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EUROPEAN ENERGY POLICY AND THE TRANSITION TO A LOW-CARBON ECONOMY

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By Jeremy Lawson

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ABSTRACT/RÉSUMÉ

European energy policy and the transition to a low-carbon economy

European energy policy faces a number of interrelated challenges, including making the transition to a low-carbon economy, increasing cross-border competition in electricity and gas markets and diversifying Europe's energy supply. The EU has developed a comprehensive strategy in all of these areas, encapsulated in 2020 targets for reducing greenhouse gas emissions, raising renewable energy and increasing energy efficiency. These targets are underpinned by an Emissions Trading Scheme, legally binding reduction commitments by member states for the emissions not covered by the trading scheme, the third energy liberalisation package and the Energy Security and Solidarity Plan. The steps the EU have taken are worthwhile but there is also room for improvement. To ensure that the transition to a low-carbon economy is achieved at a low cost, the EU should seriously consider including all transport sectors in the Emissions Trading Scheme when practical and appropriate, and ensure that only sectors rigorously identified as being at genuine risk of carbon leakage should continue to receive free allowances until 2020. Consideration should be given to making use of an EU-wide market instrument to deliver the EU's renewable energy target, and it will be important to ensure that the 10% renewable transport fuel target efficiently achieves its objectives of sustainability and security of supply given the high cost of many renewable transport fuels. Measures to raise energy efficiency will have to be designed carefully so that the overall cost of mitigation is not raised. The Commission's third energy market liberalisation package should be strengthened by requiring full ownership unbundling of transmission service operators and ensuring the powers of the proposed Agency for Co-operation of Energy Regulators are broad enough to contribute effectively to a truly single European energy market.

This Working Paper relates to the *2010 Economic Survey of the European Union*.

(www.oecd.org/eco/surveys/EuropeanUnion)

JEL Classification: Q4; Q5.

Key words: Climate change mitigation; emissions trading; energy market regulation; renewable energy; European Union.

Politique énergétique européenne et le passage à une économie sobre en carbone

La politique énergétique de l'Europe doit relever plusieurs défis interdépendants, dont le passage à une économie sobre en carbone, l'accentuation de la concurrence transfrontalière sur les marchés de l'électricité et du gaz et la diversification des sources d'énergie. Dans tous ces domaines, l'Union européenne a conçu une stratégie globale inscrite dans les objectifs de 2020 pour la réduction des émissions de gaz à effet de serre, qui fait une plus grande place aux énergies renouvelables et favorise l'augmentation de l'efficacité énergétique. Ces objectifs reposent sur plusieurs piliers : le système communautaire d'échange de quotas d'émission (SCEQE), des engagements de réduction légalement contraignants des États membres pour les émissions non couvertes par le système d'échange, le troisième paquet énergie et le Plan d'action européen en matière de sécurité et de solidarité énergétiques. Les mesures prises par l'Union européenne sont louables, mais des améliorations sont toutefois possibles. Pour passer au moindre coût à une économie sobre en carbone, l'UE devrait sérieusement envisager d'inclure tous les secteurs des transports dans le système d'échange de quotas d'émission lorsque c'est possible et judicieux, et veiller à ce que seuls les secteurs rigoureusement identifiés comme présentant un risque significatif de fuite de carbone continuent de recevoir des quotas gratuits jusqu'en 2020. Il faudrait envisager de mettre en place un instrument de marché à l'échelle européenne pour réaliser l'objectif de développement des énergies renouvelables, et vu le coût élevé de nombreux carburants de transport renouvelables, il conviendra de veiller à ce que l'objectif de 10 % de carburant renouvelable réponde à l'ambition d'assurer la durabilité et la sécurité des approvisionnements. Les mesures en faveur de l'efficacité énergétique devraient être conçues avec le plus grand soin si l'Europe veut éviter de payer un coût total plus important. Il faudrait renforcer le troisième paquet énergie de la Commission, en exigeant une séparation patrimoniale totale des exploitants de services de transport et en veillant à doter la future Agence de coopération des régulateurs de l'énergie de pouvoirs suffisamment importants pour qu'elle puisse efficacement travailler à la mise en place d'un véritable marché unique européen de l'énergie.

Ce document de travail porte sur l'*Étude économique de l'Union Européenne*

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Classification JEL : Q4 ; Q5.

Mots clés : Atténuation du changement climatique ; échanges de droits d'émission ; régulation du marché de l'énergie ; énergies renouvelables ; Union européenne.

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European energy policy and the transition to a low-carbon economy

By Jeremy Lawson¹

1. European energy policymakers face a number of complex challenges, as well as significant opportunities. Europe must make the transition to a low-carbon economy as part of a co-ordinated global approach to mitigating greenhouse gas emissions and avoiding irreversible damage of climate change. Cross-border competition in electricity and gas markets must increase markedly so that the goal of a single European energy market is finally realised. Energy security must be strengthened so that Europe is less vulnerable to supply disruptions that originate in other countries. These challenges are of course interrelated. Reducing European greenhouse gas emissions will be more costly if segmentation in energy markets dulls the price signals from emissions trading. And without more competition in energy markets, necessary investments in cross-border transmission networks will be delayed, thereby inhibiting European energy security.

2. Perhaps the most significant of these challenges is climate change. Climate change represents a global market failure. The social cost of consuming and producing greenhouse gas-intensive goods and services and the atmospheric concentration of greenhouse gases is higher than the private cost (Box 1). To meet the energy and climate challenges, the European Commission will need to work closely with member states as well as countries outside the Union, and make use of a comprehensive set of instruments that address all the market failures that plague energy and climate change policy. In addition to addressing the wedge between the social and private cost of greenhouse gas emissions, policy will also have to overcome other market failures, including capital market imperfections, externalities in R&D, lack of sufficient information, monitoring and enforcement costs, the market power of incumbent firms and the incentives for free-riding. Recognising this, the EU has developed a comprehensive energy and climate policy strategy. To contribute to climate change mitigation, the EU has set a target for reducing its greenhouse gas emissions by 20% below 1990 levels by 2020 and increasing the share of renewable sources in gross final energy consumption to 20% by 2020. To internalise the social cost of greenhouse gas emissions and send a long-term price signal in favour of investment in low-emission technologies, the EU has introduced an Emissions Trading Scheme (ETS). To improve the efficiency with which households and firms use energy, the EU has set an indicative target for reducing energy consumption by 20% by 2020 and upgrading efficiency standards applying to new buildings, passenger cars and appliances. A third liberalisation package has been agreed to increase competition in electricity and gas markets, raise the effectiveness of price signals from the ETS and stimulate investment in grids that can absorb new renewable energy capacity.

