allowances in the ETS.

CDM is also widely credited with sharpening the developing world's interest in dealing with challenges of climate change.

However, the structure of the actual projects undertaken suggests that the present framework should be reviewed in the context of the post-2012 regime. The focus in this section will be on CDM, where most problems have been identified. While it was originally envisaged that CDM projects would have a significant energy perspective, it has turned out that the main projects have to do with just two non-CO_2 green house gases which are by-products of industrial processes and where doubts have been raised as to the efficiency of CDM in practice, cf. Box 5.

Furthermore, uncertainty about the post-2012 global regime also reduce the incentive to invest in more long term projects, where benefits in terms of emission reductions, and hence credits, are reaped only after many years. In addition to uncertainty about the post-2012 price of ETS emissions allowances, investment in such projects are also adversely affected by lack of knowledge about the future of the CDM credits itself. This has been pointed out as one factor behind the dominance of projects with a short term benefit horizon, such as non-CO_2 CDM projects, and the risk of reduced inflows of new projects as 2012 is coming closer without clarity about the post-2012 situation[29].

[28] OECD/IEA (2007a)
[29] OECD/IEA (2007a)

Box 5. The economics of Teflon generated CDM credits.

HFC23 which is a by-product when producing HFC-22 – more popularly known by the brand name Teflon – accounts alone for nearly 50 per cent of all CDM credits. As these gases are estimated to have an enormous impact on climate change – one tonne of HFC23 equals 11700 tonnes of CO_2 – it implies that removing one tonne of HFC23 gives very considerable credits.

This creates very strong firm level incentives to buy and supply HFC-23 based CDM. Hence, firms subjected to EU's ETS will thus be willing to pay a high price to provide finance and credit for HFC-23 abatement. Seen from the producers of Teflon side, they face relatively low abatements costs while being in the situation of being price setters as restraints have been put on the overall supply of HFC-23 based credits. The result is that a developing country producer of Teflon may receive a subsidy by way of the CDM that is nearly twice as much as the value of product itself. Indeed, the profitability of HFC23 based CDM in China is so large that the tax authorities have introduced a specific additional tax rate above 60 per cent on these firms.

Furthermore, there are indications that the base line for emissions of HFC23 is well above what purely firm level economic incentives would suggest. The relative limited abatement costs and the fact that high HFC23 carry private economic costs on their own for their firms have contributed to much lower intensity of HFC23 as a by-product in developed countries than what is accepted as the base line for HFC-23 based CDM credits.

So the bottom line is that the base line of emissions may be inflated in order just to create more credits opportunities. This may then result in more emissions in the EU not really matched by reductions in for example China.

Source: Wara (2006).

2.4 Conclusions

The ETS is now in place and with the more tight allocation of allowances in the second allocation period from 2008-2012 it can start to deliver real results in terms of cost-effective incentives to abatement of CO_2 emissions. The experience so far has clearly defined the key issues to be addressed in the review of the ETS and which should be followed up in the discussion and implementation of the post-2012 regime as none of the major changes will have an impact before that.

First, the overall level of allowances is best decided at EU level to ensure that the overall tightness of the ETS system is consistent with the EU's objectives to reduce GHG gases. Second, grandfathering is recommended to be largely replaced by auctioning. The present maximum level of auctioning could be replaced with a minimum level of auctioning set at a very high level. Third, any mechanism that effectively undermines the effectiveness of the ETS by coupling actual/future emissions with allowances should be ruled out. Fourth, energy intensive industries in fierce competition with non-EU firms may be allowed a system of benchmarked allowances to prevent leakage. The need for such mechanism is discussed in the context of the international framework facing EU post-2012 as discussed in chapter 6.

Introduction of aviation into the ETS is likely to be a cost-effective improvement of EU climate policies. The proposed directive from the EU Commission is an improvement on the general ETS by underlining the need for an overall cap for emission defined at the EU level. Use of benchmarking rather than historic CO2 emissions to allocate free allowances is also an improvement. Whether the case of aviation offers good guidance on the scope for drawing in other sectors is less clear. Airline operators are relatively large, implying that the at least perceived heavy compliance costs are manageable, and the scope for circumventing the burdens through leakage is limited. These conditions may not be the case for some other sectors, as discussed also in Chapter 6.

The use of the other flexible Kyoto mechanisms – CDM and JI – has proved to be a success in terms of generating many credits, while also raising some questions. Apart from discussions about the large complexity involved particularly for CDMs, the main risks identified is that emissions in host countries are not reduced by the magnitude implied by the credits generated and that the CDM may be a less cost effective instrument than hoped for. The implications for the post-2012 regime including the structure on an international agreement are also discussed in Chapter 6.

3. INSTRUMENTS TARGETING DEMAND AND SUPPLY OF ENERGY

This chapter presents instruments targeting demand and supply for electricity (power) and heat production in the EU. However, with a more strict allocation of allowances in the period 2008-2012, the ETS will effectively set the overall limit for CO_2 emissions for the whole network of industries and power generators. Seen in a climate change policy context, the role of the instruments targeting demand and supply of electricity and heat is thus not to reduce CO_2 emissions further, but primarily to help reduce the costs of abating emissions and encourage a future supply of secure energy resources. Lower abatement costs would again allow setting a more ambitious future target.

The instruments fall into three main categories. First, CO_2 reduction can be achieved by cleaner power generation from coal fired power plants (3.1). Second, an increase in the share of renewable in power generation will contribute to cleaner power generation (3.2). Third, energy saving in households and in commercial buildings may decrease the need for power and heat production (3.3). We provide conclusions in 3.4.

3.1 Cleaner Coal, including CCS

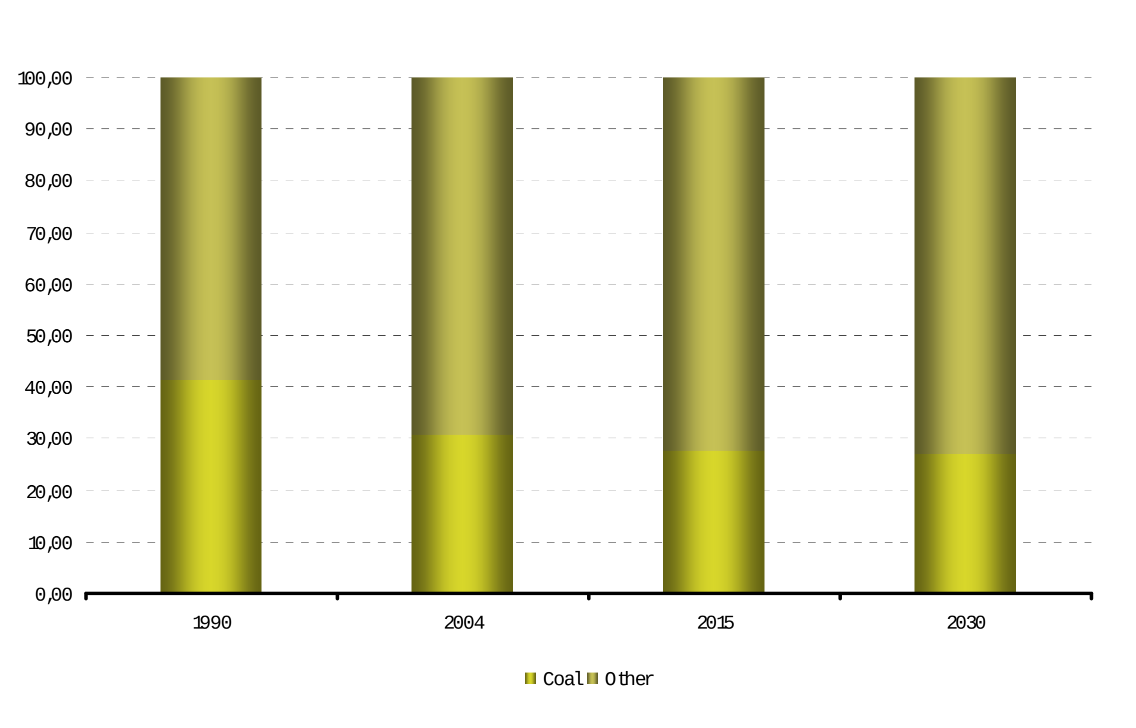
The need for reducing CO_2 emissions from coal fired plants – cleaner coal – should be seen in the light of two perspectives. First, with known coal reserves to last for several hundred years against only 40 years for e.g. gas, coal has more assured long term potential and is expected to keep a market share of around 25 to 30 per cent of power generation in the future, cf. Figure 6**.** So a marked reduction in CO_2 emissions from coal fired plants can make a significant contribution to overall containment of GHG. Second, coal offers more geopolitical security of supply relative to gas which is a close substitute to coal.[30].

A continued strong role of coal relative to gas is positive for EU energy security both in terms of its long term potential and geopolitical sourcing[31]. However, it puts more pressure on climate change policy, as CO_2 emissions per unit of energy are higher than for gas.

So the challenge is to remove barriers to allow generation of electricity and heating by reliable and abundant coal, while insuring that each unit of energy from coal leads to less emissions ("cleaner coals") so that both energy policy objectives – climate change and energy security – are respected. There are two promising mechanisms by which cleaner coal can be realised.

[30]Known gas reserves are mainly located in Russia and Middle East. See IEA (2006) for more on gas reserves.
[31] EC (2006l)

Figure 6. Share of electricity generated by coal, per cent, the EU.



Note: Based on IEA baseline scenario

Source: IEA (2006a).

First, efficiency gains in converting coal to energy to final consumers may reduce CO_2 emissions from coal fired plants by 20-25 per cent. If all plants managed the performance of best practice plants, CO_2 emissions from coal fired operations could be reduced with 8 per cent. Moreover, the next generation of coal fired power plants is substantially more efficient compared to even the best performers today, see Box 6. Hereby the efficiency may be further increased,[32] leading to an additional drop in CO_2 emission of almost 15 per cent.

The potential of phasing out of the inefficient operators, as well as the introduction of a new generation of technologies, should be seen in the context of the substantial replacement programme that is necessary with an ageing stock of power generators expected to be replaced in the coming years.

Box 6. New material based efficiency improvements for coal based generators.

The EU AD700 project is a project where most major European power companies participate. The project aims to increase fuel efficiency, thereby reducing CO_2 emissions. To this end, new materials are being developed such as nickel and high-alloy steels that can be utilised in the manufacture of power station boilers, allowing them to operate at temperatures of up to 700°C. This will make it possible to raise the steam pressure in the boilers, leading to increased production of electricity and heat without increasing fuel consumption. Implementation of the AD700 technology can provide CO_2 reductions of 13-18 per cent per MWh and a corresponding reduction in fuel consumption compared with the most efficient existing EU coal fired power plants.

If the project progresses well the AD700 project could start around 2010 with the construction of a 400 MW Full-Scale Demonstration Plant (FSDP) somewhere in Europe. Some 3.5 years would be needed for construction and commissioning and afterwards two years of operation would be needed to pick up operational experiences.

Source: DONG Energy(2006) and www.dongenergy.com.

[32] www.vgb.ong/research_project220.html

Second, estimates suggest that the technology of CCS may become economically viable at CO_2 allowance prices of 25 € / tone in 2030[33]. CCS is a technological process that separates the carbon dioxide from the gases produced by large stationary power plants, compresses the CO_2 and then transports it to a location where it can be stored in geological formations or in the ocean. Some legal, geological and technology barriers to successful exploitation of CSS are described in Box 7.

Box 7. CCS technology, exploitation, and research in the EU.

CSS is an approach to mitigating global warming by CO_2 from large point sources such as power plants and subsequently storing it instead of releasing it into the atmosphere. CCS applied to a modern conventional power plant could reduce CO_2 emissions to the atmosphere by approximately 80-90 per cent compared to a plant without CCS. Capturing and compressing CO_2 requires much energy and would increase the fuel needs of a plant with CCS by about 10-40 per cent. These and other system costs are estimated to increase the cost of energy from a power plant with CCS by 30-60 per cent depending on the specific circumstances.

EU Research on CCS

In the European Union, there are numerous projects examining different aspects of CCS - into aquifers or with enhanced oil recovery. The main EU funding mechanism for research, technological development and demonstration is the Framework Programme (FP) which is mainly implemented through calls for proposals.

The Sixth Framework Programme (FP6, 2002-2006) differs significantly from previous ones. A key difference is its role in contributing to the creation of the European Research Area (ERA) in sustainable energy systems. To ensure concentration of effort and maximise the impact of the programme, the intention is to focus research on a limited number of priority topics. Five projects on CCS were selected for EC funding in this area, with a total EC contribution of up to €35 million.

Inside FP6 The European Commission, the European energy industry, research community and non governmental organizations have together established a European Technology Platform on Zero Emission Fossil Fuel Power Plants to unite all key stakeholders in this field. Within the corporation, major energy companies involved in coal-fired generation announced their plans to build 10-12 large-scale demonstration plants testing various ways of integrating CCS in coal- and gas-fired power generation.

Legal and geological barriers to implementation of CCS technologies

Geological: Safe permanent storage must be exploited. Additional demonstration is essential to better understand and validate CO_2 storage retention in different geologic formations and to develop criteria to select and rank appropriate sites. Limited storage possibilities may be a problem. Estimates suggest that global geological storage potential equals at least some 80 years current emissions.

Legal: CO_2 storage project investors require rules that establish clear rights and responsibilities relating to access to the property and that clarify their responsibilities pre- and post closure. Important work is underway to establish methods for including CCS in the United Nations Framework Convention on Climate Change additional work may be helpful to advance CCS in the Kyoto Protocol context as well as in national and regional emissions trading systems.

Source: IEA (2004), OECD/IEA(2004c), DG Research(2004), IEA (2006b).

Some barriers may slowdown or, in worst case, block the right amount of support to the technological development and implementation of cleaner coal fired power plants. In this section we focus on economic related barriers.

The still incomplete internal market integration of electricity markets in EU reduce the pressure to phase out coal fired plants with low efficiency. Despite good progress, there is still substantial lack of integration, reflecting a regulatory framework that is still too weak. The proposed Third Energy Liberalisation package from the Commission from September 2007 intends to bring this process further. See Box 8 on the progress in establishing an internal market in electricity.

[33] IEA(2007a)

Box 8. Internal market liberalisation for electricity, including 3rd liberalisation package.

Despite substantial progress over the last decade, there is strong evidence that the functioning of the European internal market for electricity could be improved through closer integration of national and regional markets in order to enhance competition and hereby reduce cost of supplying electricity in Europe.

The Energy Sector Inquiry, initiated by the Commission and finalised spring 2007, states that the objectives of market opening has not yet been achieved and despite the liberalisation of the internal energy markets, barriers to free competition remain. Other studies have shown that there are serious congestion problems – in other words problem with handling major flows of energy across neighbouring energy areas – in many parts of EU.

One main explanation for the need of further progress towards a complete market opening is lack of unbundling between the network activities (TSO) and the commercial activities (generators). Only some of the EU25 countries have implemented full ownership unbundling. Access to the network (the market place) is cruel to efficient market functioning. One issue related to network access is cross border trade. Resistance from the incumbent actors (in transmission and generation) in some countries means lack of proper congestion management and therefore lack of proper access to the network inside the country from outside competition.

To push for further market opening and hereby further market integration through i.e. improved congestion management, the Commission has in adopted a 3rd liberalisation package in September 2007. One of the concrete main proposals is a suggestion of effective separation between network ownership and generation – ownership unbundling. In addition the Commission suggests a second option to let the network only be operated by an independent system operator (ISO). This means that the ownership of the network is maintained in the commercial company, but operation is managed by an independent company.

Source: DTI, Copenhagen Economics(2007), ECFIN(2007), COM(2006) 851 Final, MEMO/07/1361(2007).

As CCS plants in all projections will generate energy at higher costs than well performing ordinary coal plants, the success of CCS depends also on the functioning of the ETS. A high price of emission allowances is the single most cost efficient market based way to promote cleaner coal production due to the explicit pricing of CO_2 facing the owners of coal fired power plant. The emission of allowances in the period 2005-2007 has not presented much of strong signal while the more tight allocation for 2008-2012 is a step in the right direction as discussed above.

Finally, policy initiatives in adjacent areas – for example the level of support for renewable – do influence investment and development of cleaner coal technologies. If such policy initiatives are difficult to predict, the investment climate might be damaged and result in lack of proper level of clean coal investments. This should be seen in the context of CSS plants being likely to cost hundreds of millions per plants and with the profitability of the investment depending on market conditions over many decades.

The EU Commission[34] recognises that coal is a key contributor to EU power generation and will remain so for many decades to come. The EU therefore needs to develop technological solutions for sustainable use of coal not only to retain coal in the European energy mix but also to ensure that growth in coal use will be possible without damage to the climate. This is also recognized inside the Framework Programme (FP) where further development of more efficient coal fired plants and CCS is supported.

[34] EC (2006h)

The Commission's main actions are therefore to *firstly* increase the funding for R&D, making the demonstration of sustainable fossil fuels technologies one of the priorities for 2007-2013. *Secondly,* to determine the most suitable way to support the design, construction, and operation by 2015 of up to 12 large-scale demonstrations of sustainable fossil fuels technologies in commercial power generation; and *thirdly,* to assess whether new fossil fuels power plants use best available efficiency technologies, and if not equipped with CCS, whether new coal- and gas-fired installations are prepared for later addition of CCS technologies ('capture ready'). If this turns out not to be the case, the Commission will consider proposing legally binding instruments as soon as possible, after a proper impact assessment.

The EU initiatives and support for CCS will be crucial due to R&D, legal, technological and economic barriers. The high cost and risk associated with the development of CCS means that no private investor will take action alone; hence, development should be supported by the Community.

Mandatory CCS on new coal fired power plant or maximum allowed CO_2 emissions per MWh is not recommendable. CCS might not in every case be the best solution in terms of economic efficiency. A better solution is to create the right economic incentives through efficient market design to promote efficient investment decisions. This can e.g. be done through ETS and a truly integrated internal EU energy market.

Compared to the initiatives and the general debate on renewable energy until now, only limited policy actions has been taking in EU on cleaner coal. But the EU recognition that coal is unavoidable in securing energy supply and the potential for reduction for coal initiated CO_2 emission is very positive.

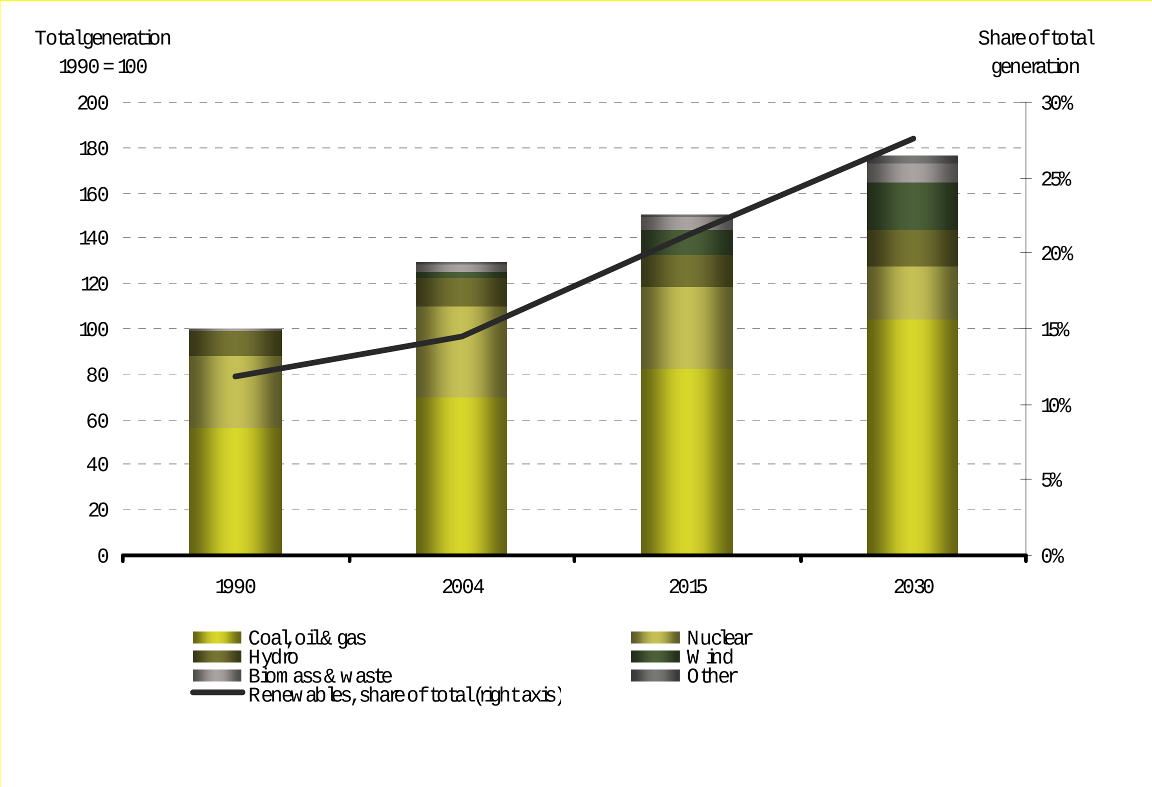
3.2 Renewable energy

EU has put an indicative target on the share of power generated from renewable energy sources. In the 2001-Directive on renewables, an indicative target of 21 per cent of total power generation shall be supplied from renewables in 2010 (ex. nuclear power generation). In addition to CO_2 reduction, an increase in renewables will also contribute to the EU objective of more secure energy supply. This is also recognized in the 2006 Green Paper and the 2005 Communication from the Commission[35].

The goal of 21 per cent in 2010 is unlikely to be met. The share of renewables in power generation was 14 per cent in 2004 with current policies and efforts in place. Unless current trends change, the EU will probably achieve 19 per cent by 2010 cf. Figure 7.

[35] EC (2006l) , EC(2005e)

Figure 7. Actual and expected renewable and fossil power production in the EU.



Note: Forecast is based on the IEA baseline scenario from WEO 2006

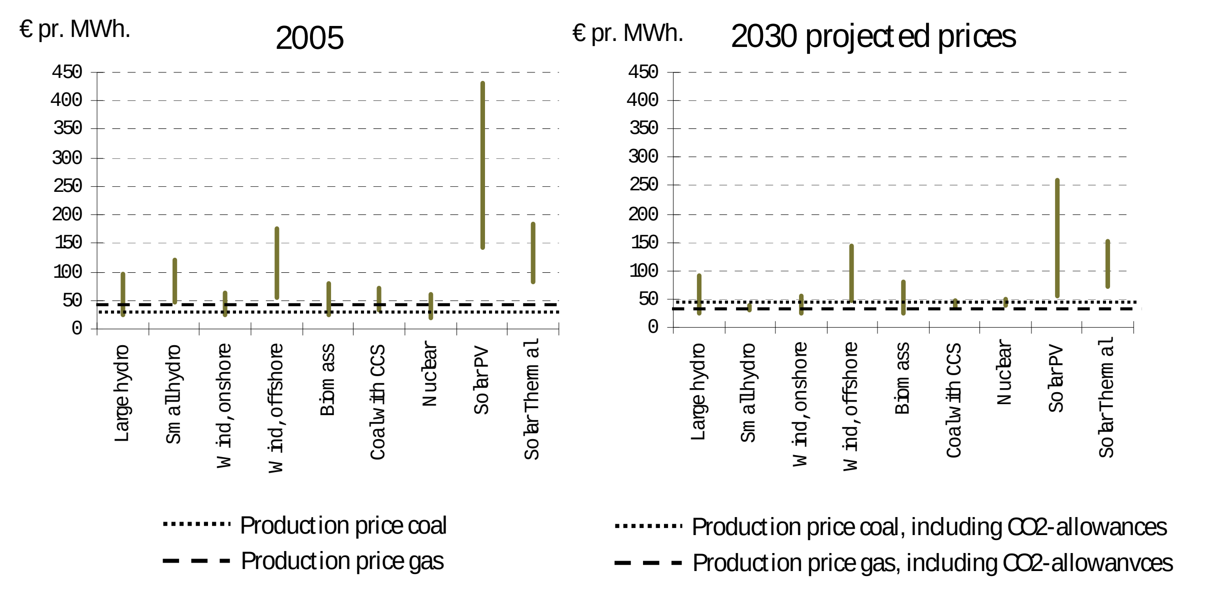
Source: IEA(2006a).

Since the mid-1990es, investments have mainly occurred in wind turbines and biomass. This investment increase is especially pronounced after 2001. Hydro Power capacity has not increased during the last 10 years. Hydro Power currently supplies 65 per cent of total renewable power generation in EU, but the share is expected to decrease due to the saturated character of hydro power (saturation refers to the fact that attempts to expand hydro will be severely limited by capacity limits defined by nature as well as environmental concerns such as effect on landscapes.

3.2.1 Barriers

While renewable energy is currently driven by national subsidy schemes because it is not yet able to compete with fossil fuels, renewable energy may become increasingly economically viable over the coming decades. This is due to advances in technology making it cheaper to produce renewable energy as well as expectations of rising energy prices. Electricity based on biomass, wind on shore and hydro power may in optimistic scenarios with strong technological advances, provide electricity at the same or lower costs as coal today that is around 40 € / MWh cf. Figure 8. But it is also important to stress that the estimation of cost ranges – especially for off-shore wind – is rather huge; indicating that predicting the winners is not an easy task.

Figure 8. Total electricity cost for power generation technologies.



Note: Total production costs are the sum of operation cost and cost of capital. Cost for coal and gas is calculated as the simple average for minimum and maximum generation costs in the data source. In 2005 no ETS allowance price is included. This is in line with the negligible price on CO_2-allowances in the ETS NAP I-period. In 2030 the projected price is added 21 € pr. tone of CO2 emissions for coal and natural gas. There is no precise knowledge of the future CO_2-qouta prices, but in EU there seems to be a general understanding of a price between 10 and 30 € / tone. On the future market for 2010 quotas the price today is slightly over 20 € / tone.

Source: IEA (2006a), IEA (2007a).

Especially off-shore wind technology will therefore need more 'help' from a stringent ETS, punishing fossil fuels in order to be economically viable. A more stringent ETS will increase the price of CO_2 allowances increasing the cost of coal fired plants. This will make off-shore wind technology more competitive compared to coal fired plants.

The future expansion of renewable energy sources faces at least five barriers in addition to the costs barriers analysed above:

First, most of the currently available technologies are often constrained by limits put in place by nature. Generation costs from large hydro power projects may be full competitive with coal even without any 'help' from the ETS (generation costs for large hydro may be as low as 24 € / MWh against 28 for conventional coal today). But expansion of hydro will be severely limited by capacity limits defined by nature as well as environmental concerns (effect on landscape etc.). In addition, fewer places than for conventional power generation are appropriate for locating wind turbines. This entails that the energy has to be exchanged between different geographical areas in order to secure an efficient utilization of wind power.

Second, power generation from wind turbines, and partly hydro is highly unpredictable and depending upon weather conditions. Unpredictability entails a need for balancing power from operational generation reserves where lack of e.g. wind entails a need of costly back-up reserves. To a certain degree the two types of reserves will be supplied from the same generator (coal or gas), as discussed in Box 9 below. The importance of this issue should be seen in the context of generation from wind turbines being expected to deliver the main increase in renewable power generation in EU up to 2030. A challenge will therefore be how to integrate highly volatile and unpredictable electricity produced by wind turbines.

Box 9. Reserve capacity in power systems with wind turbines.

In a power system with high wind shares, access to additional adjustable power generation is pivotal for two reasons:

Firstly, the simple fact that wind turbines does not generate any power at zero, low or very high wind speeds. In these cases the power needs to come from somewhere else.

Secondly, wind forecasting is still poor when it comes to forecasting one day ahead. The gab between the forecasted generation and actual output from the wind turbines has to be absorbed in one way or another. Operational reserves are needed. Due to the unpredictable of generation from wind turbines, economic efficient integration of wind turbines require access to cost effective balancing power. Balancing power may either by supplied inside the areas of control or sources from neighbouring market areas, integration of balancing markets. In the liberalisation process up until now focus has been on the day ahead spot markets. Market players are now able to trade day-ahead power across the European borders (albeit the trade can be improved on many borders). But a greater focus has to put on balancing markets in order to decrease the cost of balancing power. If wind energy is to increase its share in total generation of electricity these problems are going to mount in importance

Source: IEA(2007a).

The inherent problems associated with this volatility are compounded in many parts of Europe by weak interconnection across borders and regions. One way of reducing costly back-up capacity and increase the economic viability of wind energy is to import electricity when there is weak local supply from wind mills and export wind energy rather than dump in on the local market when surplus electricity is generated. The congestion problems and lack of trade possibilities of balancing power across Europe reduce the options for such trade in energy when demand and supply fluctuates. Both Danish and UK operators have faced congestions problems when trying to export electricity to respectively Germany and Belgium in situations with abundant supply of energy from windmills[36].

Third, the potential use of biomass for power and heating – bioenergy – may be reduced due to legislative barriers as well as the use of biomass for biofuels which has pushed up prices of biomass. Biomass used for power and heat generation and biomass used in the transport sector is mutually sourced from agriculture and forestry. Therefore the cost of bioenergy is linked to how much biomass is used for biofuels production as supplies are limited.

Co-firing of i.e. biomass and coal is a low-cost and low-risk way of adding biomass capacity. Co-firing systems that use low-cost biomass supply can have payback periods as short as two years[37]. In addition, biomass can substitute up to 15 per cent of the total energy input in a power plant, often with few modifications other than the burner and feed intake systems. However, legislation and rigid renewable subsidy schemes may be an obstacle to increased use of biomass in co-firing with coal. Denmark has a high degree of renewable power generated from biomass, but the main coal fired power plants are not allowed to use biomass in co-firing with coal[38].

Fourth, the expected cost-efficiency of solar energy in 2030 is not very promising, see Figure 8. The IEA forecasts solar to play a minor role compared to other renewable technologies. According to their projections, the share of solar is expected to be 1 per cent compared to wind's 12 per cent of total generation in 2030.

[36] IEA (2007a) and DTI (2006)
[37] Compared to other renewable technologies, the capital cost of co-firing is among the lowest.
[38] See the Danish Energy Authority on subsidies for biomass on the main power plants http://www.ens.dk/sw23705.asp

This is mainly due to the high generating cost for solar energy. Solar energy suffers from the same variability in generation as wind turbines. However, solar electricity supply fits well with demand wherever peak demand occurs during daylight hours. Further concentrating solar power plants can provide electricity especially in areas with long and reliable hours of direct sunshine. In these areas peak demand is usually driven by air-conditioning systems and the availability of concentrating solar power matches peak and mid-peak demand well.

Fifth, the economic promotion of renewable energy has often relied on national subsidy schemes not always in line with idea of an internal market approach. An example is the key instrument in many Member States to reach targets for renewable energy, namely so-called Public Service Obligations. These mandate consumers to purchase a minimum share of renewable electricity but in certain cases only allowing consumers to credit purchase of such ‘green’ energy from national sources. As explained in Box 10 below, rulings by the court of justice has effectively prevented the EU commission from taking action to insure that green energy produced in other countries can be counted as renewable energy in such PSO schemes.

Member States have a somewhat legalistic argument for keeping out imported green energy as such energy is not credited towards the renewable energy targets defined in the electricity directive. Only energy produced within borders is included, not the energy consumed. Consequently, the combination of distorting PSO schemes and a production-based definition of what counts drives up consumer costs[39].

[39] Estimations done by the Danish Energy Association (2007) suggests that forcing an increase in the share of renewables of 13 percentage-points (21 per cent to 34 per cent) equally across EU25 Member States may cost up to €180 billion per year. In contrast, by letting investments in renewables take place where conditions are optimal, the same 13 percentage point rise may only cost around €33 billion per year.

Box 10. National PSO systems: Lack of internal market in the support of renewable energy

A large number of EU countries have so-called Public Service Obligations in place that obliges consumers to purchase electricity from renewable energy resources at a given price. This is often the preferred method of meeting the obligation of the directive on renewable electricity.

Electricity consumers pay a tariff beyond the pure market price of electricity. These tariffs on consumption are effectively turned into subsidies and/or guaranteed minimum prices to producers of renewable energy. The support schemes differ among Member States but all in all, the schemes entail an extra payment to renewables that could not be obtained under normal commercial circumstances and the support schemes are often restricted to credit only national sources of renewable energy.

PSO schemes are not considered covered by state aid rules, despite the fact that the schemes are mandatory and that they to a large extent has the same material effect as a classical subsidy over the budget. This follows from a ruling by the EU court of Justice (ECJ). The case treated the German support scheme Stromienspeisunggesetz. ECJ stated in the case C-379/98 Preussenelectra Aktiengesellschaft v. Schleswag Aktiengsellschaft:

…that the purchase obligation combined with the minimum setting of prices does not imply a transfer , either directly or indirectly , of State resources , since the payment of those purchases go directly to the producers of renewable electricity and does not originate from the State or from a public or private body designated or established by the State

...that the question whether it is incompatible with Article 28 EC Treaty (on free movements of goods) depends on the aims of the Stromienspeisunggesetz and the particular features of the electricity market. Due to the need of promoting renewables and that the German policy also is designed to protect human, animals and plant the German legislation is not incompatible with Article 28 EC treaty.

As the PSO systems are not covered by state aid rules, Member States can require that only nationally produced renewable energy can be counted under the PSO obligation which is not an option in budget based subsidy.

Source: EC(2005h), Case C-379/98 (2001).

3.2.2 Assessment and conclusion

The promotion of electricity produced from renewable energy sources has mainly been driven by the directive on renewals[40]. It leaves a substantial amount of latitude to Member States as to precise instruments to put in place, but allows specifically subsidy schemes to encourage production and development of renewable electricity see Box 11.

In the short term, it would be natural to allow cost-effective expansion of those renewable energy sources that are already economically viable. Action could focus on:

Breaking down barriers to trade coming from weak interconnection of electricity across borders, which is particularly problematic given the expected expansion in wind energy.

Reviewing the current practice of reviewing compliance with renewable energy targets following production rather than destination principle

Examining the justification of not allowing foreign green energy to be counted in domestic PSO systems.

Ensuring that current support to renewable generation is consistent with the development of a true internal market with one price for electricity. This will make the present national PSO system more difficult to operate as the option of pushing up general retail electricity prices will no longer be possible due to the possibility for cross border trade.

[40] Directive 2001/77/EC.

Box 11. EU directive on promotion of electricity produced from renewable energy sources.

There are many policy actions put in place to support the promotion of renewable energy in the EU power system. In this box we line up the most prominent initiatives.

Member States are required to promote electricity produced from non-fossil renewable energy sources (such as wind, solar, geothermal, wave, tidal, hydroelectric, biomass, landfill gas, sewage treatment gas and biogas energies) with an indicative target of 22 per cent in the share of EU power production to be reached by 2010 (currently: 15 per cent).

Member States shall take appropriate steps to encourage greater consumption of electricity produced from renewable energy sources in conformity with the national indicative targets.

In addition to the requirement for national indicative targets, the Directive lays down practical requirements for Member States in four areas. These are designed to ensure stable investment conditions for electricity from renewable energy:

- the implementation of attractive support schemes, which should be as efficient as possible,
- the removal of administrative barriers,
- the guarantee of fair grid access,
- issuing of a guarantee of origin.

Source: Directive 2001/77/EC.

In a longer term perspective, most estimates show that renewable generation will be increasingly viable if fossil fuels remain at prices close to present levels. However, there is substantial uncertainty as to relevant merits of the competing technologies. This suggests that renewable energy can largely be delivered by assisting market forces, with a focus on:

Signalling EU commitment to make use of market instruments, such as ETS with sharper reductions of allowances than in present period, to underpin investments in the development and deployment of renewable energy

Use support instruments that do not unduly favour specific generating technologies, e.g. national schemes supporting certain types of wind turbines. Support schemes can gradually move from an RD focus with diffusion of results to encourage a next step where products come nearer the market and where private market participants must shoulder a larger share of development costs. This is fully in line with the revised guidelines for state aid in the EU.

3.3 Energy savings

To reduce the EU's emissions of CO_2 as well as its dependency on imported energy, the EU has put in place a number of targets and policies to save energy. As regards targets, the European council endorsed in March 2007 the aim of increasing energy efficiency. A main focus area is to improve energy efficiency for electric consumer appliances and the operation of buildings which accounts for a very substantial part of total energy consumption. Electric consumer appliances such as white goods, televisions, cooking appliances, PCs account for 15 per cent of total electricity consumption in OECD countries[41]. The energy consumed in buildings account for 40 per cent of final energy consumption in the EU countries (heating, lighting)[42].