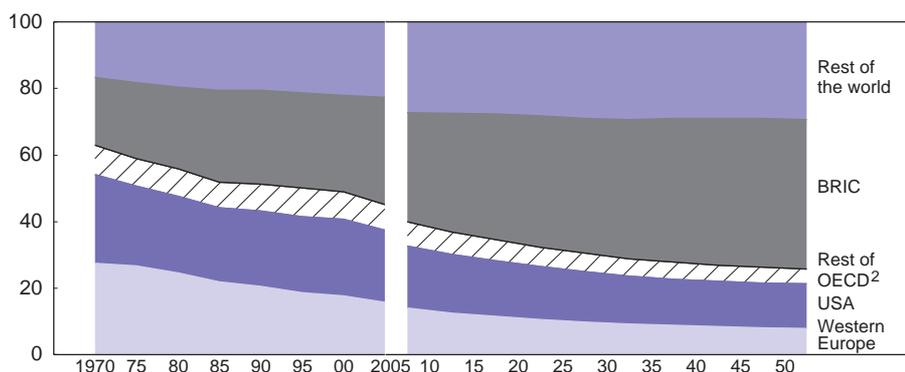
1. The author is a senior economist with the country studies branch in the Economics Department of the OECD. The paper is based largely on work originally prepared for the Economic Survey of Luxembourg published in January 2010 under the authority of the Economics and Development Review Committee (EDRC). The author would like to thank Andrew Dean, Robert Ford, Peter Hoeller and Sebastian Barnes of the Economics Department of the OECD for useful comments on earlier drafts. Thanks also to Isabelle Duong for providing statistical assistance and to Didi Claassen for editorial assistance. The author retains full responsibility for any errors or omissions.

Box 1. Greenhouse gas emissions and climate change

Since 1970, global greenhouse gas (GHG) emissions have doubled and the concentration of greenhouse gases in the atmosphere has increased to just over 380 parts per million (ppm) of carbon dioxide equivalent (CO₂^e) (National Oceanic and Atmospheric Administration Earth System Research Laboratory, 2008).^{*} Without further policy initiatives, global GHG emissions could nearly double again by 2050 and the atmospheric concentration of greenhouse gases increase to 650 ppm CO₂^e (Figure 1) (IIASA GGI Scenario Database, 2008). According to the Intergovernmental Panel on Climate Change (IPCC), the increase in the atmospheric concentration of greenhouse gases since the industrial revolution has contributed to global warming of around 0.7°C over the past 100 years (IPCC, 2007).

Figure 1. World GHG emission trends by country/region¹

As a share of world total emissions



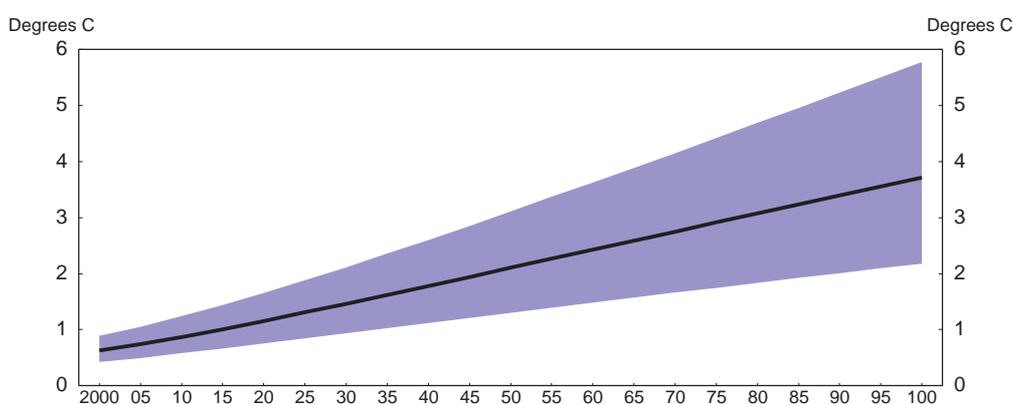
1. Data exclude emissions from land use, land–use change and forestry. Break in series in 2005 due to different sources.

2. The rest of the OECD does not include Korea, Mexico and Turkey which are aggregated in rest of the world.

Source: OECD (2008), *OECD Environmental Outlook* and OECD ENV–Linkages model.

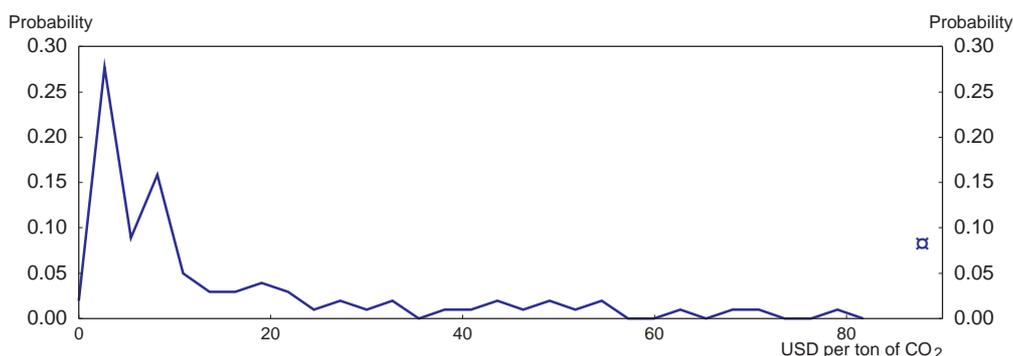
If emissions growth continues on its current trajectory, global temperatures are likely to increase by between 2°C and 6°C this century (Figure 2), and contribute to rising sea levels and more frequent, extreme weather events (IPCC, 2007). Climate change is likely to imply declining global agricultural yields, reductions in biodiversity, reduced availability of fresh water, and higher rates of diseases. Although there is uncertainty about the social cost of greenhouse gas emissions, estimates suggest that the net present value could be as high as USD 85 per ton of CO₂ (Figure 3) (Tol, 2005). Reducing the probability of extreme and irreversible climate change will require very large emission reductions in the course of the century, though there is considerable debate in the scientific and economic literature over the optimal magnitude and timing of emission reductions.

Figure 2. Projected temperature increases under OECD baseline scenario¹



1. Lower and upper bounds correspond to lower and upper values of the climate sensitivity parameter.

Source: Burniaux *et al.* (2008), "The Economics of Climate Change Mitigation: Policies and Options for the Future", *OECD Economics Department Working Paper*, No. 658.

Figure 3. The probability distribution of the social cost of carbon¹

1. The social cost of carbon is the net present value (over the simulation horizon) of the climate change impact of one additional ton of CO₂ emitted in the atmosphere today. The observation on the right hand side is the cumulative probability of social cost of carbon in excess of USD 85/tCO₂.

Source: Burniaux *et al.* (2008), "The Economics of Climate Change Mitigation: Policies and Options for the Future", *OECD Economics Department Working Paper*, No. 658.

* The six major greenhouse gases are carbon dioxide, methane, nitrous oxide, hydrofluorocarbons, perfluorocarbons and sulphur hexafluoride.

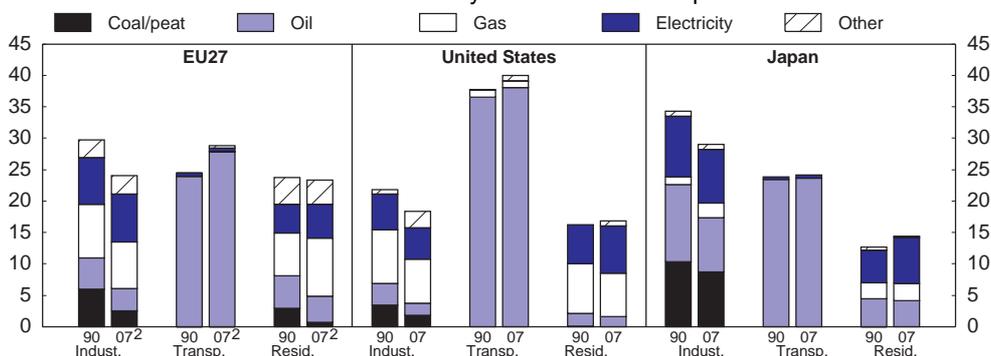
3. However, it is essential that the instruments to reach these targets are as efficient as possible, correct only genuine market failures and are flexible enough to cope with future scientific, economic and technological changes. In the short and medium term, policies to mitigate climate change will slow potential GDP growth as the higher cost of carbon-intensive goods and services reduces the productivity of the existing capital stock, and lower cost technologies are substituted for higher cost technologies. To minimise the impact on growth, the EU should avoid policies that unnecessarily raise the cost of carbon abatement, potentially lock-in inefficient technologies and overlap too much with other, more efficient policies. This chapter assesses the EU's policy strategy in this light.