A comprehensive framework of directives and regulations to improve energy efficiency in energy-using products, buildings and services is in force in Community law and constitutes the legal foundation for reaching the saving potential. In our review below, we will focus on three types of instruments from the Commissions 2006 Action Plan to encourage energy efficiency, see Box 12 below.

[41] OECD (2006c)
[42] OECD (2003)

– Labelling: the marketing of a particular product must be accompanied by information to the consumer about use of energy under specified circumstances.

– Minimum standards: products can only be marketed if they fulfil some minimum standards for energy efficiency.

– White Certificates: a proposal to create a market for energy savings.

As regards labelling and setting minimum standards, there are two critical issues we would underline:

– Achieve consistency with other climate change instruments and avoid overlaps

– Ensure compliance with internal market and external trade objectives

There is a potential risk of counterproductive effects from overlapping instruments. As underlined in this study, new policy measures aimed to reduce energy use on top of the newly established ETS can have unfavourable consequences. Raising minimum standards for electric consumer appliances will not reduce CO_2 emissions from electricity use as these emissions are largely determined by the amount of CO_2 allowances. Moreover, the key purpose of the Emission Trading System is to ensure that marginal abatement costs of reducing CO_2 are equal across different kinds of energy use. Setting different kind of minimum standards for different products thus risk undermining the very purpose of the Emission Trading System[43].

The conclusion in our view is therefore that labelling has a much stronger role to play than minimum standards. Labelling is the practical instrument that allows consumers to choose the products and services that has the lowest energy costs in use. If consumers can effectively reduce their energy costs by choosing the energy efficient products, then the actual costs of dealing with climate change becomes smaller. This in turn, allows EU to be more ambitious in setting climate policy goals.

In contrast, imposition of minimum standards should be treated more carefully. Within EU standards have more of a role to play for energy uses that are not covered by the ETS. The EU's expected revised standards for domestic heaters and boilers based upon energy sources such as gas and oil directly purchased by households themselves is a clear example. The issue here is whether minimum requirements are a better alternative than for example higher energy taxes on such energy use. Moreover, the imposed standards should be regularly reviewed in view of technology developments to insure that marginal costs of meeting standards for different producers and different products are broadly equal.

[43] The risks of counterproductive effects with overlapping instruments of this nature are highlighted in a recent study from OECD (2007).

Box 12. EU legal initiatives on energy savings and energy efficiency.

The 2005 Green Paper on Energy Efficiency points to the fact that the EU could save at least 20 per cent in 2020 compared its present energy consumption in a cost-effective manner. A comprehensive framework of directives and regulations to improve energy efficiency in energy-using products, buildings and services is in force in Community law and constitutes the legal foundation for reaching the saving potential. These include:

- Eco-Design Directive
- Energy Star Regulation
- Labelling Directive and its 8 implementing Directives and Energy Star regulation
- Directive on Energy End-Use Efficiency and Energy Services
- Energy Performance of Buildings Directive
- Combined Heat and Power (Cogeneration)

The directives and regulation covers all aspects of energy efficiency. Energy efficiency is first and foremost a matter of controlling and reducing energy demand, although legislations cover both energy consumption and energy supply. The measures used are labelling and minimum requirement standards to products and buildings.

The 2006 action plan for Energy Efficiency: Realising the Potential (COM(2006)545) put forth priority actions to reach further goals. Most important actions are:

Appliance and equipment labelling and minimum energy performance standards for appliances. On the basis of the Labelling and the Eco-design Directives the Commission has in 2007, begun the process of adopting minimum energy performance standards (eco-design requirements) in the form of implementing Directives for 14 priority product groups including boilers, water heaters, consumer electronics, copying machines, televisions, standby modes, chargers, lighting, electric motors and other products

Under the Directive on Energy Performance of Buildings the Commission will propose expanding the scope of the Directive to include smaller buildings, by lowering significantly the current threshold from 1000 m² for minimum performance requirements for major renovations to include a majority of existing buildings. In 2009, it will also propose EU minimum performance requirements for new and renovated buildings (kWh/m²) and for components, such as windows.

Under the Directive on Energy End-Use Efficiency and Energy Services the EU Commission has prepared a scheme for so-called white certificate. These are systems where suppliers or distributors are obliged to undertake energy-efficiency measures for final users. Certificates corroborate the amount saved, giving both energy value and lifetime. Such certificates can, in principle, be exchanged and traded. Trade secures that savings will take place at a least cost dispatch. But in order to secure that actual trade will take place the white certificates needs to have a positive price, scarcity has to be created. If the contracted parties cannot then submit their allocated share of certificates, they can be required to pay fines that may exceed the estimated market value.

In the framework of the implementation of the Directive on the Promotion of Cogeneration, the aim is to raise overall efficiency from power generation. Combined heat and power production (CHP) will raise the efficiency compared to individual production of both items. There is scope for reducing losses in distribution networks. To date, only around 13 per cent of the electricity consumed in the EU is generated using this technology.

Source: EC(2005c).

Finally, the standards may have most de facto effect where consumers do not go for obvious costs savings despite clear labelling. This may because electricity costs form only a minor part of the total user costs for a given product or because the consumers bearing the costs are not making the decision about which product to buy[44].

[44] A recent study highlights that particularly within the area of operation of buildings, such split of incentives can have a significant impact: A developer of a building may focus more on total construction costs than the potential of reducing long term running costs of a building by choosing the most energy efficient solutions. While this incentive problem should ideally be solved by a good contract design, it often does not take place (OECD (2007h)).

The second issue is the effect on the internal market and trade friction with the EU's trading partners. The global market for consumer appliances is large and growing, with cross-border within the EU and between the EU and trading partners also considerable. In this context, it is obvious that a proliferation of standards, with countries or regions setting standards potentially favouring domestic products, could hurt competition and consumer choice.

For the EU, it is preferably to have a policy of commonly set standards rather than a multitude of national standards and in this respect the approach from the Commission with more stringent but also common EU criteria is much to be preferred to a development where individual Member States set their own standards. This applies to labelling as well as to minimum standards. For the EU consumers as well as for the EU firms operating globally, it would be productive to have as many standards agreed in an even larger forum and this should be a key aspect of the EU's external energy policy dialogue with main trading partners[45].

While labelling and careful design of minimum energy standards clearly have a role to play, it is more difficult to see benefits from so-called white certificates. The idea is to create a benchmark of minimum energy savings required for each firm for example on a yearly basis. Thus who save more gets credits, thus saving less will have to buy these credits. It thus creates a market for energy savings just as the Emission Trading System creates a market for trading in CO_2 emission.

However, the system will have little or no effects on CO_2 allowances while creating non-trivial compliance costs for firms. The compliances costs arise from the needed establishment of base lines against which to define energy savings. Most industries are improving efficiency standards all the time, but the scope for continued improvement differs considerable across sectors. So the baseline will have to be defined industry by industry or even firm by firm. As most of the energy savings are likely to come from energy sources covered by the ETS, the addition of a White Certificate Scheme would hence have no impact on CO_2 emissions for firms within the ETS covered sectors. However, it would add non-trivial compliance costs for firms and authorities to the operation of the EU's energy policies as baselines have to be defined and savings to be verified[46].

3.4 Conclusions

There are number of policies that could help the EU achieve its ambitions of reducing CO_2 emissions and support the development of secure energy sources for the production of heating and electricity which has been the focus of this chapter. We focus on a set of policies.

First conclusion is that a tight allocation of emission allowances to ensure reduction of CO_2 emissions in the coming years is also the most cost-efficient instrument to encourage the development of new technologies, such as cleaner coal and renewable energy. The EU's commitment to further reductions post 2012 will help establish credibility that carbon will be priced high in the future and create incentives to invest now.

Second, there are significant internal market barriers to expansion of renewable energy sources which are economically viable already today. These barriers are linked to weak interconnection of often nationally segregated electricity markets as well as national support instruments favouring nationally produced energy. The Third Energy Liberalisation package of the Commission may be helpful, as the weak interconnection presently is connected with the protection of national electricity markets.

[45] A recent study looks particularly on energy standards from a trade policy perspective highlighting some of these issues (IEA/OECD 2007).
[46] See also: Nera (2005)

Thirdly, labelling of energy efficient products can help consumers buy the most energy efficient products. This is natural counterpart to the use of market based instruments such as ETS that puts a higher price on the use of fossil fuels and can help reduce the costs for consumers of dealing with climate change. Minimum efficiency standards can be a helpful supplementary tool particularly when it is focused on products where market based instruments provided limited incentives to savings in practice. But care should be taken not to create unproductive overlap with other climate policy instruments, such as the ETS. These issues could be looked carefully at in the upcoming discussions on labelling and efficiency standards.

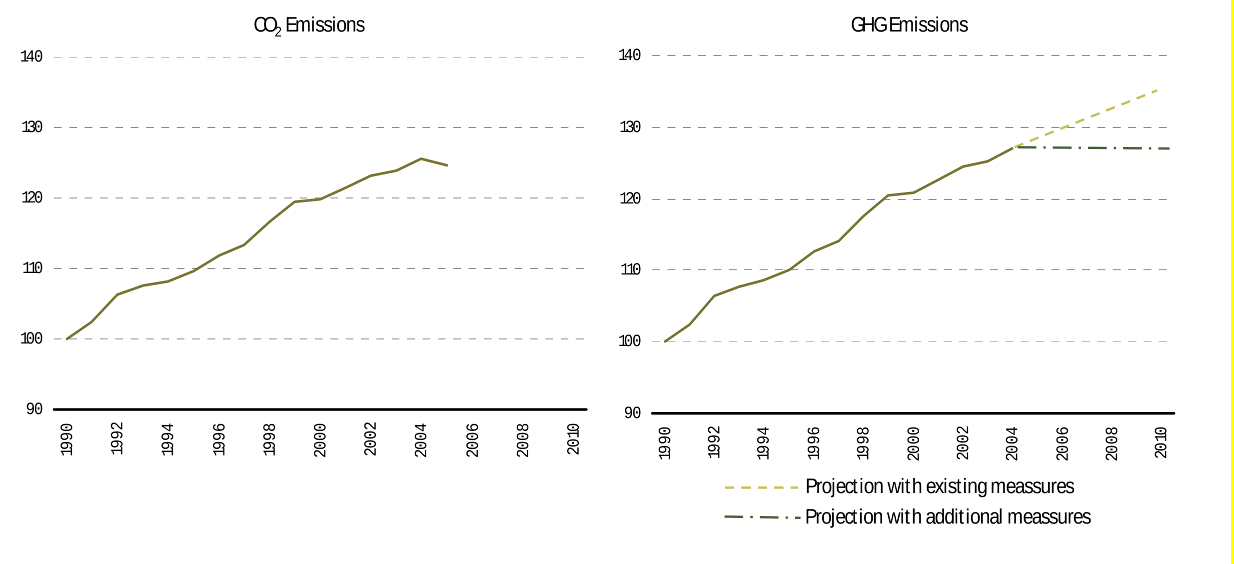
Fourthly, there is good evidence that low fossil sources of energy will become increasingly viable in the coming decades, but considerable uncertainty about which technologies that will become most effective. For thus technologies which at present a very far from being commercially viable, support instruments could focus on research and development and development of demonstration projects rather than binding, large scale commitments that may prove very costly.

4. INSTRUMENTS TARGETING ROAD TRANSPORTATION

This chapter addresses the challenge of reducing CO_2 emissions from passenger cars. The road transport sector plays an important role in reaching the Kyoto target of reducing CO2 emissions by 8 per cent between 1990 and 2008-2012.

The reason is that road transport is a strong emitter of CO_2 gasses, responsible for around 20 per cent of the total EU15 emissions in 2005. Furthermore, CO_2 emissions have risen at a steady rate by around 25 per cent during the past fifteen years. Projections from 2006 by the European Environment Agency (EEA) suggest that emissions will continue to increase, cf. Figure 9.

Figure 9. CO_2 and GHG emissions, respectively, EU15.



Note: Projections for GHG emissions refer passenger and freight road transport. The projections are based on individual Member State projections and include EU as well as national initiatives.

Source: EEA(2006).

Reducing CO_2 emissions, and therefore fuel consumption, is also important for energy security. Road transport consumes around 60 per cent of all the oil consumed in the EU[47], and the majority of this oil comes from politically unstable parts of the world[48].

So the question is how to reduce emissions in the best way.

Basic economic principles on public intervention suggest addressing an externality – in this case CO_2 emissions from driving a car – as close to its origin as possible as such approach will result in the strongest impact. That translates into making it more expensive to emit CO_2, or simply putting a tax on actual CO_2 emissions. Since there is a tight link between CO_2 emissions and fuel consumption, a tax on fuel consumption based on its emission level would be equivalent to a tax on CO_2.

[47] EC (2007a), SEC (2007) 60
[48] EIA (2005)

A tax on fuel consumption making fuel consumption more expensive would combat CO_2 emissions in two ways. First, it would reduce the demand for transport (km driven), vehicle power, and weight, increase demand for more fuel efficient cars, improve on driving style, and so forth. Second, it would make alternative fuels emitting less CO_2 than petrol and diesel more competitive. This would stimulate supply and demand for alternative fuels eventually reducing the market share of petrol and diesel.

Hence, rising oil and fuel prices during the past ten years have actually put a lid on emissions, and, if the predictions of future high oil prices turn out to be true, will continue do so in the future (we will look more at oil prices later in this chapter). Nevertheless, road transport emissions have de facto risen during the past decade; even during times of rising oil price. The implication is that consumers do not react strongly enough to the current oil and fuel price levels compared to what we would like them to in order to reduce emissions from cars: consumers keep buying cars that are not fuel efficient enough, they drive too much and perhaps not economically enough, and consumers do not demand alternative fuel sources.

The solution is to tax fuels harder thereby raising fuel prices. However, as Member States set fuel excise duties, and not the EU, it is not obvious that direct EU intervention would work particularly well.

Below we present the most important EU initiatives aimed at reducing CO_2 emissions from cars. We will argue that some of the initiatives may have only limited merit, and that a more effective solution is probably to tax fuels harder. We therefore look at what the EU can do to encourage Member States to increase fuel taxes. We find that border problems may pose a serious problem for Member States wishing to raise fuel taxes. Consequently, we believe that the EU could look into raising the minimum fuel excise duties.

4.1 New strategy to reduce CO_2 emissions from new cars

In 1995, the Council and the European Parliament approved a Community Strategy to reduce CO2 emissions from passenger cars[49]. The Council foresaw three inter-related policies, which, when taken together, would reduce CO2 emissions to an average level of 120 g/km for newly registered cars by 2012. The three elements were 1) a voluntary agreement with the car manufacturers to 'commit the industry to make a major contribution' to the 120 g/km average standard; 2) a CO2 information and labelling scheme directed at consumers; 3) an increase in the use of fiscal instruments.

The voluntary agreement was assumed to deliver the bulk of reductions in CO2 emissions. However, the Commission has recently concluded that the agreement is not successful.[50]

In February 2007 the Commission therefore launched a new strategy to reduce CO_2 emissions from new cars and vans sold in the European Union[51]. The Commission's goal is to reach a CO_2 emission level of 120 g CO_2/km for the average of new cars sold by 2012 - a reduction of around 25 per cent from current levels of around 160 g CO_2/km.

The most important change compared to the 1995-strategy is that the Commission replaces the voluntary agreement with legislation on mandatory standards. The target for the standards is to reduce CO_2 emissions to 130 g CO_2/km by 2012 through improvements in vehicle technology.

[49] COM (95) 689, Council conclusions of 25.6.1996, European Parliament resolution of 22.9.1997.
[50] EC (2007a)
[51] EC (2007a)

In addition to the legislation on mandatory standards to improve fuel efficiency, the new strategy introduces 'complementary measures' to reduce emission by 10 g CO_2/km. Thus, the complementary measure is intended to bridge the gap between the target of 130 g CO_2/km to be achieved by the legislation on mandatory standards and the overall goal of 120 g CO_2/km by 2012. Box 13 lists the main measures in the new strategy.

Box 13. Main measures in the strategy to contain CO_2 emissions from cars.

Legislation on mandatory standards to reduce CO_2 emissions from new cars and vans will be proposed by the Commission by the end of this year or at the latest by mid 2008. This will provide the car industry with sufficient lead time and regulatory certainty.

Average emissions from new cars sold in the EU-27 would be required to reach the 120 g CO_2/km target by 2012. Improvements in vehicle technology would have to reduce average emissions to no more than 130 g CO_2/km, while complementary measures would contribute a further emissions cut of up to 10 g CO_2/km, thus reducing overall emissions to 120 g CO_2/km. These complementary measures include efficiency improvements for car components with the highest impact on fuel consumption, such as tyres and air conditioning systems, and a gradual reduction in the carbon content of road fuels, notably through greater use of biofuels. Efficiency requirements will be introduced for these car components.

For vans, the fleet average emission targets would be 175 g by 2012 and 160 g by 2015, compared with 201g in 2002.

Support for research efforts aimed at further reducing emissions from new cars to an average of 95g CO_2/km by 2020.

Measures to promote the purchase of fuel-efficient vehicles, notably through improved labelling and by encouraging Member States that levy car taxes to base them on cars' CO_2 emissions.

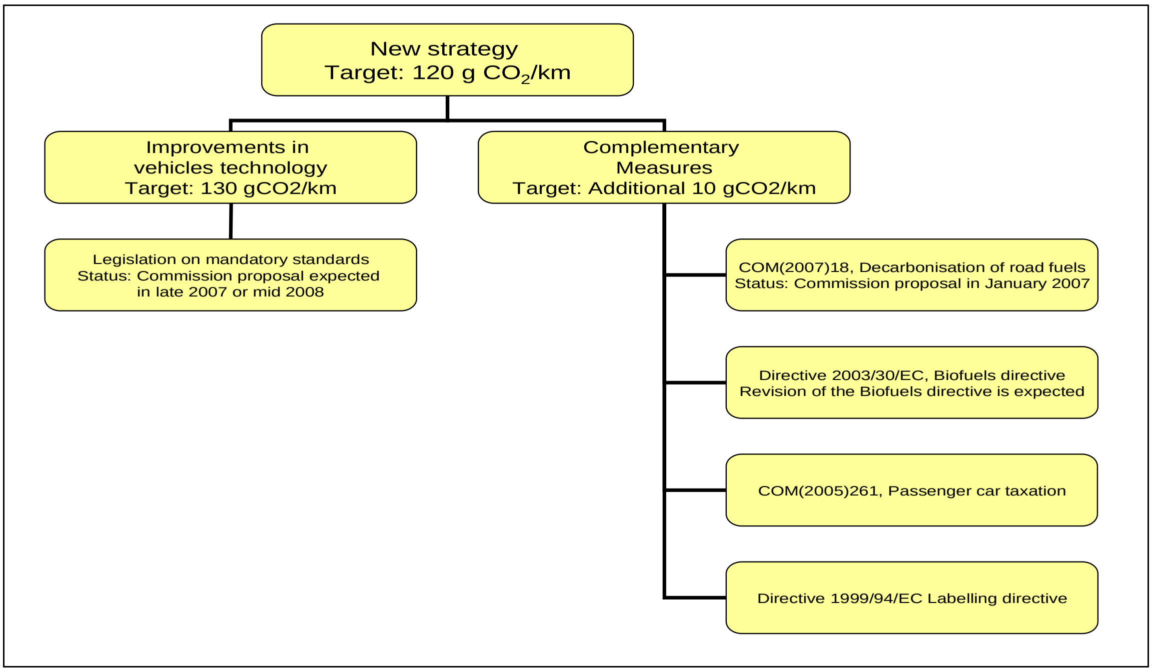
An EU code of good practice on car marketing and advertising to promote more sustainable consumption patterns. The Commission is inviting car manufacturers to sign up to this by mid-2007.

Source: http://europa.eu/rapid/pressReleasesAction.do?reference=IP/07/155#fnB3, EC(2007a).

The improvement in vehicle technology and the complementary measures are supposed to deliver the target of 120 g CO_2/km. Five directives or (forthcoming) proposals make out the core initiatives in our view, and which we discuss later in this chapter, cf. Figure 10.

The Commission believes that the new strategy will enable the EU to reach its goal of limiting average CO_2 emissions from new cars to 120 grams per km by 2012. We believe that to be optimistic. The legislation on mandatory standards which is thought to contribute the most to achieving the goal is unlikely to come into force earlier than a few years before 2012; hence, it will only have demonstrated a limited effect by 2012. Furthermore, biofuels have not become a significant fuel source in cars. It is therefore not likely that biofuels will contribute much to reaching the goal. We do not believe that the remaining initiatives are able to alter the conclusion.

Figure 10. Overview of core initiatives for reducing CO_2 in road transport.



Note: The figure shows the main (forthcoming) proposals and legislations at EU level for reducing emissions in road transport.

Source: Copenhagen Economics.

4.2 Legislation on mandatory standards to increase fuel efficiency

In its Communication COM(2007)19 from February 2007, the Commission states that it will present a proposal in late 2007 or mid 2008 on a legislation on mandatory standards with the purpose to increase fuel efficiency.

Box 14. Legislation on mandatory standards.

The Commission will propose legislation on mandatory standards, if possible in 2007 and at the latest by mid 2008, to reach the objective of 130 g CO2/km by 2012 for the average new car fleet by means of improvements in vehicle motor technology.

The Commission agrees that the legislation on mandatory standards implementing the average new car fleet target of 130 g CO2/km will be designed so as to ensure competitively neutral and socially equitable and sustainable reduction targets which are equitable to the diversity of the European automobile manufacturers and avoid any unjustified distortion of competition between automobile manufacturers.

Source: EC(2007a).

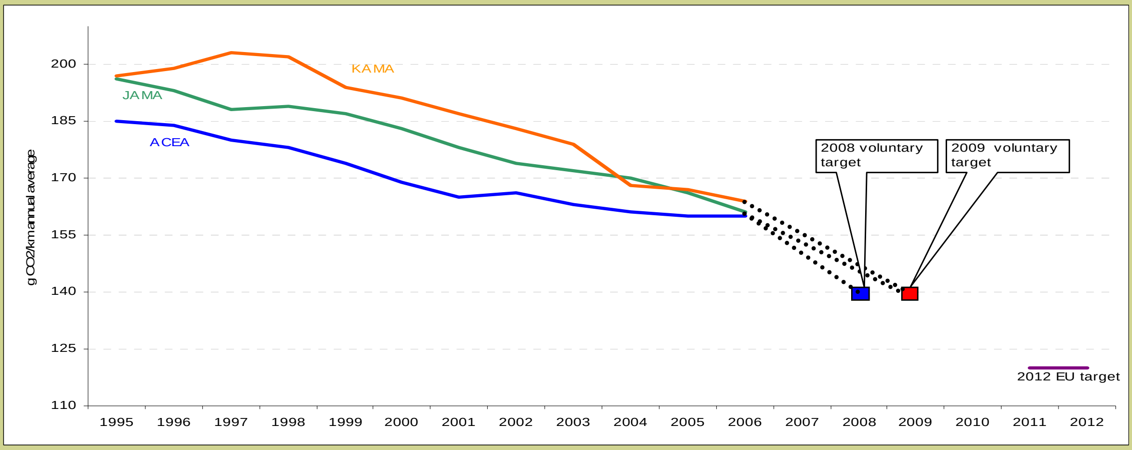
There are basically two ways to secure higher fuel efficiency in the average of sold new cars: through the supply side and through the demand side. First, producers (supply side) can increase fuel efficiency for all cars through technology improvements. Second, consumers (demand side) can choose to purchase more fuel efficient cars; for example lighter and less powerful cars.

Experience with the voluntary agreement between the Commission and associations of car manufacturers indicates that without affecting the demand side, specific targets on fuel efficiency for new cars are very hard to reach. The reason is that total of producers cannot control the mix of cars purchased by the consumers from a large number of individual companies. Box 15 explains this in more detail.

Box 15. Voluntary agreement between the Commission and automobile manufacturers.

The voluntary agreement of 1998 between the Commission and the European Automobile Manufacturers Association (ACEA) committed the ACEA to collectively achieve an emission target of 140 g CO_2/km on average for new cars sold by 2008. This target was to be attained mainly by technological development. The agreement further required the ACEA to reach the Community target of 120 g CO_2/km by 2012. Agreements have also been signed by the Japanese and Korean automobile manufactures (JAMA and KAMA respectively) to reach the 140 g CO_2/km emission target by 2009. The Commission reviewed the Community's strategy in 2005-06. It concluded that the targets would not be reached. The latest evidence confirms this, *cf.* Figure 11.

Figure 11. Development in fuel efficiency and target value

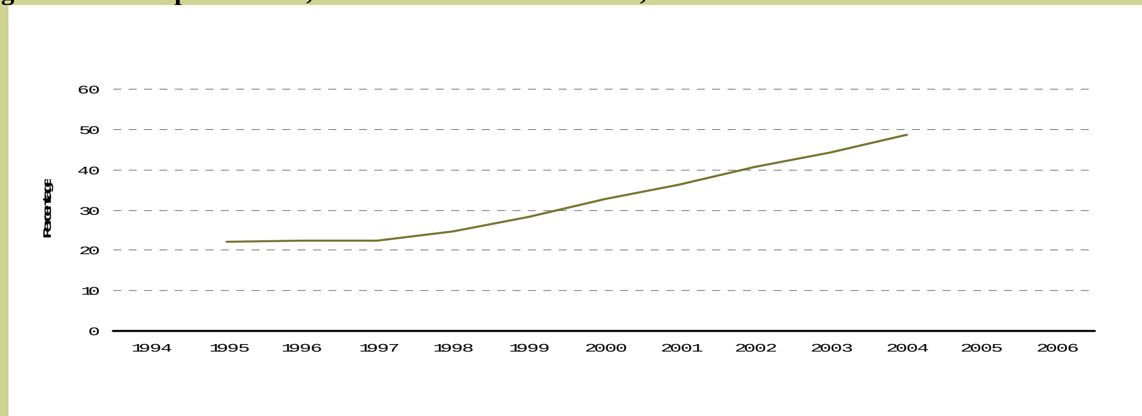


Source: EC(2006j) for the years 1995 to 2004. T&E (2007) for 2005 and 2006.

It is likely that the voluntary commitment has only delivered part of the increase in fuel efficiency during the period. The mere inspection of the historic trend in fuel efficiency since 1995 suggests that fuel efficiency was increasing (g CO_2/km was decreasing) before the 1998 voluntary agreement; at least for ACEA and JAMA manufacturers.

For such a target on fuel efficiency to be reached, high emitting cars must be priced higher compared to low emitting cars. Only in this way can demand be regulated to ensure the target is met. However, because the agreement is voluntary, no such specific instrument exists. This implies that market forces, specifically changes in oil prices, are important drivers for reaching the target on fuel efficiency. In a very recent evaluation of the voluntary agreement, Fontaras and Samaras (2007) conclude that a significant part of the reductions achieved so far is in fact due to a shift in consumer demand towards diesel vehicles. Diesel cars are more fuel efficient, typically producing 15-20 per cent less CO2 than petrol equivalents52. Diesel penetration has indeed grown dramatically since the voluntary agreement in 1998, cf. Figure 12. This increase coincides with rising oil prices since around 1999.

Figure 12. Diesel penetration, share of new diesel cars sold, EU15.



Source: COM(2006) 463

Source: EC (1999), ACEA (1998) (www.acea.be), EC(2006j).

[52] SMMT (2006)

Since the Commission has presented no actual proposal, we have instead reviewed some options on how the legislation could end up looking.

The only way for producers to make sure they reach the target of 130 gCO_2/km is for them to set prices on cars in a way that makes consumers purchase the right mix of highly fuel efficient and less fuel efficient cars resulting in an average of 130 gCO_2/km; that is, affecting the demand side. This may result in big and powerful cars becoming more expensive as car manufacturers increase margins relative to small and less powerful cars.

However, a single mandatory standard for all manufacturers would distort competition between automobile manufacturers. For example, a manufacturer, selling both small and therefore very fuel efficient cars, as well as more fuel consuming luxury cars, may have no problem adhering to the standard; while another manufacturer selling predominantly luxury cars with lower fuel efficiency would have great trouble adhering to the standard in the short to medium run. The manufacturer selling both types of cars could expand the selling of more luxury cars, even if these cars were less fuel efficient than the manufacturer just specialising in luxury cars. In contrast, the manufacturer selling only luxury cars would have to reduce sales of his most fuel consuming cars.

This suggests dividing the manufacturers into different segments each with different mandatory fuel efficiency standards. This could for example be by setting minimum requirements defined by size of motor size or weight. However, this would end up reducing the overall effectiveness of the system. The reason is that this would allow luxury cars to operate with a more lenient standard. Recently, the European Parliament has proposed a Carbon Allowance Reduction System (CARS)[53] along such lines.

A similar type of system is known in the U.S. The so-called CAFE system sets mandatory fuel efficiency standards for car manufacturers to meet, and it has been in place for the last thirty years. The US Corporate Average Fuel Economy (CAFE) Act sets minimum acceptable standards of fuel economy that the average vehicle sold by each manufacturer must meet. For passenger cars the fuel standard is 27.5 miles per gallon, (MPG). For light trucks it is less stringent (22.2 MPG). The values must be met separately by each firm's domestically produced cars and imported cars. Fines of $5.5 per vehicle for every 0.1 mpg below the established standard are levied on manufacturers failing to meet the required level.

Instead of imposing mandatory standards for manufacturers to meet, another option is a system of tradable emissions credits. An advantage of a tradable credits scheme is that an agreed target would be achieved.

Finally, the Commission will explore the possibility of including the road transport sector for the third period allocation of the ETS[54]. If in such a setup consumers will be held responsible for buying credits to meet their own emissions from driving, compliance costs will be substantial.

To sum up this discussion, we conclude that designing and implementing a system for mandatory standards will be a complex issue. And, as we have suggested earlier, it will not be as effective as increasing fuel taxes which directly targets CO_2 emissions; among other reasons because it does not affect emissions from the entire car stock, only for new cars. Recent studies evaluating the CAFE finds that reaching a specific emission target through the CAFE mandatory standards may be much more expensive than raising fuel taxes[55].

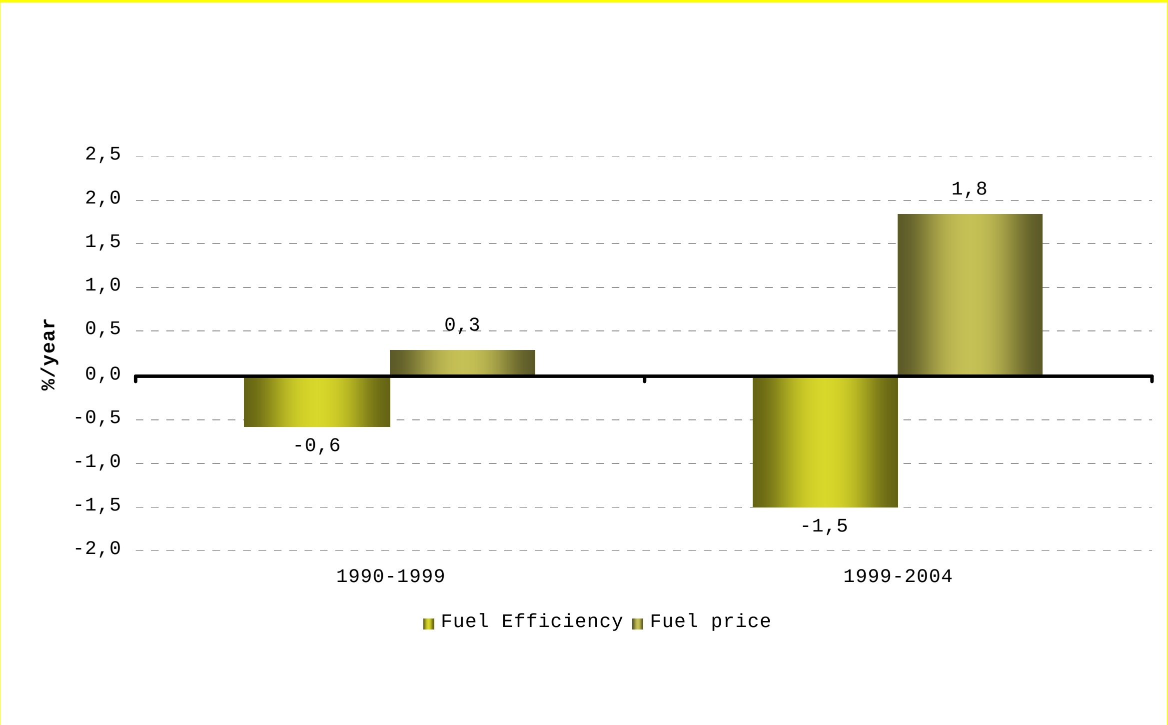
[53] 2007/2119/(INI)
[54] EC (2007a).
[55] See Kleit (2004) and Fischer et al. (2007).

We now briefly demonstrate how higher fuel prices affect consumer behaviour and emissions.

4.2.1 Taxes on fuel

Higher oil prices are likely, by themselves, to increase the demand for more fuel efficient cars. The explanation is that when oil prices are high, consumer demand will automatically go in the direction of more fuel efficient cars, in turn providing economic incentive for manufactures to produce and market such cars. Litres of fuel per 100 kilometres (a measure of fuel efficiency) has indeed fallen the most, equivalent to rising fuel efficiency, during times when fuel prices have increased the most cf. Figure 13.

Figure 13. Correlation between fuel prices and fuel efficiency (l / 100 km), EU15.



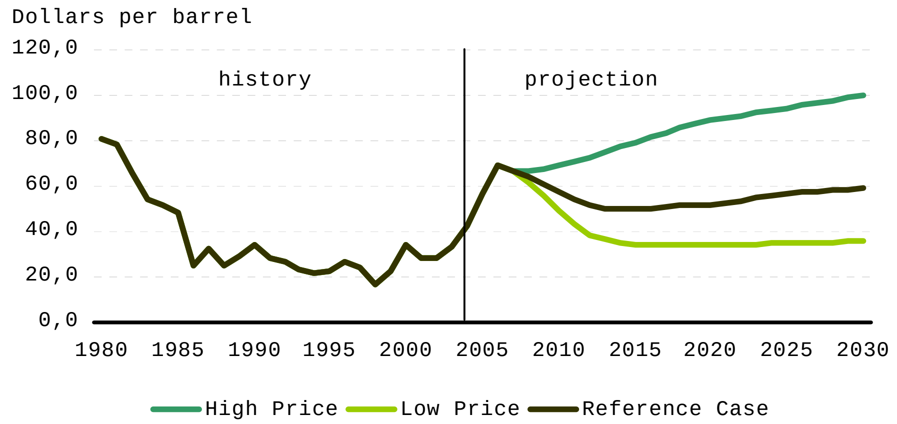
Note: Fuel efficiency of new cars (test values) is measured as liters per 100 km.

Source: Odyssey database, Enerdata 2006.

Part of the increase in fuel efficiency is caused by consumers shifting demand towards diesel cars and away from petrol cars. Diesel cars are in general more fuel efficient than petrol cars so the shift is stronger in times of strong increases in fuel prices (we described how a part of the rising fuel efficiency during the period of the voluntary agreement could probably be attributed to this phenomenon).

Projections show that the current high oil and thereby fuel prices, are expected to continue in the future, cf. Figure 14.

Figure 14. Historic and projected oil prices.



Note: In addition to the reference case, two alternative scenarios have been considered: a high oil price and a low oil price case.

Source: Historic time series: EIA(2004),. Projection: EIA (2007b).

4.2.2 Car registration taxes and labelling directive

As part of the complementary initiatives in the new strategy, the Commission relies on two interesting initiatives: on car registration taxes and on labelling.

Car registration taxes based on CO_2 emissions work like the legislation on mandatory standard, in the sense that prices will increase for less fuel efficient cars compared to prices for highly fuel efficient cars. Currently, 11 Member States have differentiated by CO_2 emissions car taxes.

Box 16. Directive on car registration taxes.

The Commission has a proposal in place suggesting differentiated car taxes based on CO2 emissions.

The tax proposal contains the elements:

- Abolition of car registration taxes over a transitional period of five to ten years
- Introduction of a CO2 element into the tax base of both annual circulation taxes and registration taxes

The proposal does not touch the tax *levels* and tax differentiation *rates* and leaves Member States the flexibility to apply those levels which fit better to the particular conditions of their national car markets. Member States will remain free to decide the steps to take in abolishing Registration Tax, the part of the CO_2 based element to insert in the tax base of Annual Circulation Tax and Registration Tax, and potentially the introduction of other emissions in these tax bases.

Source: Commission proposal for differentiated registration taxes on cars.

The labelling directive affects the demand side, but evaluations show no significant impact[56]. The same experience can be found in North America. The mandatory fuel labelling scheme of the United States and the voluntary labelling programme promoted by Transport Canada appear to have had an insignificant influence on consumer preferences[57].