A snapshot of the energy sector

4. The EU is heavily dependent on energy imports. In 2005, imports represented about 50% of total EU energy supply, with import dependence most acute for oil and gas. Between 1990 and 2005 energy consumption increased by 10%, compared to a 35% increase in GDP, implying an average annual drop of 1.4% in the energy intensity of the economy (IEA, 2008a). Fossil fuels dominate energy supply; in 2005 oil, gas and coal together accounted for 78% of the total, compared to just 7% for renewables. Within fossil fuels there has been some substitution from coal to gas, though the share of fossil fuels is only slightly lower than it was in 1990. The share of nuclear energy was 14% in 2005, up from 12% in 1990.

5. Although the energy mix has been fairly stable over the past two decades, this masks considerable variation across sectors as well as member states. Overall, the industrial and transport sectors account for the largest shares of final energy consumption (each around 30%), followed by the residential sector at just over 20% (Figure 4.4). Not surprisingly, oil is the predominant energy source for the transport sector, while electricity dominates the industrial and residential sectors. At the member state level there is considerable variation in the energy used to produce electricity (Figure 5). For example, France has the highest share of nuclear, while Sweden makes proportionally more use of renewable energy (largely hydropower) and the Eastern European countries are the heaviest consumers of coal. The difference in the energy mix across countries reflects a number of factors, including available national resources, policy choices and R&D priorities.

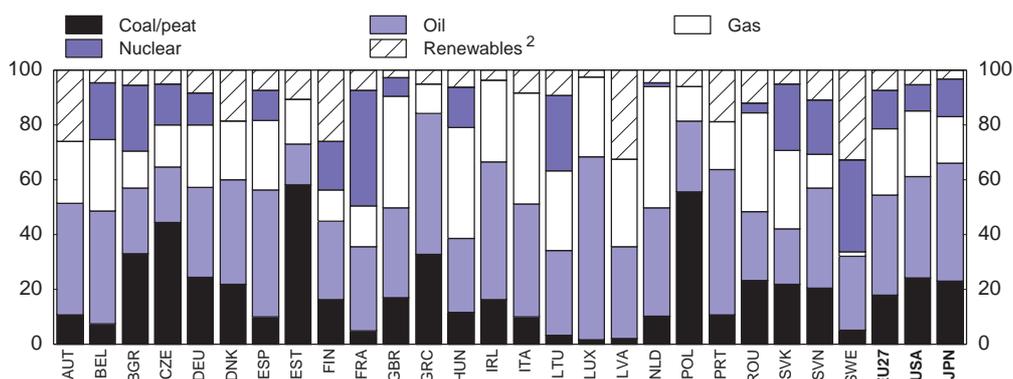
Figure 4. **Sectoral final energy consumption by source**
Share of each country's total final consumption¹



1. The three sectors shown (industry, transport and residential) don't add up to the total as the total includes other sectors such as agriculture.
2. 2006 data.

Source: IEA (2009), *Energy Balances of OECD Countries* and *Energy Balances of non-OECD Countries*.

Figure 5. **Total primary energy supply**
Per cent of total, 2008¹

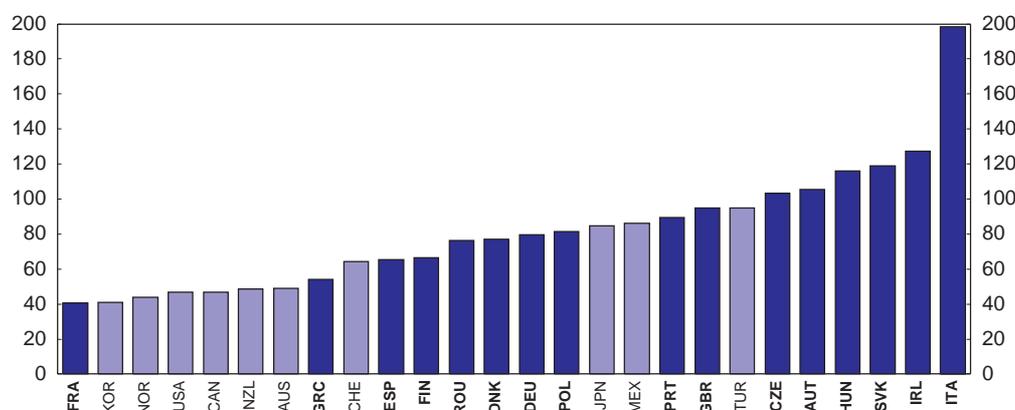


1. The total excludes electricity and heat. 2006 data for Bulgaria, Estonia, Lithuania, Latvia, Romania, Slovenia and the EU27.
2. Hydro, geothermal, combustible renewables and waste and solar, wind and other.

Source: IEA (2009), *Energy Balances of OECD Countries* and *Energy Balances of non-OECD Countries*.

6. There is also considerable variation in energy prices. For example, electricity prices for industry in 2008 ranged from EUR 40 per megawatt hour in France to about EUR 200 per megawatt hour in Italy (Figure 6). These differences reflect differences in the cost of generating electricity, together with the lack of competition and integration in the EU electricity market which hampers electricity being exported from low-cost countries to high-cost countries. Differences in taxation also have an impact. The introduction of the EU Emissions Trading Scheme (ETS) in 2005 is having an impact on absolute and relative energy prices. The spot price of emission allowances has so far averaged EUR 16 per tonne of carbon dioxide equivalent (CO₂^e) during the second phase of the ETS, which had only a small effect on average retail electricity prices. The variation in the use of energy sources across member states, combined with the different carbon intensities of those energy sources (coal is most carbon intensive per unit of energy produced, and nuclear and renewable least), means that the ETS is having a differential impact on overall energy prices across countries.

Figure 6. **Electricity prices for industry**
EUR per thousand kilowatt hours, 2008¹

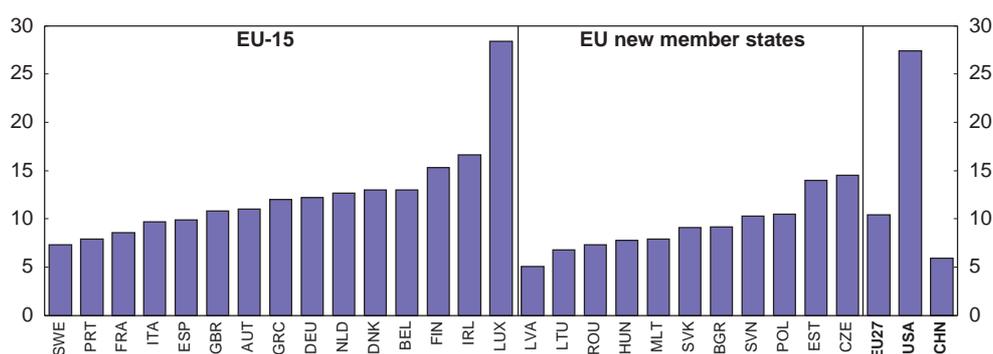


1. Or latest available data.

Source: IEA (2009), *Energy Prices and Taxes*, 2nd Quarter 2009.