[56] SEC (2007) 60

[57] Kågeson (2005)

Box 17. The labelling directive.

The labelling Directive (1999/94/EC) makes it mandatory for all car dealers to provide information on the fuel economy of new passenger cars in showrooms and advertising. The Directive aims to make this information available to customers in four ways. Via:

- a fuel economy label attached prominently to all cars at the point of sale
- dissemination of a short guide containing the fuel economy data on all vehicles on sale on the new car market of the Member State
- display posters in showrooms, covering fuel consumption data for all models on sale
- the inclusion of fuel consumption data in all promotional material used to market new cars.

Source: Directive (1999/94/EC).

4.3 Biofuels directive

Another way of reducing CO_2 emissions from cars and increasing energy security is to use alternative fuels emitting less CO_2, such as biofuels. Biofuels are processed from biomass, and is today converted into biodiesel and ethanol. Biofuels are a renewable source, and can be a direct substitute for fossil fuels in transport. Biofuels can, in low blends, be readily integrated into the fuel supply system. All vehicles today are able to operate on a five per cent blend of biofuels with petrol or diesel.

Below, we argue that while biofuels may reduce conventional fuel consumption thereby increasing energy security, it has at least three undesirable properties. First, new research suggests that most biofuels emit more GHG than petrol and diesel thus contributing more to global warming than conventional fuels. Second, the demand for biofuels may raise agricultural prices causing adverse distributional effects. Third, biofuels used in cars produce less energy than biomass used for heat and electricity production, and is thus an expensive way to reduce CO_2 emissions compared to using biomass for heat and electricity production. This is an important point because production of bioenergy cannot simply be expanded without rising costs as has now become very clear, implying clear trade-offs between what is used in cars and what is used to generate heat and energy.

4.3.1 Targets and progress for biofuels

Biofuels are currently not competitive with conventional petrol or diesel. Biofuels are still more expensive to produce than petrol and diesel in addition to having lower energy content.

To encourage take-up of biofuels, the Commission launched the biofuels directive in 2003. The biofuels directive sets reference values of a 2 per cent market share for biofuels by 2005 and 5.75 per cent by 2010.

Box 18. The biofuels directive.

Directive 2003/30/EC on the promotion of the use of biofuels or other renewable fuels for transport was adopted by the Union in 2003. A review of the Directive is due at the end of 2007.

The directive aims at promoting the use of biofuels or other renewable fuels to replace diesel or petrol for transport purposes. The objective put forward by the Directive was for the Member States to ensure that biofuels and other renewable fuels made up a minimum proportion of the petrol and diesel for transport purposes on their markets. Member States were to set national indicative targets taking reference values of a 2 per cent share by 31 December 2005 and a 5.75 per cent share by 31 December 2010 into account. The targets for Member States are not mandatory.

In March 2007 the council endorsed a target of 10 per cent for biofuels out of fuel for road transport by 2020.

Source: Directive 2003/30/EC- On the promotion of the use of biofuels and other renewable fuels for transport.

The Commissions biofuels progress report from 2007[58] concludes that the target of a market share for biofuels of 5.75 per cent for 2010 is not likely to be achieved. In 2005, among 21 Member States for which data are available, only two achieved the targets they had set. The average Member State achieved only 52 per cent of its target. Even if the shortfall is only half as much as this in 2010, the Union would only achieve a biofuels share of 4.2 per cent in 2010. The Commission considers that this is a reasonable estimate of the likely outcome of existing policies and measures. This judgment is also in broad accord with the view expressed in the public consultation exercise on the review of the biofuels directive where the vast majority of respondents said that they did not expect the 5.75 per cent share to be achieved.

Box 19. Two successful Member States.

The two Member States that have made most progress are Germany and Sweden. While Germany's success has rested mainly on biodiesel, Sweden has concentrated on bioethanol. In other respects, however, their policies have several common factors. Both countries have been active in the field for several years. Both promote both high-blend or pure biofuels and low blends compatible with existing distribution arrangements and engines. Both have given biofuels tax exemptions, without limiting the quantity eligible to benefit. Both have combined domestic production with imports (from Brazil in the case of Sweden, from other Member States in the case of Germany).

Source: EC(2006i).

To implement the Directive, Member States use two instruments, both aiming at making conventional fuel more expensive relative to biofuels. They are fuel tax exemption for biofuels and obligatory or mandatory mix of biofuels in petrol and diesel.

The first approach of tax exemption increases the competitiveness of biofuels by making it relatively less expensive than fossil fuels. Tax exemptions are a longstanding form of support for biofuels. Even with the tax exemption biofuels are, however, more expensive than petrol and diesel.

In the second approach, Member States require a share of biofuels to be mixed with petrol and diesel, creating though a demand for biofuels, ensuring large scale deployment while making the (blended) fuel more expensive. The latter reduces demand for fuel and thereby CO_2 while making biofuels more competitive. Some Member States are using obligations as a complement to tax exemptions, others as an alternative, cf. Table 5.

[58] EC (2006i).

Table 5. Choice of instruments to further the deployment of biofuels.

Country	Mandatory mix	Tax incentives
Germany	X	X
Sweden		X
Denmark		X
Italy	X	X
France	X	
Poland		X
Portugal		X
Spain		X
Hungary		X
Finland		X
Austria	X	X
Cyprus		X
Slovenia	X	
Czech Republic	X	X
Nederland	X	
Malta		X
UK	X	
Estonia		X
Switzerland		X

Source: EC(2006i).

4.3.2 Undesirable properties of biofuels

New research suggests that the current strong focus on biofuels may cause serious adverse effects. We identify three such effects.

First, many conventional biofuel technologies may emit more green house gasses than petrol and diesel. A new OECD study[59] argues that among current technologies only sugarcane-to-ethanol in Brazil, ethanol produced as a by-product of cellulose production and manufacture of biodiesel from animal fats and used cooking oil, can substantially reduce GHG compared with petrol and diesel. The other conventional biofuel technologies typically deliver GHG reductions of less than 40 per cent compared with their fossil-fuel alternatives. The study claims that when impacts such as soil acidification, fertilizer use, biodiversity loss, and toxicity of agricultural pesticides are taken into account, the overall environmental impacts of ethanol and biodiesel can very easily exceed those of petrol and mineral diesel.

This claim is supported and further strengthened by a recent study led by the Nobel prize-winning chemist Paul Crutzen[60]. Crutzen and colleagues have calculated that growing some of the most commonly used biofuel crops releases around twice the amount of the potent greenhouse gas nitrous oxide (N_2O) than previously thought - wiping out any benefits from not using fossil fuels and, perhaps even contributing to global warming. See Box 20.

[59] OECD (2007b)
[60] Crutzen et al. (2007)

Box 20. New research questioning the potential for biofuels to reduce emissions.

The paper suggests that microbes convert much more of the nitrogen from fertilisers into N_2O than previously thought - 3 to 5 per cent or twice the widely accepted figure of 2 per cent used by the International Panel on Climate Change (IPCC). N_2O is much worse in relation to global warming than is CO_2.

For rapeseed biodiesel, which accounts for about 80 per cent of the biofuel production in Europe, the relative warming due to N_2O emissions is estimated at 1 to 1.7 times larger than the quasi-cooling effect due to saved fossil CO_2 emissions. For corn bioethanol, dominant in the US, the figure is 0.9 to 1.5. Only cane sugar bioethanol - with a relative warming of 0.5 to 0.9 – looks like a viable alternative to conventional fuels.

Source: Crutzen et al. (2007).

While the Crutzen-paper has not yet been officially published and the assumptions behind the conclusions thus not yet fully scrutinized, this paper together with the OECD paper does seem to suggest that supposed benefits of biofuels are more disputable than currently thought.

Second, biofuels may adversely affect availability of affordable food as the growing demand for biofuels may increase food prices. The OECD agricultural outlook for 2007-2016 points out that structural changes are underway which could well maintain relatively high prices for many agricultural products over the coming decade. Most importantly is the growing use of cereals, sugar, oilseed and vegetable oils to produce the fossil fuel substitutes, ethanol, and biodiesel. This is underpinning rising crop prices and, indirectly through higher animal feed costs, also the prices for livestock products. The report points out that higher commodity prices are a particular concern for net food importing countries as well as the urban poor.

Third, biomass converted into biofuels has lower energy content than when used for heat or electricity production. A recent UN report concludes that using biomass for combined heat and power rather than for transport fuels or other uses, is the better choice[61].

A very recent report prepared for the Global Subsidies Initiative (GSI) emphasize that biofuels are an expensive way to reduce GHG emissions[62]. In addition to finding that biofuel policies in the EU and Member States ran at around € 3.7 billion in 2006, the report shows that abatement costs far exceed the price of allowances on the European Climate Exchange. For example, the study finds that the cost of obtaining a unit of CO_2-equivalent reduction through biofuel subsidies lies between € 575 and € 800 for ethanol made from sugar beet, around € 215 for biodiesel made from used cooking oil, and over € 600 for biodiesel made from rapeseed. The report states that “Governments could achieve far more reductions for the same amount of public funds by simply purchasing the reductions in the marketplace. For the price of one tonne of CO_2 reduction through EU biofuel subsidies, more than 20 tonnes of CO_2-equivalent offsets could be purchased on the European Climate Exchange”.

[61] The report states: “Thus, the greatest potential for reducing GHG emissions comes from the replacement of coal rather than petroleum fuels. Analyses from many countries indicate that biofuels are currently a relatively expensive means of reducing GHG emissions relative to other mitigating measures”, see UN (2007)

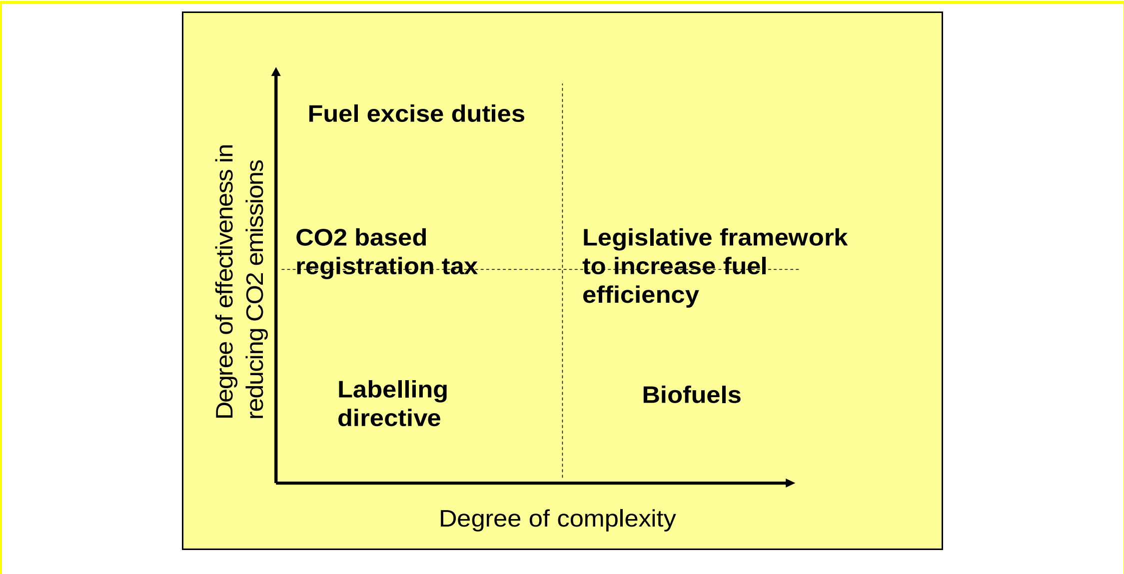
[62] Kutas et al. (2007)

4.4 Conclusions

We believe that initiatives at Member State level will often produce better results than EU initiatives. The reason is that Member States have the chance of addressing the problem at the origin by imposing a CO_2 or fuel consumption tax. Moreover, higher fuel prices reduce transport kilometres for the entire stock of cars thereby reducing CO_2 in addition to increasing fuel efficiency in new cars, and providing consumer incentive to buy new, more fuel efficient cars at the expense older less fuel efficient cars. At the same time, a tax on fuel is simple to implement.

Legislation that raises prices on cars emitting more CO_2 relative to cars emitting less CO_2 might also be effective at reducing CO_2 emissions. However, it may be more expensive and certainly more complex while only affecting fuel efficiency in new cars. Moreover, it will not directly affect the current car stock (by replacing older cars) or kilometres driven. As the most ineffective means, we identify the current generation of biofuels[63] and labelling, the latter, nevertheless, being a 'low hanging fruit' easy to implement, cf Figure 15.

Figure 15. Ranking initiatives on complexity and ability to reduce CO_2 emissions.



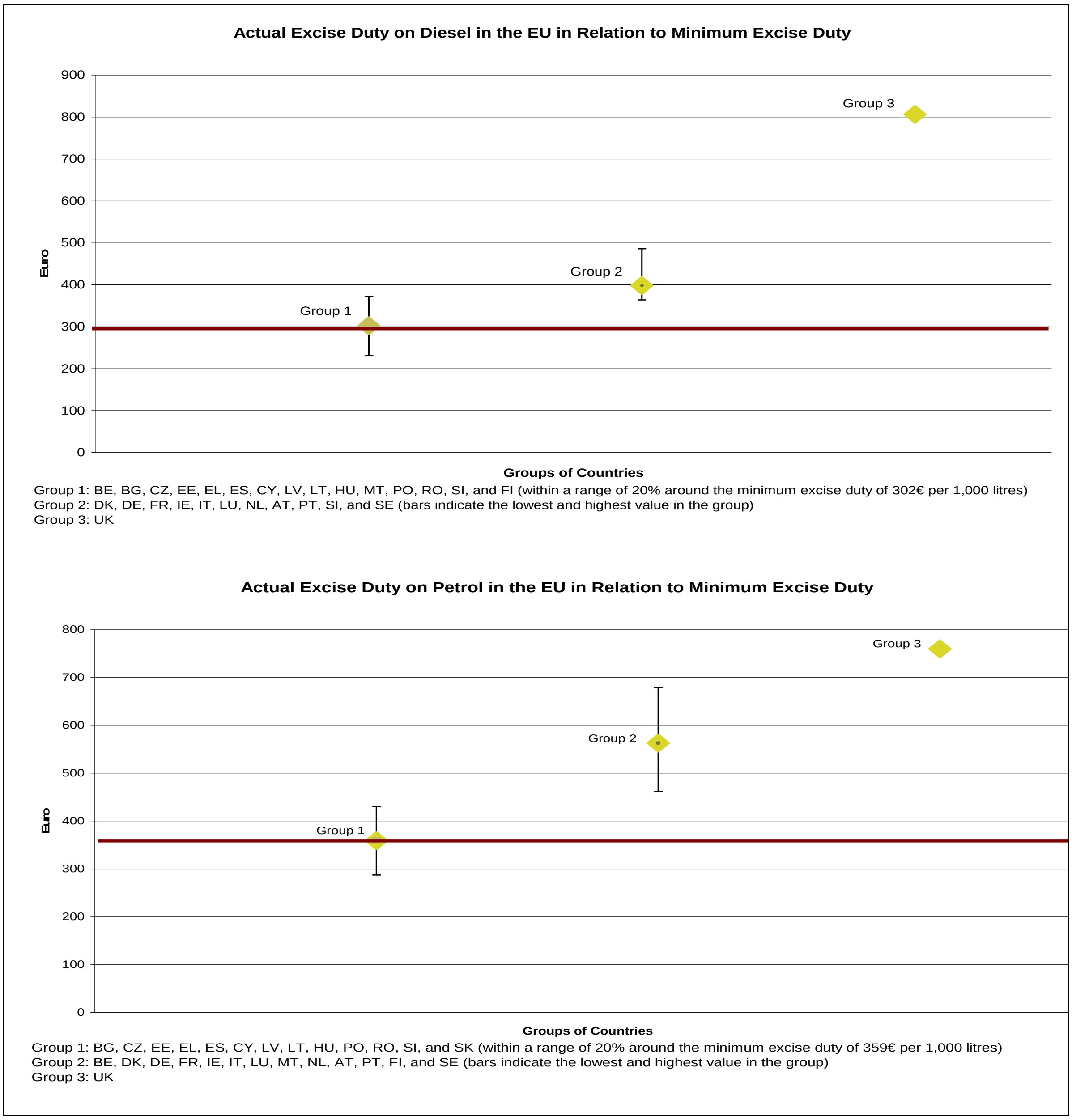
Source: Copenhagen Economics.

Based on the ranking, the EU could consider raising minimum fuel excise duties set down in Directive 2005/96/EC, since a significant barrier for a Member States to raise fuel taxes may be threat of increased border trade with a neighbouring Member State with lower fuel taxes.

Looking at actual fuel taxes across the EU, we find some support for this hypothesis. The fuel taxes in the eastern European countries (group 1) are of about the same size and the same goes for the western European countries (group 3). Most interesting, UK (group 3), with no bordering neighbours, has by far the highest fuel taxes, *cf.* Figure 16.

[63] This goes for the current so-called first generation of biofuels which uses crops grown for biomass. The so-called second generation biofuels would make use of for example waste and would presumably entail lower green house gas emissions than first generation.

Figure 16. Fuel taxes on diesel and petrol, respectively.



Note: the points indicate average excise duty for the group. The bars indicate country spread within each group.
Group 1 diesel: BE, BG, CZ, EE, EL, ES, CY, LV, LT, HU, MT, PO, RO, SI, FI (all within a range of 20 per cent around the minimum excise duty of €302 per 1,000 litres). Some of the new Member States are currently below the minimum excise duty.
Group 2 diesel: DK, DE, FR, IE, IT, LU, NL, AT, PT, SI, SE
Group 3 diesel: UK
Group 1 petrol: BG, CZ, EE, EL, ES, CY, LV, LT, HU, PO, RO, SI, SK (all within a range of 20 per cent around the minimum excise duty of €359 per 1,000 litres). Some of the new Member States are currently below the minimum excise duty.
Group 2: BE, DK, DE, FR, IE, IT, LU, MT, NL, AT, PT, FI, SE
Group 3: UK
Source: EC (2007c)

5. INSTRUMENTS TARGETTING NON-CO_2 EMISSIONS AND SINKS

This chapter addresses the significance of non-CO_2 GHG emissions and reviews the status on use of terrestrial CO_2 sinks. Although non-CO_2 gasses have been excluded from the EU ETS, their emissions have a substantial environmental impact so that their containment is necessary while their inclusion in a revised ETS is investigated.

As for terrestrial CO_2 sinks, the Kyoto protocol allows their use to help Member states achieve the 8 per cent Kyoto target. This happens through reducing the size of the mandatory emission reduction, since Annex I countries can deduct the CO_2 removed by primarily forestry-related sink activities n from their 1990 emission level.

5.1 Non-CO_2 GHG emissions and agriculture

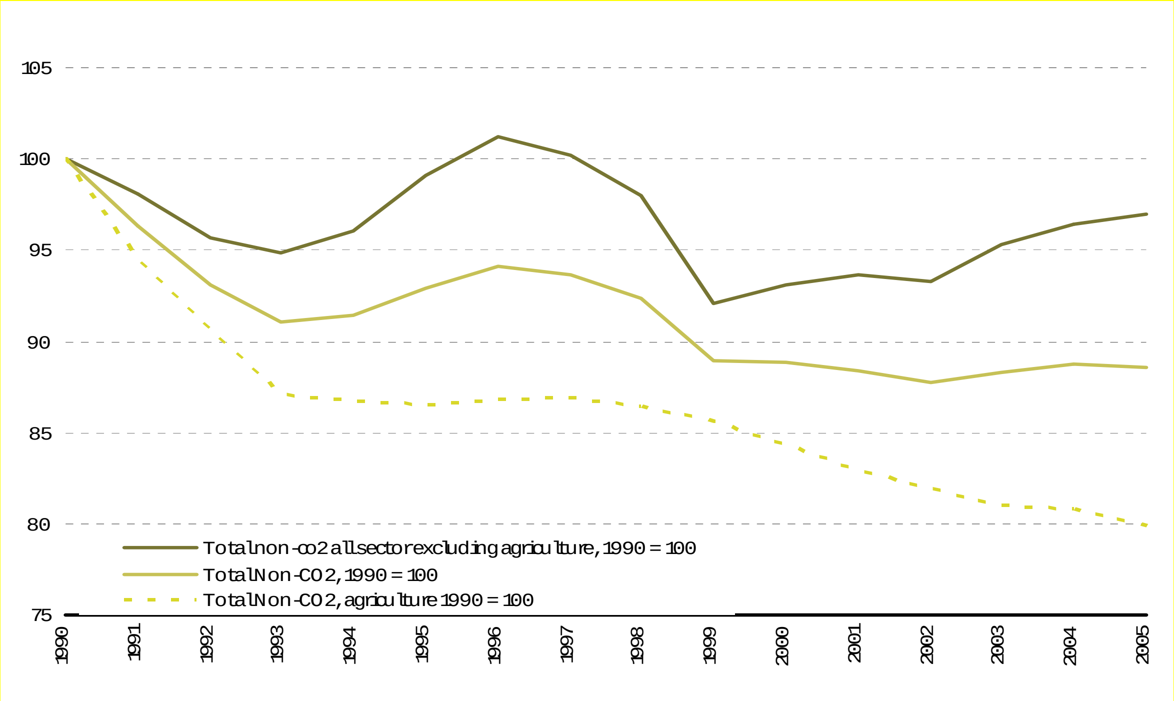
The Kyoto protocol includes five types of non-CO_2 gases in the overall emissions that the signing countries are allowed to emit. These are methane (CH_4), nitrous oxide (N_2O), as well as three types of fluorinated gases, incl. hydro fluorocarbons (HFCs), petrofluorocarbons (PCFs) and sulphur hexafluoride (SF_6). The agricultural sector account for 45 per cent of total non-CO2 gases mainly methane and nitrous oxidesCH_4. Industrial sectors emit the remaining gasses.

Between 1990 and 2005, total emissions of non-CO_2 gasses in the EU27 declined by approximately 12.5 per cent. Overall, the declining trend has been driven by significant reductions of emissions from agriculture, while emissions from industrial sources remained fairly stable. Agricultural emissions, consisting almost entirely of CH_4 and N_2O (respectively making up about 40 per cent and 50 per cent of EU's total non-CO2 emissions) dropped by nearly 20 per cent vis-à-vis the benchmark year. Industrial emissions oscillated between 92.5-100 per cent of their 1990 level, to reach 97 per cent in 2005, cf. Figure 17.

During 1990-2005, the observed declines in N_2O and CH_4 as well as certain fluorinated gases emissions appear to be primarily driven by private economic and technological incentives rather than regulation. Certain emitters may have natural economic incentives to EU's non-CO_2 GHG, e.g. burn CH_4 to produce electricity or adopt a more efficient nitric acid production technology. Existing legislation supports these incentives.

In the future, it is expected that non-CO_2 gas emissions will continue to decline for two reasons. First, as technology makes recycling of non-CO_2 gasses more and more valuable, they are less likely to be vented than e.g. CO_2. Implementing non-CO_2 gas reduction projects is likely to continue being more cost efficient than CO_2 emission reductions, especially as significant amount of the latter is linked to energy generation. Second, adaptation of more efficient and conservationist farming methods in agriculture, declining demand for milk and meat products, increasing popularity of organic farming, and enforcement of the nitrogen directive, will all contribute to further reductions in CH_4 and N_2O emissions.

Figure 17. Development in non-CO_2 gases emissions, EU27, 1990-2005.



Note: HFC-P ends at index 13000 in 2005 and PFC-P ends at index 1900 in 2005. Index 1990=100.

Source: EEA(2006a).

Future policy efforts could thus concentrate on areas where present private economic incentives as well as policy measures to contain emissions are weak. For example, CH_4 emissions from coal mining or oil and gas production and transportation, are not regulated at all. In the case of the growing emissions from fluorinated gasses, legislation appears effective in preventing growth of these emissions. The recent directive, on the phase out of HFCs in inefficient automotive air-conditioning systems, is an example.

5.2 Use of terrestrial CO_2 sinks in the current Kyoto regime

Terrestrial CO_2 sinks are instruments with a potentially dual role in the current and the post-Kyoto regimes. Currently, countries can use them as a means for reducing the size of their mandatory GHG emission reductions to fulfil the 8 per cent target in the first accounting period, 2008-2012. Furthermore, if sink-generated credits become included in the revised ETS in a post-Kyoto regime, the instrument will bring about an additional range of economic, social and environmental effects. Below we describe the use of terrestrial CO_2 sinks in the current Kyoto regime. Section 6.2.4 reviews implications of the potential incorporation of sink credits into the ETS, in a post-Kyoto regime.

As of present, the Kyoto Protocol allows Annex I countries to use CO_2 removals by terrestrial sinks in order to offset emissions from industrial sources and thereby contribute to the fulfilment of the Kyoto 8 per cent GHG emission reduction target in the first commitment period, 2008-2012[64]. No trade in sink credits is allowed within the ETS, but the Linking Directive explicitly calls for an investigation of such possibility in a post-Kyoto regime.

[64] EEA (2006) Annex IV, Amano and Sedjo (2003)

Terrestrial sinks function as biological carbon stores, removing CO_2 from the atmosphere and converting it into biomass. Following a series of technical consultations, a range of human-induced land use, land use change and forestry activities (LULUCF), taking place after 1990, have been designated as permissible sinks. Countries choosing to use the 'sink option' may to account for CO_2 storage from activities taking place within their own borders as well as transfer a limited amount of activities undertaken in developing countries, through the CDM[65].

For activities taking place domestically, countries are obliged to report CO_2 sinks from afforestation, reforestation and deforestation activities and choose voluntarily to report additional agricultural and additional forest management activities.[66] Once the voluntary activities are chosen, the countries are obliged to stick to their monitoring and reporting, even if the activities become net CO_2 emitters in the future.

For activities taking place in developing countries, the permissible sinks are limited to reforestation and afforestation activities, while the amount of CO_2 reductions thus acquired is limited to 5 times 1 per cent of the Annex I country CO_2 emission level from 1990.

As of 2006, the participating Annex I countries estimated their CO_2 sinks to provide, on aggregate, about 10 per cent of the 8 percentage points GHG emission reduction target under Kyoto (i.e., 0.8 percentage points of the Kyoto target), corresponding to 34.1 Mt CO_2 per year[67]. Together with the two other flexible instruments CDM and JI, removal CO_2 through sinks makes it possible to achieve the stated Kyoto emission reduction target, cf. the latest Commission Impact Assessment COM (2007) 2. Furthermore, according to the ECCP, sinks have the potential to remove as much as three times more CO_2, from among the EU15[68].

While terrestrial sinks can contribute to the achievement of Kyoto targets in a significant way[69], a word of caution is in order when interpreting sink figures. Estimates of sink capacities are inherently complicated to provide and subject to high uncertainty. Measurement of sinks involves not only the measurement of constantly evolving biological systems, but also uncertainties such as undefined forestry policies on the Member State level, changes in agricultural productivity, or temperature changes affecting sink CO_2 storage capability. Furthermore, measurement methodologies are being reviewed and perfected, which implies potential disparities in the accounting methods applied by countries. Evidence shows that these issues can lead to as much as 50 per cent volatility in annual estimates of sink capacities, cf. EEA(2005) and EEA(2006).

[65] Benitez and Obersteiner (2003)
[66] See Kyoto article 3.3 and 3.4, respectively, and the Marrakesh agreement.
[67] EEA (2006) Annex IV, 32.1 Mt CO_2 equivalents according to COM (2007) 2, p. 5.
[68] EEA (2006) Annex IV
[69] Cf. COM (2007) 2, p.5.

6. POST 2012 CHALLENGES

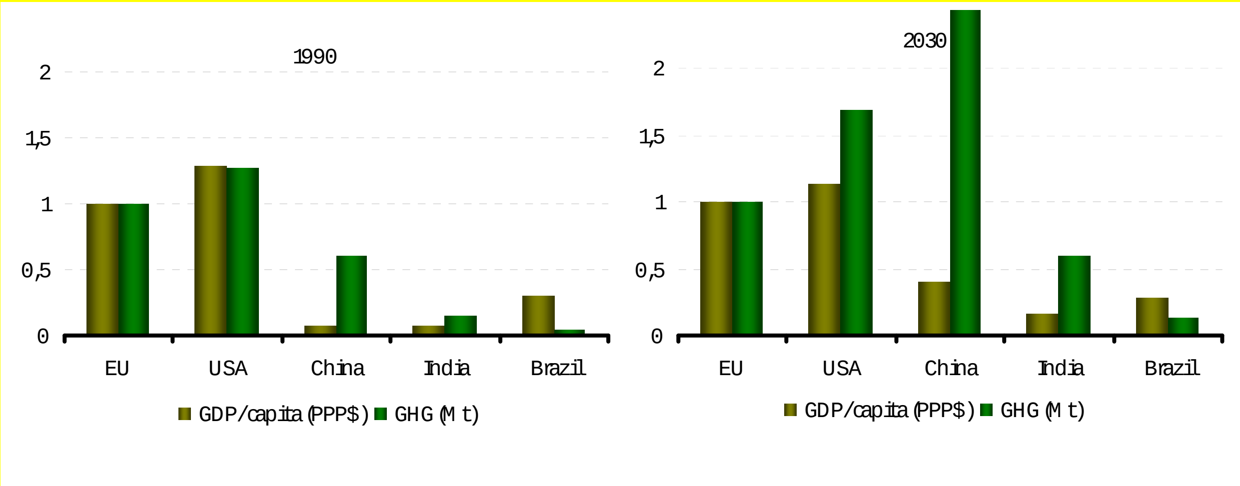
In March 2007 the European Council committed itself to CO_2 reduction targets for the post-2012 period, as well as for specific targets for renewable energy. The strategy is based upon two set of options:

A strong and binding international agreement to reduce GHG is reached. The agreement must include the main emitting countries. In this case, the EU offers to reduce GHG with 30 per cent between 2012 and 2020

No such agreement is reached. In this case the EU will unilaterally commit itself to a reduction of 20 per cent between 2012 and 2020

The challenges involved in getting an international agreement in place are without doubt considerable, but not the object of this study. The most critical issue is to get the U.S., as well as rapidly growing countries like China and India, committed to abatement of GHG. While the two latter countries, in 1990, jointly emitted less GHG than the EU, China alone is projected to emit more than twice than the EU by 2030 if no action is taken cf. Figure 18. Over the same period, China is expected to grow much richer, suggesting that its willingness and ability to pay for costs associated with GHG abatement should increase.

Figure 18. No policy change scenarios: GDP/capita and GHG emissions in 1990 and 2030, relative to the EU.



Note: The EU figures do not include Croatia, Estonia, Latvia, Lithuania, Slovenia and Slovakia.

Source: IMF (2007) and IEA (2006a).

Indeed, global emissions will only be marginally affected by unilateral EU action. The purpose of EU acting alone would be to keep up pressure on other developed and emerging countries to sign up to more binding targets at a later stage, by having well developed climate policies that offer a strong platform for continued co-operation.

Our aim in this chapter is to present the key economic challenges that either of the two options present and examining the implications for EU's internal climate policies. We focus our attention on three issues:

- Evaluating overall costs of meeting the targets of 30 or 20 per cent (6.1)
- Promoting a cost-effective approach to reach each of the two targets (6.2)
- Internal burden sharing within the EU (6.3)

6.1 Evaluating the costs of the two targets

We find indications that the costs for the EU of reaching either of the two targets are small compared to projected income growth. Furthermore, we find that costs are larger in the case of EU acting as part of a broad international agreement compared to unilateral action. This may seem somewhat counterintuitive: If we all pull together, it ought to be easier to reach the target. There are, however, three reasons why this analogy is wrong:

First the obvious one: it simply costs more to reduce GHG emissions by 30 per cent than by 20 per cent. *Second*, any target is more costly to meet for the EU when the rest of the world is also containing GHG emissions. In that situation, demand for fossil fuels is less pronounced and prices of fossil fuels become lower. This implies that the EU will be helped less in terms of market driven energy savings from higher prices of fossil fuels, otherwise 'automatically' providing economic incentives for EU users of energy to reduce emissions. *Third*, the Clean Develop Mechanisms (CDM) is more expensive under a broad international agreement than under unilateral action. With strong global efforts outside the EU to contain CO_2 emissions under a broad international agreement, the price of CDM will be higher than without an international agreement. There are more producers seeking projects providing energy savings, which forces down the 'productivity' of projects thus creating less energy savings per invested unit of investment.

Two studies have looked specifically at the two options of 1) an international agreement with a 30 per cent reduction target and, 2) a unilateral EU action with a 20 per cent target. An EU Commission study suggests that costs of an international agreement with a 30 per cent reduction target would be equivalent to 2.8 per cent of the EU Gross Domestic Product (GDP), but only 0.3 per cent of GDP with unilateral action and a 20 per cent target, cf.

Table 6. A recent Dutch study, using a somewhat different method, suggests abatement costs to reach targets around 0.4 per cent of GDP in the case of an international agreement, but only 0.1 per cent in case of unilateral EU action.

Table 6. Abatements costs.

	Broad international agreement, the EU reduces by 30 per cent	Unilateral EU reduction of 20 per cent	
		With CDM	Without CDM
EU Commission impact assessment, negative effect on GDP level in 2020, in per cent of GDP	2.8	0.3	-1.4
Dutch study, abatement costs in 2020 in per cent of GDP	0.4	0.1	0.1

Source: EC(2007b), NEA(2007).

As GDP is expected to rise by 35 per cent over the same period, costs are in any case relatively modest.

As the costs for the EU as a whole seem surmountable, we suggest that the economic and political challenges lie elsewhere. The above calculations are based upon the EU and Member States systematically using the least cost approach to reducing emissions. Moreover, the challenges may be more linked to needed adjustments in smaller segments of industries, not the least those exposed to international competition. Second, the internal distribution of the reduction targets among Member States will be subjected to intense discussions. We deal with the first two points below in the section on "Cost-effectiveness and international competition" and the third point in the section on "Internal burden sharing"

6.2 Cost effectiveness and international competition

The ETS is generally hailed as the key Community instrument in place to promote cost effective abatement of CO_2 emissions at the EU level. Below, we address five issues related to the role of the ETS vis-à-vis other national and community instruments dealing with climate change. They are:

- Allocation mechanisms for the ETS emission allowances and international competitiveness
- The link between ETS and CDM/JI mechanism
- Extending the scope of the ETS to new sectors
- Extending the scope of the ETS with LULUCF credits
- Complementarities between ETS and other instruments

6.2.1 ETS allocation mechanisms and international competitiveness

A key outstanding issue, relative to the ETS, is the allocation mechanism post-2012. As reported in Chapter 2, the evidence is overwhelming for moving in the direction of more auctioning/sales of allowances; a decision at the EU level on the overall level of allowances as well as the criteria under which industries can receive allowances partly for free as well as based upon so-called benchmark criteria.

A critical point in terms of the allocation process is the effect on international competitiveness for firms with energy intensive production placed in the EU and facing fierce competition from firms placed outside the EU. The industries are primarily the classical heavy industries such as metal producers. They account for only 1-2 per cent of valued added in the EU but a much larger share of GHG emissions[70].

The size of this competition challenge is to a very large extent depending upon which of the two scenarios that are realised. If the global community manages to agree to binding commitments covering all the main countries from which EU firms may face competition, then 'flagging out' (leakage) will prove much less of a problem. If such a commitment cannot be reached, the difference in energy prices facing firms inside and outside EU will be more important and flagging out a larger issue.

The economic adjustment costs of dealing with climate costs in either of these two situations are not trivial but neither very significant relative to other adjustments that economies are constantly facing. That has also been the assessment in evaluation of Community climate programmes so far.

Nonetheless, resistance to deal effectively with climate change may be fiercer if the competition challenge is not addressed. The reason is primarily that the negative effects on jobs will be concentrated in a very few industries. Provided that policies are taken in good time and implemented gradually, firms and economies can adjust. Firms producing environmental equipment may see expanding production, R&D expenditure and exports. Firms very much exposed to higher energy costs will see contractions, but the sector shifts are not likely to be very large. It should be the role of labour market policies to ensure that this process runs smoothly and job effects at the macro level are likely to be zero over the medium term.

[70] Grubb et al. (2006), Neuhoff et al. (2007)

However, in addition to such broad based policies, there is a good case for using the so-called benchmark allocation models for precisely the industries like steel and cement (energy intensive and in sharp international competition) where the effects of EU taking unilateral action will be most felt. Such firms could partly be provided with allocations on the basis of updated value of their production with the allocation not based on own emissions but on industry specific averages of emissions (one for cement, one for steel etc.).