7. Greenhouse gas emissions in the EU27 fell by 7.9% between 1990 and 2005, while emissions fell by 2% in the EU15. Overall, the carbon intensity of the EU economy has fallen by 0.8% per annum since 1990. The reduction in carbon intensity predominantly reflects the substitution in the energy mix from coal to gas, and the restructuring of the eastern European economies after the fall of their Communist regimes (IEA, 2008a). Under the Kyoto Protocol, the EU15 is obliged to reduce its greenhouse gas emissions by 8% from 1990 levels by 2008–12 in aggregate, though obligations vary from country to country and some countries are making better progress toward their targets than others. *Per capita* greenhouse gas emissions vary considerably because EU countries vary both in their relative use of carbon-intensive energy sources and the efficiency with which they use those energy sources (Figure 4.7). Although poorer EU countries tend to have lower *per capita* emissions, they also tend to be more carbon intensive per unit of GDP. Overall, *per capita* emissions in both the EU15 and EU27 are considerably lower than in the United States and Japan, though above those of most developing countries.²

Figure 7. **Per capita GHG emissions**
tCO₂-equivalent, 2006¹



1. 2005 data for the United States and China.

Source: EEA (2008), *Greenhouse Gas Emission Trends and Projections in Europe 2008*, and Burniaux *et al.* (2008), "The Economics of Climate Change Mitigation: Policies and Options for the Future", *OECD Economics Department Working Paper*, No. 658.

2. The exceptions are developing countries such as Brazil, Indonesia and Papua New Guinea, whose forestry and land use practices contribute to very high *per capita* emissions.

The energy policy framework

8. To get energy policy right, policymakers must have a good sense of the factors that will shape energy demand and supply over the coming decades and plan ahead accordingly. Energy policies enacted today can have long-lasting impacts because the economic life of the energy capital stock is often very long (Table 1). This is complicated by the uncertainty that surrounds future economic developments, the state of scientific knowledge about climate change, potential breakthroughs in low-emission energy technologies and the elasticity of such breakthroughs with respect to carbon prices, and the energy policies of other countries.

Table 1. Typical service life for selected investments

Type of asset	Typical service life (years)
Household appliances	8–12
Automobiles	10–20
Industrial equipment/machinery	10–70
Aircraft	30–40
Electricity generators	50–70
Commercial/industrial buildings	40–80
Residential buildings	60–100

Source: Jaffe, A., R. Newell and R. Stavins (1999), "Energy-Efficient Technologies and Climate Change Policies: Issues and Evidence", *Resources for the Future Climate Issue Brief*, No. 19, Resources for the Future, Washington, DC.

9. Recognising the importance of a forward-looking, comprehensive energy strategy, the EU has agreed to the EU energy and climate change policy in 2007. Key elements of the strategy are:

- Reducing greenhouse gas emissions by 20% below 1990 levels by 2020. The main instruments to achieve this target are the ETS and other measures targeted at sectors not covered by the ETS.³ To achieve the overall reduction of 20% relative to 1990 levels, the EU needs to cut its greenhouse gas emissions by 14.5% relative to 2005 levels. This will be achieved by capping emissions for all installations across the EU covered by the ETS at 21% below 2005 levels and through individual member state targets for emissions reductions in all sectors outside the EU ETS, which add up to a reduction of 10% relative to 2005 levels.
- Involving non-EU countries in an international agreement to reduce global greenhouse gas emissions through the United Nations Framework Convention on Climate Change process. The EU is willing to go further and sign up to a 30% reduction target in the context of an ambitious and comprehensive international agreement if there are comparable reductions by other developed countries and appropriate contributions by the economically more advanced developing countries based on their responsibilities and capabilities.
- Raising the share of renewable energy to 20% of total EU gross final energy consumption by 2020. In addition to subsidies for renewable energy generation, the EU proposes to step up R&D spending on renewable energy technologies.

3. Note that the 20% target is a reduction compared to 1990 to be achieved by 2020. It is an independent commitment which has legal ground in a Directive amending the Emission Trading Scheme (ETS) and a Decision on the effort to reduce emissions in the sector not covered by the ETS. Specific reduction targets for the ETS as a whole and the individual targets for member states for the sectors not covered by the ETS are expressed as reductions compared to 2005 and not 1990. Choosing 2005 was necessary in order to be able to distinguish between the ETS and non ETS sectors. The first year specific data was available for the ETS was 2005.

- Increasing the use of renewables in transport fuels to 10% in each member state.
- Reducing EU energy consumption by 20% by 2020, compared to baseline developments. Measures include introducing EU-wide vehicle efficiency standards for new passenger cars, a building efficiency code, and updated, comprehensive performance standards for electrical appliances.
- Developing a fully integrated single market for electricity and gas, through the effective unbundling of transmission system operators, strengthening and enhancing co-operation amongst energy regulators, increasing investment in infrastructure to facilitate cross-border trade in electricity and gas, and rapid growth in renewable energy.
- Establishing a legal framework on carbon capture and storage (CCS) and using a dedicated part of the proceeds from the ETS to finance a number of CCS demonstration plants and innovative renewables.
- Enhancing energy security through the development of a European energy grid and diversifying the energy mix. Pricing carbon and the move to a single market for electricity and gas will be critical for achieving these goals.

10. This is an ambitious programme along a number of dimensions. In absolute terms, Europe's current emissions reduction targets are larger than for other comparable regions. A balance will have to be struck between spreading the cost of reducing emissions widely across the economy and avoiding carbon leakage. It is critical that the ETS delivers a long-term price signal that encourages firms to substitute high-emission production processes for low-emission processes, encourages households and firms to use energy more efficiently, and encourages R&D on low-emission technologies. Some of the technologies such as carbon capture and storage that will be necessary to deliver even greater emission reductions in the future have yet to be commercially developed and face high costs. To achieve the binding 20% renewable energy target will require more than doubling the share of renewables over the next decade. Raising energy security is an important goal, but even under the latest EU initiatives, the share of imports in primary energy supply will increase further over the next decade (IEA, 2008a). Achieving an effective, single energy market will be a challenge, particularly as some member states may have to defer national priorities, but this will be critical for reaching the EU's environmental targets.

11. The economic costs of delivering the climate-related elements of the energy and climate change policy are very uncertain and will depend on many variables, among other overall economic development, energy price development on the international market, the further development of the global carbon market (Box 2), the instruments chosen to encourage emission reductions, how quickly the cost of low-emission technologies falls over time, and whether a single market for energy is achieved. The Commission's impact assessment projects the cost of reaching its climate mitigation and renewable energy goals, including access to project-based mechanisms, to be 0.45% of EU GDP in 2020. This would require a carbon price of EUR 30 per tonne of CO₂ (2005 prices) and a renewable energy incentive of EUR 49 per MWh. Oil and gas imports would fall by EUR 41 billion by 2020, while electricity prices are likely to increase by 10–15%.