This will provide an incentive for firms in these industries to retain production in the EU and at the same time reduce emissions as they can sell the difference between their own consumption and the industry average. This should not simply be seen as job creation exercise as the jobs lost in out-flagging will not be substantial. The point is more there will be no global environmental gains from firms moving to areas where energy prices are lower as firms there are likely to use more energy per unit of production than within the EU. Moving production will add to global GHG emissions while reducing emissions within the EU.

With a more globally binding framework, energy costs will be higher in competitor countries implying that the benefits to EU firms of moving plants outside the EU will be lower. Hence, there is also a smaller need for benchmarked allocations to keep production on the EU soil.

6.2.2 The link between ETS and CDM and JI

The role of CDM and JI will also depend on the international structure of an agreement in more than one sense. Key issues are whether a much larger group of countries enter into annex 1 with binding targets for CO_2 emissions. If so, they automatically disappear as candidates from CDM generating projects. Given the already present dominating role of China, India, and Brazil as well as the continued strong growth of these countries, the potential inclusion of these countries is of paramount importance for the CDM.

Seen from a global efficiency point of view, the EU might have an interest in having these countries included in Annex 1 even if it allowed them continued growth in CO_2 emissions as they catch up with the EU and the US in economic growth. The point is that the CDM mechanisms as discussed above are based upon the construction of ‘business as usual’ baselines which are open to contention and can lead to controversial results as demonstrated by the experience of CDM credits for non-CO_2 projects. If instead these upward growing emissions limits were binding at the margin, it would allow the EU to develop more direct emission trading with these countries with a higher probability of a positive global effect on CO_2 emissions. By binding is meant that they require some efforts for these countries to stay within limits as their economies grow. The new Annex 1 countries would then have an own interest in not inflating credits: any credit obtained by EU firms would be added to their own emissions, making it more difficult for these countries to meet their limits.

Such more direct emission trading could take several forms. By moving them into Annex 1, Joint Implementation is directly applicable. One could also foresee a more direct linkage with the EU’s ETS. In both cases caution would suggest upper limits for the amount of trading that could take place as is currently the case for CDM/JI in the national allocation plans.

If China and other key developing countries stay outside Annex 1, the question is what potential reforms of CDM may be envisaged. This study does not offer room for a substantial discussion of this but various options have been proposed both to avoid inflation of credits not the least for non-CO_2 gases as discussed in chapter 3. But some continued use of CDM provided that they are kept under some limits at present seems recommendable both to keep non-annex 1 countries engaged in the global efforts to reduce GHG emissions and to promote CO_2 savings where it is most effective as recommended by the EU Commission[71].

[71] EC (2007b)

6.2.3 Extending the ETS to other sectors

The European Council has explicitly suggested that the extension of ETS to other sectors in addition to aviation should be a part of the review of the ETS[72]. The potential inclusion of maritime transport and land use changes has been specifically mentioned as a possibility. The key advantage for doing so would be to extend the present benefits of the ETS, namely equal costs of abatement for the covered industries, to a wider part of the economy.

A review for the EU Commission suggested that benefits of inclusion into the existing ETS should be based upon a number of requirements of which the following five are the focus here[73]. The first requirement is that sector emissions should constitute a certain significant amount relative to overall emissions (*relevance*). The second and third requirements are that it is possible to *monitor* emissions levels and that there is a well defined operator that can be made responsible for any given level of emissions (*enforceability*). A fourth requirement is that *transaction costs* are relatively low. The fifth requirement is that distortions of competition from including them would be significantly reduced; for example because the industry is in near competition with industries already subjected to the ETS.

We would add two supplementary and linked arguments. First the arguments for inclusion are stronger if flagging-out or leakage issues are not too strong; that is when distortions of competition with non-EU producers can be limited. Secondly, we would add that the arguments are strong if the industries/activities in question are international in nature making it difficult for individual Member States to act alone. This was indeed a reason for introducing the ETS in the first place; to target EU industries with significant energy intensity as well as intense EU cross-border trade.

Based upon the first five criteria, nine industries were top ranked, cf. Table 7. The main reasons for ruling out sectors, like agriculture or road transportation, were poor monitoring ability and enforcement opportunities as well as high transaction costs associated with the industry being dominated by many small emitters (installations).

From the above sectors the feasibility of maritime transport for inclusion into the EU ETS has been widely discussed, not the least in the context of its significant share in global CO_2 emissions ranging from 1.8 to 3.5 per cent[74] – as well as the upcoming inclusion of civil aviation in the scheme. The two sectors have a number of similarities, in that they are both rapidly growing sources of GHG emissions, internationally traded, their operators being rather large companies already compliant with several regional GHG emission control agreements.

[72] Council of the European Union (2007a)
[73] EC (2006k)
[74] Estimates vary depending on measurement methodology, see CE Delft (2006), p. 181.

Table 7. Best candidates for inclusion into the ETS.

Industry	Type of GHG	Number of installations
Martime transport	CO_2	Large
Coal mining	CH_4	54
Aluminium production	CO_2, PCFs	25
Gypsum production	CO_2	220
Stone wool production	CO_2	17
Fertilisers and ammonia	CO_2, N_2O	100
Adipic Acid	N_2O	4
Petrochemical processes	CO_2	17
Waste incineration	CO_2	400

Note: Maritime transport added by Copenhagen Economics. This is for three reasons: Maritime transportation is dominated by large and medium sized firm while the EC study looked at the size of ships as the defining criteria for assessing compliance costs. Fuel use information is more often than not monitored on the ship (installation) level for commercial purposes and international statistics are available. Finally, the aviation sector – also characterized by many small installations – is to be included in the ETS as of 2010.

Source: EC (2006k) and Copenhagen Economics.

Just as for aviation, maritime transport emissions yield themselves to relative precise measurement and monitoring. At present, there are several CO_2 emission indices calculated by various institutions, and the IMO undertakes efforts to strengthen measurement methodologies. The Entec and Eurostat databases make it possible to calculate emissions from shipping. CO_2 emissions are also quantified in sources[75].

However, there are also several differences between them, which complicate the inclusion of marine transportation into the ETS. The leakage problem is more severe in marine shipping. This is because 'sequential' journeys[76] are more likely, and the problem of defining geographical coverage of the ETS needs more careful considerations than in aviation (domestic, intra, extra EU, more frequently changing and less predictable shipping routes). A further complication is that there are more substitute marine ports between the non-EU and the EU countries (e.g. Kaliningrad may be preferred to Vilnius or Gdansk, Istanbul to Piraeus, Oslo to Goteborg etc) than substitute airports.[77]

Next, while most of civil aviation traffic is scheduled flights, shipping consists of irregular tramp and regular liner operations, both of which are roughly equally important in terms of GHG emissions generated. This feature complicates the choice of the method for allocating allowances, since the use of either grandfathering or benchmarking may give raise to distortions, which can generate windfall profits to some operators but not others[78].

Although marine shipping differs from aviation in several important aspects, its inclusion into the ETS appears a viable possibility on technical grounds, especially on intra-EU routes. However, attention must be drawn to the treatment of extra-EU journeys, whether the expected evasions and market distortions can be avoided, while compliance costs and their differentiation between small and large operators minimized.

The relevance of this point diminishes to the extent future allowances are to be auctioned rather than grandfathered.

[75] CE Delft (2006), Annex A.
[76] It is easier for ships to change their destination en route, or e.g. call to non-EU ports whereby the ETS would apply only to the EU-bound leg of the journey.
[77] CE Delft (2006), p. 239.
[78] CE Delft (2006), p. 232.

6.2.4 Extending the EU ETS with sink credits

Section 5.2 reviewed the use of CO_2 sinks in the current Kyoto protocol. While sinks are used to reduce the size of the required GHG emission reductions in the current Kyoto regime, the Linking Directive sets aside the inclusion of LULUCF credits into the ETS, calling for a review of this possibility in a revised ETS79. Inclusion of CO_2 sinks in a revised ETS has been subject of numerous studies with conflicting advice. This reflects not the least the highly technical and complex character of the issue.80

The main argument for including sinks in the ETS is because they expand the range of flexible instruments to achieve GHG reductions in a cost-effective manner.81 Furthermore, sink projects have the potential of reducing CO_2 emissions from two large sources: agriculture or forestry. Once credits from sink activities become tradable, the demand for sink projects will increase, contributing to emission reductions from these sources.82 Furthermore, since part of the sink credits arise through the CDM mechanism, increased demand for CDM will have positive social and economic spillovers to developing countries, in addition to the environmental effect. Finally, as forestry credits are currently included in e.g. the US and New Zealand's emission trading schemes, their inclusion in the ETS will make a potential future integration of the systems easier.

Opponents of including sinks in the ETS primarily argue that sink credits are either incompatible with or even contrary to the Kyoto objectives. Firstly, CO_2 removals by carbon sinks are temporary by nature. Sinks imply the risk that CO_2 will be released in the future, in a random event like a fire, or predictable event like forest (biomass) decay. Thus, sink credits must be replaced on an ongoing basis; else they will only transfer CO_2 emissions over time. This is an inherent risk that must be borne by potential traders in the ETS, thus sink credits are expected to be cheap. Cheap sink credits, in turn may undermine the demand for the permanent 'industrial' credits. Thus, industrial emissions will remain, while traders invest in sink credits provided by CDM from offshore projects, possibly providing a dubious environmental impact. Secondly, sinks allow the retention of a tonne of CO_2 emissions from fossil fuels[83]. 1 tonne of CO_2 stored in sinks will mean 1 tonne retained CO_2 emissions from industry. This is argued to be incompatible with the Kyoto objectives.

Considering these arguments, it is valid to support two actions. Firstly, a careful overhaul CO2 sink design concentrating on what activities are allowed (incl. the implementation of measurement and the quality of monitoring, esp. in the CDM case), the technical provisions governing the inclusion of sink credits from CDM and JI projects in the ETS, as well as the expected impacts in terms of mitigating industrial CO_2 emissions. Secondly, a development of assessment methodology for the anticipated effects from inclusion of sink credits in the ETS is to be encouraged.

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[79] Specifically, the Linking Directive calls for a reconsideration of 1) the technical provisions relating to the 'temporary nature of credits and the limit of 1 per cent of for LULUCF project activities and 2) to allow operators to use CERs and ERUs from LULUCF project activities in the EU ETS from 2008.

[80] In addition to sink projects undertaken by Annex I countries, LULUCF activities can take place within the JI and CDM frameworks in developing countries, technically generating temporary ERUs and CERs, respectively. In its Extended Impact Assessment, COM (2003) 403, the Commission argued that LULUCF credits are not be included in the ETS as they are temporary in nature and therefore incompatible with credits arising from permanent reductions. The Linking Directive 2004/101/EC Article 11a paragraphs 3(a) 3(b) excluded LULUCF credits from the EU ETS.

[81] However, opponents use this argument by pointing out that it allows emitters to retain their fossil fuel based emissions rather than reducing them directly.

[82] World Bank (2006), Streck (2007)

[83] http://www.fern.org/pages/climate/carbon.html

6.2.5 Complementarities with other policy instruments

While the ETS is likely to be extended to some more industries, it is highly unlikely that the system will be extended to other big emitting activities such as road transportation for the arguments provided above. This raises the questions about how to ensure the proper mix of instruments that could mimic some of the potential benefits of a wider extension of the ETS.

The question is narrowly linked to the issue of energy taxation, as also underlined in a recent EU Commission Green paper. The logic would be to use energy taxes mainly/exclusively to further climate change goals in sectors and industries not covered by the ETS while allowing national rates of zero for industries covered. Furthermore, national energy tax rates could be set so as to reflect the expected price of CO_2 allowances to expose firms and households to equal incentives to save on CO_2 emissions.

However, for Member States two key issues are important. First, if they are to operate with zero rates on energy taxes in industries subjected to the ETS, they lose revenues unless a much higher level of auctioning of allowances is reached. Second, the setting of rates for other activities may be determined partly by spillover effects from cross-border shopping. For example in road transportation, the EU could be helpful in raising minimum rates to provide Member States with room for manoeuvre as discussed in Chapter 4. Both issues could be addressed in the context of the review of the ETS and the review of the directive on energy taxes following the EU Commission's Green Paper.

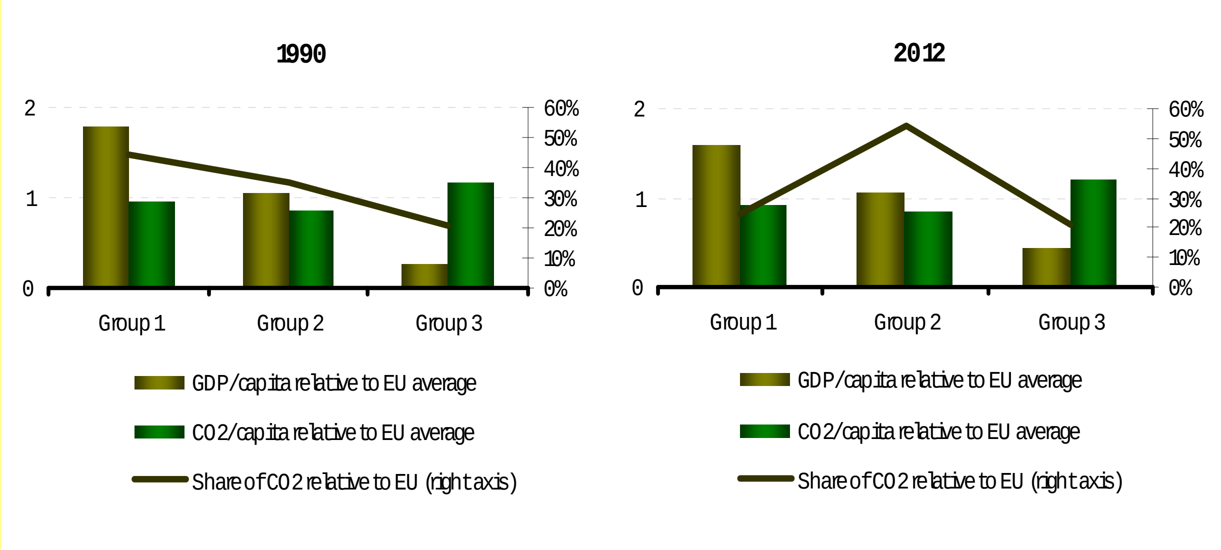
6.3 Burden sharing within the EU

A key issue for the internal burden sharing within EU will be how to split the reductions of either 20 or 30 per cent across Member States. There is a wide range of studies that examine these issues. To illustrate some of the key questions, we have focused on a recent study that examines in detail the implications of the scenarios now endorsed by the European Council[84].

Before moving into the discussion of specific models, we suggest that the catching-up within the EU suggest that the spread of national GHG emission reductions in a post-2012 regime could fall into a more narrow range than in the 1990-2012 period. Differences in income levels per capita are expected to be more limited in 2012 relative to 1990. CO_2 emissions per capita have also narrowed.

[84] NEA (2007)

Figure 19. Per capita GDP and CO_2.



Note: Countries not included: Cyprus, Malta, Luxemburg, Romania and Bulgaria CO_2 numbers in 2012 are considered to be the Kyoto individual targets.

Source: Eurostat, EEA (2006) and EC (2006m).

The model calculations from the study do confirm this picture of more equal target reductions for the period 2012 to 2020 than in the first round. We have here looked at two types of burden allocation criteria. In model 1, Member States are “allowed” to converge to a common CO_2 emission per capita in 2050. In the second model, allocations are based upon the same broader range of criteria (Triptych) as for the period 1990-2012 as explained in Chapter 1 and Box 1. Basically, the results are relatively converging for the different group of countries cf. Table 8. In the final agreement from 1998, covering the first commitment period, some EU15 countries were allowed to let emissions grow with up 20- 25 per cent while others were forced to cut emissions with 28 per cent. Looking at the scenario with 20 per cent reductions and using per capita convergence, all EU15 countries fall within a range of minus 6 to minus 25. If the so called Triptych approach was used, the range would also be much smaller, from minus 19 to plus 1. The twelve new Member States would generally face higher emission target reductions, in particular Romania and Bulgaria.

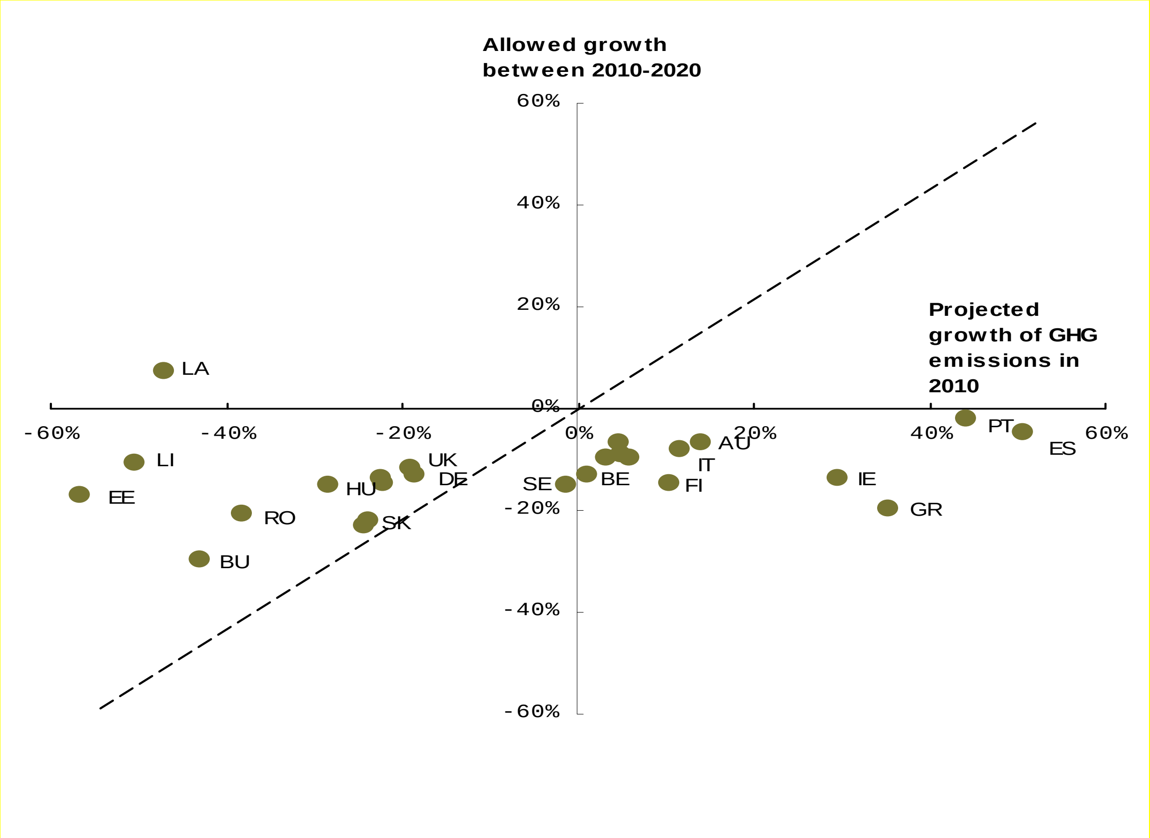
Table 8. Burden sharing scenarios: distribution of emission reductions post 2012, EU countries.