Box 2. Sharing the global burden of climate change mitigation policies

Because climate change is a global market failure with severe environmental, social and economic costs, mitigation requires co-ordinated global action to reduce global greenhouse gas emissions. However, there is still no agreement amongst all countries by how much global emissions should be reduced and how the burden of reducing greenhouse gas emissions should be distributed across countries, creating incentives for countries to free ride on the actions of others. This makes effective global mitigation actions less effective.

Some developing countries argue that as climate change is largely due to earlier emissions by developed countries, it would be unfair for them to bear much of the cost of abatement, particularly as their living standards are still comparatively low. On the other hand, because developing countries now account for over half of GHG emissions, and their share is rising over time, climate mitigation will be unsuccessful without an important contribution by developing countries, and poor countries have the most to lose from climate change (Stern, 2007).

A variety of suggestions have been made to secure binding political support for mitigation across all countries. These include:

- Allocating emission allowances to countries on the basis of historical emissions.
- Allocating emission allowances on the basis of long-term equalisation of *per capita* emissions.
- Implementing a globally-agreed carbon tax without explicit country-specific emission targets.
- Country-specific targets differentiated according to a country's ability to abate.
- Burden sharing, whereby developed countries agree to immediate abatement while abatement in developing countries is delayed until they reach higher *per capita* income levels.
- Dynamic targets taking into account historic and projected future emissions, *per capita* income and population (Bosetti *et al.*, 2008).

By requiring binding emission reductions of only developed (Annex 1) countries by 2012, the Kyoto Protocol took the burden-sharing approach. However, because of the rapidly growing share of developing countries in global emissions, an agreement that does not require at least some binding emission reductions below their business-as-usual path from large developing countries such as China and India appears unlikely.

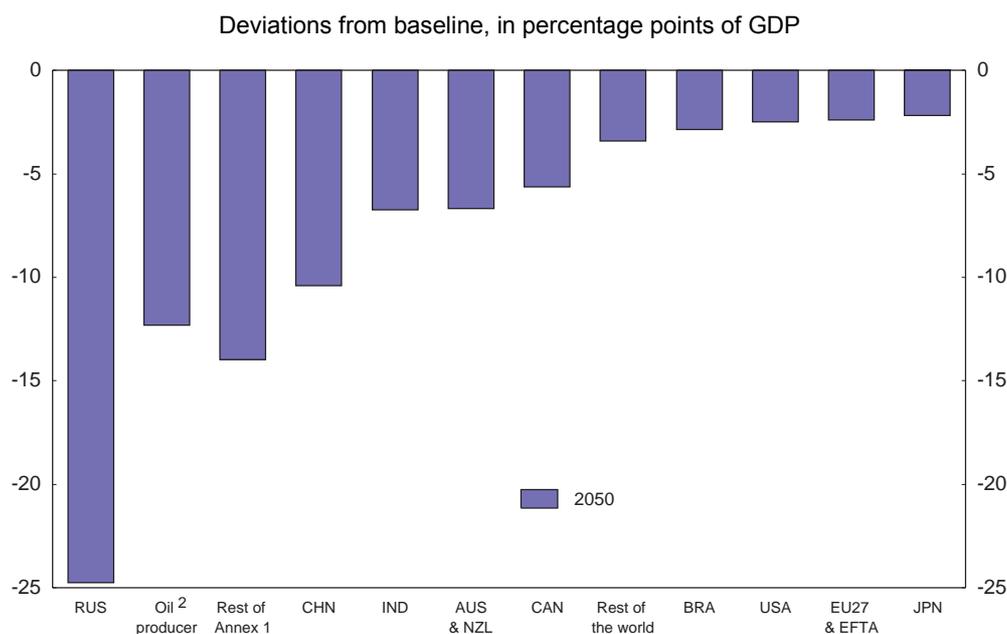
In January 2009, the European Commission unveiled its proposals for achieving a global agreement at the UN climate conference in Copenhagen in December 2009. The Commission called for collective 30% emission cuts for the group of developed countries by 2020 below 1990 levels and has proposed 15–30% cuts below current baseline trajectories for developed countries as a group. The Commission called on OECD members to set up their own Emissions Trading Scheme (ETS) by 2013 and will reach out to developing nations such as China, India and Brazil to encourage them to join an international carbon trading system. The Commission has also advocated substantial funding for developing countries to help them reduce their emissions and help secure their participation.

While the EU's example from its own mitigation policies, together with its international leadership are laudable, it remains to be seen whether these proposals will do much to secure a binding, effective agreement, especially after the disappointing conclusion to the Copenhagen conference.

12. Overall, this leads to an energy intensity improvement of approximately 30% between 2005 and 2020. Results of OECD modelling suggest that if Europe acts in concert with other countries to stabilise the atmospheric concentration of GHG at 550 ppm, GDP in 2050 would be just over 2% below its baseline level (Burniaux *et al.*, 2008) (Figure 8). The costs for the EU are considerably smaller than those for many other countries, largely because countries in Europe are less fossil fuel intensive (Figure 9). However, this assumes that there is a global carbon tax and that there is no burden sharing between the EU and developing countries. The 550ppm stabilisation target used in the modelling is also higher than the 450ppm being pursued by the EU in international negotiations.

13. If inefficient instruments are chosen to reduce emissions, abatement costs will be higher and output will be lower. If R&D leads to only incremental improvements in energy efficiency, mitigation costs will be reduced little. If, however, R&D leads to major technological breakthroughs, especially in the transport and industry sectors where marginal abatement costs are highest, mitigation costs could fall significantly. If Europe does not move promptly toward a single energy market, the price signals from the ETS will be blunted, convergence in energy prices will not take place, and it will be more difficult to absorb low-emission energy sources into energy grids (Bosetti *et al.*, 2008). The rest of the chapter considers the EU's battery of energy and climate change mitigation policies in more detail.

Figure 8. **Costs of stabilising GHG concentrations at 550ppm¹**

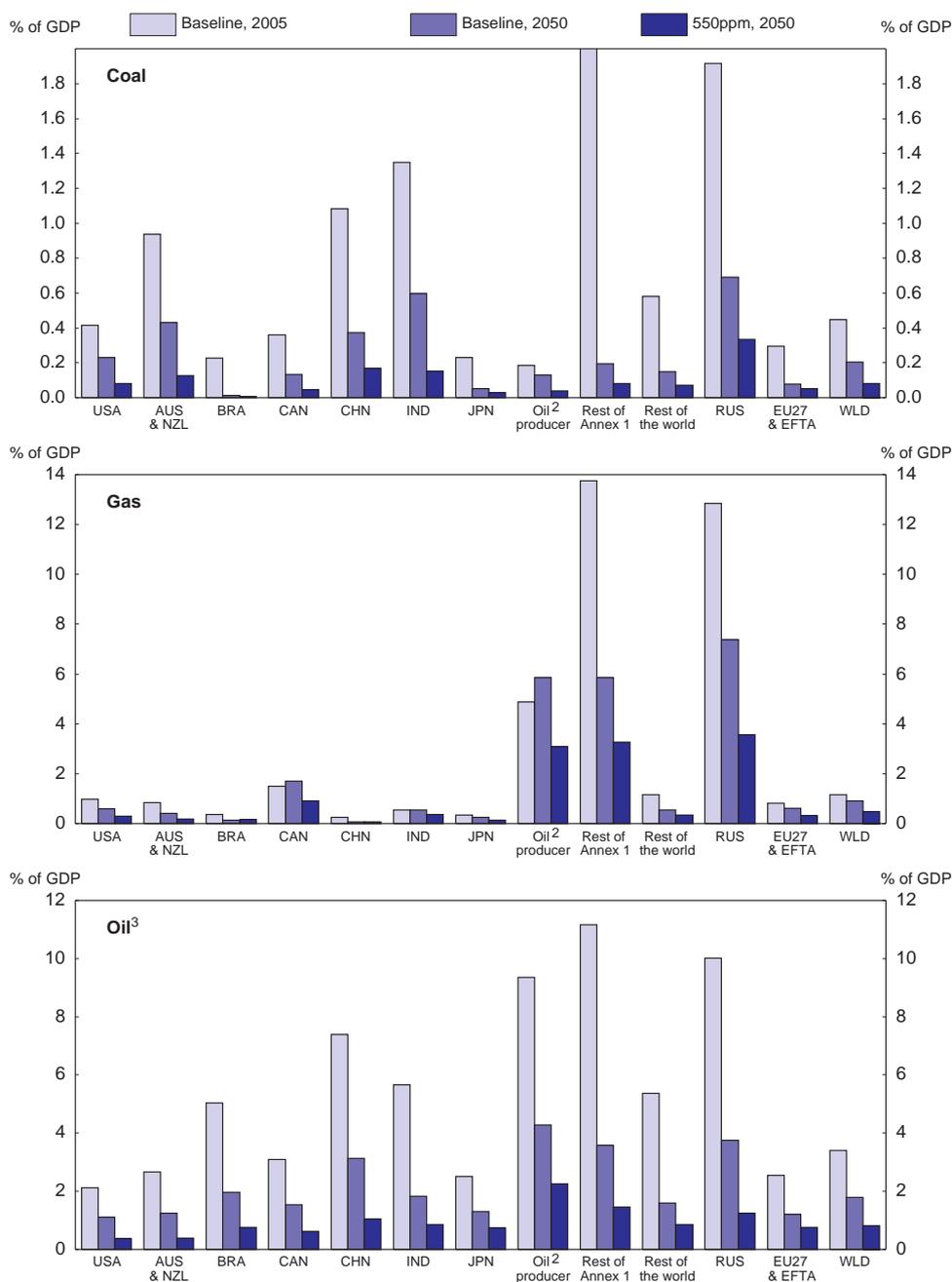


1. Scenario "550ppm-base", see Table 3.1 in Source. "2050" denotes the cost as a per cent of GDP in 2050 relative to baseline.

2. The region includes the Middle East, Algeria-Libya-Egypt, Indonesia and Venezuela.

Source: Burniaux *et al.* (2008), "The Economics of Climate Change Mitigation: Policies and Options for the Future", *OECD Economics Department Working Paper*, No. 658.

Figure 9. Projected fossil fuel intensities
Under baseline and 550ppm GHG concentration stabilisation scenarios¹



1. Energy intensity, defined as domestic demand as a percentage of GDP in 2050.
2. The region includes the Middle East, Algeria–Libya–Egypt, Indonesia and Venezuela.
3. Refined oil only.

Source: Burniaux *et al.* (2008), "The Economics of Climate Change Mitigation: Policies and Options for the Future", *OECD Economics Department Working Paper*, No. 658.

Emissions Trading Schemes

14. The most important instrument for delivering the goal of reducing greenhouse gas emissions is the European Emissions Trading Scheme (EU ETS). The rationale for the policy is simple (Duval, 2008). In possible fuel intensive sectors of the economy, a by-product is the emission of greenhouse gases which,

also has a social cost. The energy price will not include the social costs of climate change and emissions will be larger than is socially optimal. The main market mechanisms for internalising the social cost of carbon emissions are “cap and trade” emissions trading schemes and carbon taxes. Under “cap and trade” total emissions are capped in each period and allowances to emit allocated to firms either free or through an auction. Firms can then trade their allowances depending on whether it is profitable to emit more or less than their allocation. Because the quantity of allowances in the market is fixed, the price of allowances, and hence the price of carbon, adjusts according to demand and supply in the allowance market. In contrast, under a carbon tax, the price of carbon is set by the government, with the quantity of emissions determined by households and firms reacting to the change in relative prices (Box 3).

Box 3. Emissions trading compared with other carbon pricing mechanisms

Cap and trade emissions trading and carbon taxes should result in the same price and quantity of emissions when there is no uncertainty about current and future costs and benefits of greenhouse gas abatement; the policymaker would set the tax or cap on emissions to equalise the benefits and costs of abatement. However, because there is uncertainty about the impact of climate change and the costs of abatement, in practice the two instruments are not equivalent (Weitzman, 1974; Stern, 2007). Determining the optimal scale and timing of greenhouse gas abatement is further complicated by the fact that policymakers have to weigh the welfare of current and future generations because the costs of policies to reduce climate change accrue mostly to the current generation, while the benefits accrue mostly to future generations.

Any welfare advantages of carbon taxes are most likely to exist in the short run, where abatement costs are arguably relatively high because production reflects the low relative prices of fossil fuels and the capital stock is fixed, while the short-run benefits of abatement may be relatively low because emissions in any one year have little impact on the stock of greenhouse gases in the atmosphere (Weitzman, 1974; Stern, 2007; McKibbin and Wilcoxon, 2006). In this case, if policymakers believe that the cost of abatement is lower than it actually is, a carbon tax will be more efficient than an emissions cap because the cap has to be met by firms regardless of the cost. The price of carbon will also be more volatile under a cap if the costs of abatement shift with the state of the economy. However, given the broad uncertainty about likely environmental damages and the fatness of the tails in the distribution of possible damage costs, the benefits of price-based instruments in the short run may be overstated (Jamet and Corfee-Morlot, 2009).

In the long run, when the costs of abatement are likely to be lower because production has adapted to the higher relative prices of fossil fuels and the benefits of abatement are greater because the costs of climate change increase sharply as cumulative emissions increase, welfare is likely to be higher under a cap (Weitzman, 1974; Stern, 2007). Here, if the policymaker believes that the cost of abatement is lower than it actually is, a relatively low tax would result in less abatement than is socially optimal. Hence, if a carbon tax was in place, its level would need to be updated when new information about long-run costs and the *ex post* quantity of emissions became available.

However, even in the short term a quota scheme such as an ETS can be adapted to mimic the short-run benefits of carbon taxes. Flexibility mechanisms such as emission fees, banking and borrowing can all help to contain the short-run costs of abatement, while secondary markets for emission allowances help firms to hedge their carbon risk. It may also be more difficult to build long-term political coalitions around carbon taxes, which could undermine the credibility of climate mitigation policies. On the other hand, transaction and administrative costs of permit trading are likely to be higher than for carbon taxes, caps potentially offer more opportunities for rent seeking by interest groups and it may be difficult to implement a truly international permit trading system because of monitoring problems in poor countries (Nordhaus, 2004). Hybrid approaches have also been advocated that explicitly combine the short-term benefits of a fixed carbon price, with the advantages of tradable long-term permits (McKibbin and Wilcoxon, 2006).