Group of countries	**Final agreement 1998**	**EU 20 per cent unilateral without CDM scenario (2020 target-Kyoto target)**	
		Per capita convergence	**Triptych**
Rich and green: AU, DK, FI, DE, NL, SE	-21 to 4	- 20 to – 6	- 14 to -2
Rich but less green: BE, FR, IT, LU, UK	-28 to 0	-17 to - 7,5	- 12 to - 8,5
Poorer and least green: GR, ES, IE, PT	13 to 25	- 25 to -5	-19 to 1
EU 10	- 8 to – 6	- 21 to 9	- 31 to -6
RO	-8	- 22 to – 14	- 37 to – 27
Total	**-8**	**-20**	**-20**

Source: NEA (2007).

The more equal reduction targets may suggest an easier path to internal agreement but also mask difficult underlying realities. First, some countries will have to face much slower growth path for CO_2 target reductions for the period 2012 to 2020 than in the previous commitment period, particular countries such as Greece, Portugal. Second, such a slowdown problem is for some countries compounded by coming in 2012 well above target rates with Spain, Portugal and Greece being clear examples. Their emissions are projected to grow with more than 30 per cent; they may be facing a need to reduce emissions with up to 10-20 per cent from 2010 to 2012.

Figure 20. Growth rates of GHG emissions 1990-2010 and allowed rates post 2012.



Note: Situation in 2010 – emissions in 2010 compared to the base year, 1990; "Growth 2010-2020" is the 2020 target - Kyoto target

Source: EEA (2006) and NEA (2007).

Finding a solution to this may well depend on two key questions. First, will some countries with very green agenda volunteer larger reductions than "objective" criteria suggest? Second, will over performers, like most of the EU10, accept a solution where their reduction targets for 2012-2020 are lifted somewhat to reach a solution? This may well entail solutions where they may actually emit more CO_2.

7. CONCLUSIONS

All EU countries have agreed to reduce GHG emissions by signing the Kyoto protocol. The overall commitment corresponds to a reduction of 8 per cent from 1990 to 2012, though with different commitments between member states. All member states have signed up to commitments to reduce emissions; in aggregate equal to a reduction of 8 per cent in the reference period 2008-2012 relative to 1990. By March 2008, the European Council has committed itself to a further reduction post 2012 when the current Kyoto protocol expires: 30 per cent if a binding, international agreement can be reached with the other main emitters, 20 per cent if not.

The EU has already initiated a large number of initiatives in order to meet the 2012 target, but given current trends it is still unclear whether these initiatives will succeed in meeting the target. In addition, the EU must decide which initiatives to implement to meet the post 2012 target.

With these perspectives in mind, Copenhagen Economics has been asked to review current and prospective climate policy related initiatives and provide recommendations for future policies.

We start by reviewing the experience with the implementation of the key sector oriented policies in place, namely (1) the flexible Kyoto instruments, primarily the ETS (2), other policies targeting the energy sector such as supply of renewable electricity and energy efficiency standards (3) road transportation discussing such instruments as biofuels and fuel efficiency standards and (4) other less sector based policies including containment of non-CO_2 emissions, sinks (absorption of CO_2 in biomass).

In the second part we review the policy challenges for the post 2012 period, drawing on the experiences from the first commitment period.

Flexible Kyoto instruments:

In place since 2005, the ETS is an effective and cost effective solution to the challenge of reducing GHG emissions in the covered industries.

The ETS is effective because the overall amount of allowances is limited to a given level; and because it requires all emitters of CO_2 in a certain sector (except for small emitters) to hold an amount of CO_2 allowances equal to their own levels of emissions. Moreover, they account for almost 50 per cent of CO_2 emissions within EU and include power industries as well as energy intensive manufacturing. Consequently, the ETS puts a binding overall limit on CO_2 emissions for a very substantial part of total CO_2 emissions.

The ETS is cost effective because it creates the same marginal incentives to save on CO_2 across the EU. It does so by allowing trading of allowances between firms. If any covered firm can save CO_2, it frees up allowances which the firm can sell to other firms in need of more allowances due to for example an expanding production. The allowances are sold and bought in a common EU market, establishing one single price for using less or more CO_2 in the sectors covered by the ETS.

The operation of the ETS since 2005 has shown both its substantial success in achieving cost effective CO_2 abatement as well as substantial shortcomings in terms of design.

On the success side, two issues are worth mentioning. First, the system is up and running and this should be seen in the context of this type of system being by far the largest ever in place to abate substances damaging the environment. The pioneering schemes in the US are far more modest in scope. Second, there is strong evidence that changes in CO_2 allowance prices are (almost) fully reflected in heat and electricity prices facing industrial and private consumers. This is important for providing clear economic incentives for consumers to reduce CO_2.

However, there are shortcomings of which we mention the three most important ones which are to be tackled in the reform of the ETS for the post 2012 regime.

First, too many allowances have been allocated. The total amount of allowances being allocated in the EU implies only a limited reduction of 5 per cent in 2012 relative to 1990 from the ETS covered sectors. This is well below the required reduction of 8 per cent for the EU15. This is a result of allocation happening at the national level, rather than being harmonised on the EU level.

Second, the allocation periods of first three and then five years are arguably to short (2005-2007, 2008-2012). If electricity generators and energy intensive industries have no clear view of the costs of using CO_2 beyond five years, how are they to plan investments with a life time of perhaps 30 years?

Third, it is not recommendable to use grandfathering as the main principle for distributing allowances. Grandfathering means giving CO_2 emitting firms allowances free of charge, based upon their historical emissions. The main arguments against grandfathering are that it is not credible to give firms in 2013 allowances based upon what they emitted more than 10 years ago. Indeed it so lacks credibility, that there may well be expectations in the market that future allowances are to based upon emissions also in the run up to 2012, potentially undermining the system: if emitting more CO_2 today means receiving more future allowances, then the incentive to save on CO_2 today goes down.

Moreover, grandfathering does not solve the potential competitiveness problem that energy and trade intensive firms such as cement and metal producers face when competing against non-EU firms with lower energy costs. Giving these trade and CO_2 intensive industries allowances based upon *past* behaviour/emissions does not really affect their incentives to place their *future* production within Europe.

Because of its overall success, it may be sensible to include other sectors into the ETS. In turn, the EU commission has proposed to extend the ETS with GHG emissions from aviation from 2011. The context is that the aviation sector is one of the industries with the largest historical and projected growth and GHG emissions if no action is taken. Furthermore, unilateral national action such as higher taxes on fuels, risks being undermined by operators buying their fuels outside the national jurisdiction imposing taxes and serving that Member State with 'untaxed' fuel.

Other policies targeting the energy sector:

The EU – as well as Member States – has a wide range of policies in place that effectively targets the sectors that are also covered by the ETS. At the Community level, the most important are initiatives favouring CCS, the Renewable Energy Directive and a wide range of measures encouraging energy savings related to consumer appliances and buildings.

In this context, it is very difficult to overstate the importance of the nature of interaction between the ETS and these other measures. Once the total level of allowances has been decided and allocated to the ETS covered industries, any new measures targeting these industries will have virtually no impact on their CO_2 emissions. The ETS covers about 95 per cent of all electricity production.

We therefore emphasise that the objective in these areas is to help the EU meets its climate change targets and energy security policies in a cost effective way, rather than being instruments to reduce CO_2 in their own right at least in a short term perspective. However, in a longer term perspective, cost effective support policies in these areas will allow the EU to be more ambitious in reducing GHG emissions without excessive economic costs and this perspective is important to keep in mind. We have key priorities in this regard.

First, a better functioning internal market for energy has substantial potential for helping the EU reaching EU climate targets. The costs of climate change are currently inflated by the lack of effective interconnection between Member States and regions. Dealing with the regulatory failures that have created this situation would lead to a better functioning internal market for energy; this could increase cost effectiveness.

It may drive up the average efficiency in coal fire plants as increased competition speeds up the phasing out of less efficient plants. Reducing the current spread of plant efficiency to half would deliver substantial savings of CO_2 for a given level of energy delivered from coal fired plants.

Moreover, it may help producers of wind power to export surplus electricity when the wind is blowing hard rather than dump it into local markets at a low price. Similarly, it may help to increase electricity imports when it is not blowing, thus reducing the need for expensive backup capacity in traditional coal driven plants. This should be seen in the context of the renewable energy directive as well as national efforts to boost renewable energy that is relying on a sizeable increase in the share of wind energy in total production. Windmill production is very volatile and the capacity to produce wind power very unevenly spread across the EU. This indicates that costs of poor interconnection between Member States and regions will rise in the future.

Finally, internal market 'thinking' would also be productive in schemes promoting renewable energy. Often, only renewable energy produced within a country's own borders is accepted when judging whether consumers have purchased a sufficient amount in mandatory Public Service Obligations (PSO). This practice is accepted in the renewable energy directive and also, somewhat surprisingly perhaps, in rulings from the Court of Justice. As such 'green' electricity may be produced more cheaply in other countries, not least because most green energy comes from hydro power and windmills concentrated in a relatively small number of countries; this makes the burden of meeting targets different across Member States and limits competition.

Second, the promotion of standards for energy efficient products can help consumers reap savings but should be done more selectively. Labelling of energy efficient products can help consumers buy the most energy efficient products. This is a natural counterpart to the use of market based instruments such as ETS that puts a higher price on the use of fossil fuels and can help reduce the costs for consumers of dealing with climate change. Minimum efficiency standards can be a helpful supplementary tool particularly when they are focused on products where market based instruments provide limited incentives to savings in practice. But care should be taken not to create unproductive overlap with other climate policy instruments such as the ETS. These issues could be looked carefully at in the upcoming discussions on labelling and efficiency standards.

Thirdly, support for renewable energy can be more focused. Rising costs of fossil based fuels aided by a more stringent future ETS imply that a wider range of low or zero carbon technologies may become economically viable over a period of 2-3 decades. Surveys show that private investment in R&D in both energy saving technologies as well as renewable energy has risen in response to fuel price increases, which should help a market driven innovation process. There is nonetheless a considerable amount of uncertainty presently about which specific winners will come out on top to provide a substantial contribution to the goal of producing zero carbon energy at reasonable costs.

This suggests that public support to relatively mature, but still improving technologies such as wind and hydro power, can be slowly phased out as market prices for energy have already risen considerably. On the other hand, support for the next generation of technologies (biomass, solar power, tides, CCS) should be more of an R&D nature and not too technology specific. There is substantial evidence of room for improvement in both these areas.

Road transportation:

Road transportation is one of the key drivers of GHG in the EU, as well as globally, with CO_2 emissions up 21 per cent between 1990 and 2005 and projected to grow also in the coming years. Presently, the EU has two key instruments in place in this area to reduce emissions and increase energy security.

The first instrument is fuel efficiency standards. Voluntary agreements to reach specific fuel efficiency standards have been in place with car associations from three global regions (Japan, South Korea and Europe) since 1998. Their impact on improvements in fuel efficiency is difficult to judge; in any case the Commission assesses that the target of 140 g CO_2/km for the average of new cars in 2008/2009 is not likely to be reached.

As a response, the Commission is planning to go for legally binding fuel efficiency standards imposed on individual car manufacturers. The Commission has proposed a target of 130 g CO_2/km for the average new car sold in 2012. Recently, the European Parliament has proposed a target of 125 g CO_2/km for the average new car sold in 2015.

US experience shows that regulatory fuels standards imposed on manufacturers, presents a trade-off. On the one hand, as car producers are very much specialised in different segments of the car market (luxury versus mini cars for example), equal standards will lead to distortions of competition between manufacturers. On the other hand, allowing luxury car manufacturers to adhere to a less stringent target on fuel efficiency will reduce the effectiveness of the legislation in reducing CO_2-emissions.

The second instrument is the biofuels directive to encourage the take-up of biofuels. The Commission target is a market share of biofuels of 5.75 per cent in 2010. The Commissions finds it unlikely that the target will be met. The way the biofuels directive works is that Member States set their own targets for market share of biofuels and then use instruments to ensure compliance. Either Member States reduce taxes on biofuels thereby making biofuels more competitive compared to standard fuels; or Member States introduce a compulsory mix of standard fuels and biofuels on distributors. The trend seems to be going in the direction of the latter.

Currently, biofuels come from biomass grown in fields. This is also referred to as first generation biofuels, which implies some risks. Biomass for heat and electricity has a higher energy output than biomass used for biofuels. This implies that the available biomass is perhaps better used in power plants than in cars. There are other reasons why biofuels may be a good idea anyway, for example as a means to increase energy security.

Another potential caveat with first generation biofuels is the impact on agricultural prices. Globally, the rise in demand for biofuels has been a contributor in the recent surge in agricultural prices, because biomass grown on fields directly competes with feed stock. Consequently, the supply of biofuels might only be increased at the risk of further price increases on feed stock, with potential adverse consequences for lower income groups.

Second generation biofuels is another matter, because they allow the use of a much wider range of raw material, especially waste. Hence, agricultural prices would not be affected. However, second generation biofuels are far from being competitive with fossil fuels and do therefore not exist in a large scale. EU research support could be an important driver for developing second generation biofuels.

We believe that especially legally binding fuel efficiency standards has a potential for reducing emissions but is not the best option. Member States are better equipped to handle emissions from cars than the EU level; primarily because higher fuel taxes is perhaps the most powerful instrument for reducing car emissions, and they are decided at the Member State level. Higher fuel taxes would directly spur consumer demand for more fuel efficient new cars. But maybe more importantly, higher fuel taxes tax will also directly affect emissions from the entire car stock, something that the proposed EU legislation on fuel efficiency standards does not (it only increases fuel efficiency in new cars slowly increases fuel efficiency in the entire car stock as new cars replace old cars). Higher fuel taxes would for example reduce demand for kilometres driven, spur consumer interest into auto parts that could increase fuel efficiency (for example better tyres), and promote more fuel efficient driving in general. Studies looking at costs of increasing fuel efficiency by way of a tougher standard find that it can be several times more expensive than simply raising fuel taxes.

The EU commission will shortly start discussions on a renewed approach to energy taxation also with the vision to address climate change. This discussion could include a discussion on raising minimum fuel taxes. There is some evidence that Member States presently refrain from raising taxes on diesel and petrol because border region consumers (and lorry drivers as well) will source their fuel purchases from lower priced countries/neighbours if price differences become more than minimal. Efforts to raise minimum tax levels on petrol and diesel may help Member States in this regard.

7.1 Post 2012 regime

A number of the conclusions above – such as the strengthening of the internal market dimension, selective promotion of energy standards and the started review of energy taxation to deal cost-effectively with climate change – can be instigated immediately.

By contrast, reform of the ETS following the review process is intrinsically linked to the post 2012 regime and needs to be taken up in the context of the negotiations for a replacement of the current Kyoto agreement.

We highlight three areas as being the most important issues for the post 2012 regime; assessment of overall costs and its distribution across sectors, how to achieve cost-effectiveness; and agreeing on the distribution of target reductions within the EU.

The overall costs from meeting post 2020 reduction cuts may be relatively modest while not trivial. The EU Commission’s own impact assessment suggests that less than 10 per cent of the total economic growth between now and 2020 may be lost due to the cost of reducing emissions. A Dutch study from 2007 suggests also that costs could be relatively modest.

In view of this, we find the economic and political challenges to be less of a question on the overall costs but more about their distribution across industries and between countries. Furthermore, these studies assume that least cost solutions to delivering emission reductions are chosen, the question is then what this implies for the overall design of EU climate policies.

As regards *improving cost-effectiveness* our key recommendation is to reform the ETS in line with the identified shortcomings and extend it to new sectors where this is cost-effective. As regards shortcoming, the overall level of allocations should be consistent with further substantial reductions from this sector. This will also help the development of alternative sources of energy by keeping the price of fossil energy high.

Moreover, the degree of auctioning is recommended to reach a much higher level. At the same time, benchmark models can be used to prevent out-sourcing of the very energy intensive industries in strong *international competition*. These industries may account for less than 1 per cent of total value added and perhaps 10-20 per cent of total emission under the ETS. Provided such a safety net is extended to firms in strong competition with non-EU firms, it is difficult to see significant job losses at industry level following from ambitious EU goals and even less at the macro level. The key here is that policies are announced in good time and follow least cost methods, providing the minimum of disruption and costs to firms.

ETS can productively be extended to new industries and activities, for example aviation as proposed by the EU Commission to take place already from 2010. We review the options for bringing in additional activities based upon a number of selection criteria. The most important are high ability to monitor and verify emissions, limited compliance costs and the size of emissions being important. A final positive inclusion criterion is a limited ability of member states to reach reductions themselves – for example by imposing national CO_2 taxes – as activities are strongly traded internationally. Indeed the present ETS industries fulfil these criteria as does also aviation clearly. We suggest the inclusion other activities with marine transportation being one example. It shares many of the same characteristics as aviation. However, the scope for legally avoiding the obligation to buy CO_2 allowances when shipping goods to and from EU is much larger, so its candidacy for inclusion is weaker. Road transportation is ruled out by these criteria.

The internal burden sharing of the targets for emission cuts of GHG within the EU will undoubtedly be subject to intensive political negotiations. Early studies suggest that the range of national targets for reductions could become narrower for the next period. This reflects member states becoming more alike with catching-up of income levels and more equal levels of emissions per capita: some of the key criteria for assessing national reduction targets in the first commitment period. However, a key problem may arise from some countries being forced to go from allowed positive growth rates in the present commitment period to target reductions for emissions post 2012. This problem is compounded by some of the same countries already facing problems meeting the targets for the present commitment period. In the first commitment period, some countries stepped forward committing themselves to larger relative target reductions than objective criteria suggested. A repeat of this can prove helpful in meeting overall targets for the EU, also for the second period.

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