15. The European Union chose a cap-and-trade ETS because it will credibly deliver its emissions-reduction targets for covered sectors; it could be linked with other emerging national schemes, provided that the schemes are compatible with the EU ETS; it is more likely to sustain the political coalition required for the long-term credibility of climate mitigation policy; and it enables firms to manage carbon risk through the secondary market for emission allowances. When setting up an ETS, a number of important design issues need to be considered, including:

- The sectoral coverage of the scheme. The efficiency and fairness of an ETS will be enhanced if the scheme includes as many sectors as is practical. Broad coverage ensures that low-cost abatement opportunities will be implemented and distributes the social burden more equitably (Duval, 2008; Garnaut, 2008). Governments also need to decide where in the supply chain the point of obligation for surrendering allowances should be. The implementation of schemes can be different for different sectors, and for some sectors it may be easier to implement schemes at upstream points (*e.g.* oil importing companies rather than individual emissions sources) due to lower compliance and administrative costs, while for others (*e.g.* energy utilities) implementing schemes downstream, *i.e.* at the point source of emissions, is more practicable and likely to ensure necessary compliance.⁴
- A mechanism for allocating emission allowances. Allowances to emit greenhouse gases can be allocated to firms through auctioning and/or free allocation based on likely losses in asset value, historic emissions (grandfathering) and industry benchmarks. When allocating allowances, governments need to consider equity and the need to encourage abatement and promote market efficiency. Emissions trading *per se* ensures static efficiency because it generates a uniform price signal that allocates mitigation efforts across firms depending on their own marginal abatement costs. In addition to that, auctioning maximises dynamic efficiency through incentivizing long-term technological change. Moreover, auctions deliver revenue to governments that allows other taxes to be reduced and greater support for research and development of low-emission technologies. Auctions can also promote equity by transferring income from firms that can pass on the cost of allowances to those that are most affected by carbon pricing. One argument for the free allocation of allowances to firms is that it is a transparent way of compensating firms for the loss of value of their existing assets that still preserves the price signal from the ETS. However, Stern (2007) argues that free allocation (especially if based on grandfathering) can reward the worst polluters, delay investment in low-emission technologies and can deter competition if new entrants in a polluting industry do not receive any free allowances. Free allocation may also generate windfall profits for firms that are over-allocated allowances and are able to pass the opportunity cost of holding allowances to households and firms downstream. Free allocation is more likely to be appropriate for firms operating in energy-intensive, trade-exposed industries that cannot pass on the cost of allowances as a way of combating carbon leakage to countries that have not imposed a price on carbon (Reinaud, 2008). However, assistance should only be given to firms that are genuinely at risk of relocating offshore or losing market share; assistance should be strictly transitional, and allocated on the basis of industry best practice.
- Measures to increase the flexibility of the scheme. The short-run costs and uncertainty from complying with an ETS can be alleviated by allowing the use of carbon offsets that come at a cheaper price than allowances for compliance purposes. Offsets can be created outside or within a country with an ETS by investing in projects that reduce greenhouse gases already in the atmosphere (carbon sinks) or by capturing and storing gases at the point of emissions (carbon sequestration). Investors in offsets can be credited with allowances that can be sold to emitters with allowance shortfalls. Flexibility can also be enhanced by allowing allowances that are not used within an allocation period to be banked and used to acquit emissions in future periods. Borrowing allows emitters to use allowances allocated to them for use in future periods to meet current period emissions. By allowing emissions to be transferred between periods, borrowing and banking may imply that the profile of emission reductions may vary from the trajectory

4. While a large literature is available recommending the upstream approach for the transport sector, the EU believes that using an upstream approach involves risks because there is no practical experience of whether an upstream approach creates the same behavioural incentives at the point of emissions as the carbon price signal is transmitted to the emitters.

chosen by the government. This should not affect the integrity of the scheme as long as the long-term emission reduction target is achieved. However, because emitters have an incentive to bank allowances for future use and pay the emission penalty when they expect the future price of allowances to increase above the level of the penalty, it is necessary to limit the amount of allowances that can be banked in a scheme with a fee, or at least raise the fee in real terms over time (Duval, 2008). Borrowing can create shortages of future allowances, increasing the cost of the scheme, undermining the credibility of the scheme and pressuring governments to relax emission caps. For this reason borrowing should only occur within one trading period, thus not jeopardising the envisaged emissions trajectory.

- Penalties can be charged for non-compliance to firms whose emissions exceed the amount of allowances they hold (IEA, 2009). Schemes can also levy fees designed to cap the short-term cost of the scheme. Capping prices below the potential market price of allowances comes at the expense of losing short-run control over aggregate emissions, although authorities can maintain longer term control by including a make-good provision that requires any short fall in emission reductions to be made up in future periods.
- A process for setting long-term emission reduction trajectories. In setting a long-term trajectory for emissions reductions, governments provide firms greater predictability. But they must balance firms' desire for certainty over future emission constraints with the need to retain flexibility to react to new information and future international agreements on emissions reductions.
- Emission trading schemes in different regions can be linked, by acquitting allowances created in one region against emissions in another. Linking can reduce the cost of global emission reductions, enhance liquidity in the market and thus avoid volatility of carbon prices stimulating the development of a global carbon market (Garnaut, 2008). Different emission penalties for non-compliance or fees may be one of the main barriers to linking schemes in case the fee set in one system is below the current market price. In this case emitters in the market with the lowest fees will have an incentive to sell their allowances in the markets where the price is above the domestic market price and meet their domestic obligations by paying the fee in their domestic market. This arbitrage will drive carbon prices across linked markets towards the lowest carbon price.⁵ Different rules governing banking, borrowing and allowable offsets can also make it more difficult to link schemes.

The European Emissions Trading Scheme

16. The EU ETS has distinct trading phases. Phase I (2005–07) was the initial learning period which primarily did not aim to reduce emissions but set up the institutions and to create a carbon market. Phase II (2008–12) coincided with the Kyoto Protocol commitment period which requires the EU15 to reduce its annual emissions to 8% below the 1990 level. It cut down the EU's emissions 6.5% below 2005 emissions, achieving more than 40 % of the EU's Kyoto obligation. Phase III will cover the period from 2013 to 2020 and aims to reduce emissions in the ETS by at least 21% below 2005 figures. Key features of the EU ETS in Phase I included:

- The coverage of the scheme was limited to the stationary energy sector, production and processing of ferrous metals, parts of the mineral industry, and pulp, paper and board activities. In total, some 12 000 installations were covered, representing some 50% of total CO₂ emissions and 40% of total greenhouse gas emissions. The point of obligation was set at the point of

5. Other barriers include different allowable offsets under the two schemes, and the difficulty of verifying emissions in other jurisdictions.

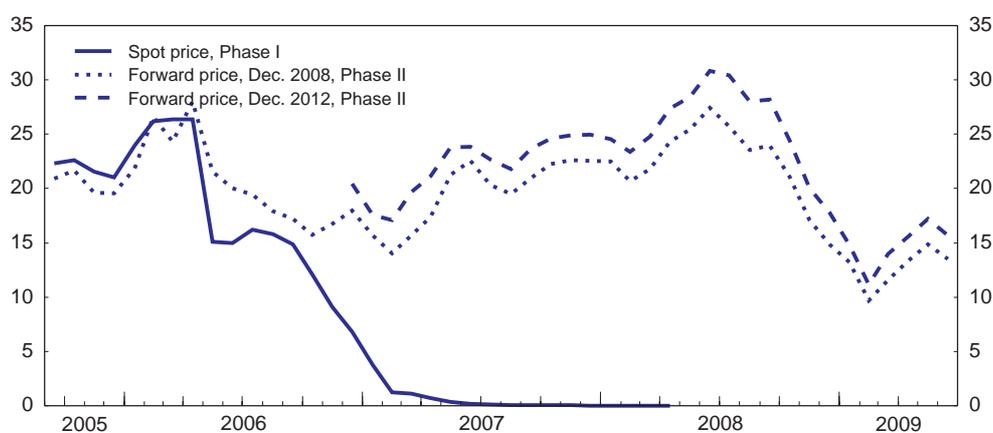
emission, meaning for example that electricity generators had the obligation of surrendering allowances.

- Emitters were allocated free, grandfathered, multi-year allowances, known as EU allowances, which were used to acquit their actual emissions. Although the Commission was responsible for the overall governance of the scheme, allowance allocations were undertaken by member states. Member states submitted a National Allocation Plan to the Commission for approval, including overviews of action in sectors not covered by the scheme.
- An emitter with a shortfall in allowances must pay a fine of EUR 40 per tonne of CO₂, but must nevertheless purchase the missing allowances. No banking or borrowing was allowed.
- The scheme was internationally linked through the Kyoto Clean Development Mechanism (see below).

17. Phase I of the ETS contained successes and failures that have paved the way for reform in subsequent phases of the scheme. The most important success was the demonstration that carbon trading could work and the institution building, including the gathering of a robust data base to build on for future targets. Another was the development of a range of financial derivatives of European Emission Allowances (EUAs) that have allowed emitters to transfer some of their carbon risk to others for a price and thereby helping to prevent the volatility in EUA spot prices from affecting investment decisions. There is also some evidence that limited abatement occurred in Phase I (Ellerman and Buchner, 2007).

18. The biggest failure of Phase I was the collapse in EUA prices in April 2006 when it was revealed that actual emissions, and expected emissions during the rest of Phase 1, would be lower than the total cap. Prices collapsed because Phase I allowances were in oversupply and could not be banked for later phases (Figure 10). There are two explanations for the excess supply in the allowance market. First, member countries over-allocated allowances to emitters by, in many cases, basing allocations on what emitters claimed their emissions were rather than on rigorously measured actual emissions, as such emission data were not available at that time. Second, traders in the EUA market may have over-estimated the cost of abatement, a fact only revealed when 2005 emissions came in below expectation (IEA, 2008a). There are other criticisms of Phase I: emitters may have expected the grandfathering of allowances to continue, reducing incentives to abate (Neuhoff *et al.*, 2006); the allocation of free allowances to new entrants may have created incentives to set up new fossil fuel fired electricity generation plants; national methods for allocating allowances varied significantly across member countries, undermining competition in the internal market; free allocation of allowances to firms that could pass on the opportunity cost of allowances may have generated windfall profits for some emitters; too many small installations were included, resulting in compliance costs for small installations that were disproportionate to their emissions; and by making the ETS a point of emission scheme, it has made it more difficult to broaden its coverage to include other sectors such as road transport. Some of these flaws have been addressed for Phases II and III of the scheme.

Figure 10. **EUA prices in Phase I and Phase II of the EU Emissions Trading Scheme**
EUR/tCO₂

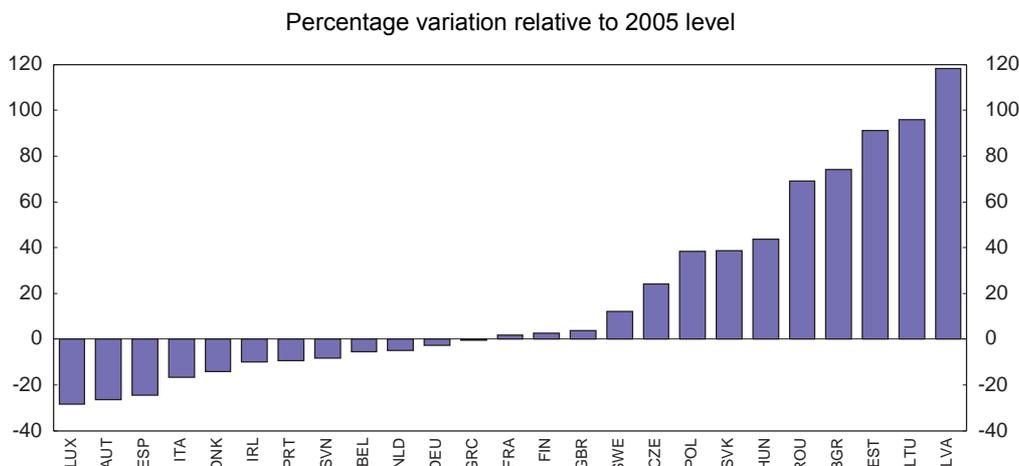


Source: Point Carbon and Caisse des Dépôts (2009), *Tendances Carbone*, No. 38, July.

19. An important change for the ETS in Phase II was to allow EUAs to be banked for later phases, making it unlikely that prices would fall to zero. Limited auctioning by member countries of up to 10% of allowances is also allowed to recover the cost of setting up and running the scheme but so far few countries have taken up this opportunity. The allowance fine has been increased to EUR 100/t. National Allocation Plans (NAP) for Phase II will result in an average cut in emissions of around 6.5% below 2005 levels (Figure 11). The magnitude of the cuts varies across EU member states according to their individual obligations under the Kyoto Protocol. The European Commission approved the original National Allocation Plans only conditionally for all member states except Denmark, France, Slovenia and the United Kingdom, because various shortcomings of member states' NAPs, including the outer limit of allowances that member states wanted to allocate to their industries which did not comply with criteria as set out in European legislation, in parts also because the planned reductions were not strict enough to be consistent with some member states' Kyoto commitments. The Commission also commenced infringement proceedings against some countries for failing to submit National Allocation Plans on time.

20. The global financial crisis and associated recession have been a pivotal event during Phase II of the ETS. Before the collapse of Lehman Brothers on 15 September 2008, the December 2009 EUA contract price was trading around EUR 25. Subsequently, the contract price fell significantly and at end-August was trading around EUR 15 as the economy in the EU appeared to be stabilising. In one sense, the fall in allowance prices was to be expected; the recession, together with expectations for only a weak recovery, have left many emitters with an excess supply of allowances, which they sold. The fall in allowance prices also provides a small amount of counter-cyclical support to the economy during the downturn. However, the magnitude of the fall seems a little surprising given that allowances can be banked for future use. There are a few potential explanations. The first is that the price genuinely reflects the bearishness of investors about future energy growth. Another is that amidst the financial crisis emitters and speculators are dumping allowances to raise liquidity. Whatever the explanation, because forward permit prices are quite low there is a concern that the price signal coming from the ETS will be insufficient to drive enough investment in low-emission technologies.

Figure 11. Greenhouse gas emission targets for 2008–12



Source: EEA (2007), *Greenhouse Gas Emission Trends and Projections in Europe 2007*.

21. Phase II of the EU ETS worked within the existing Kyoto framework. However, with no international agreement in place for the period beyond the expiry of the Kyoto commitment period in 2012, the EU decided to push ahead unilaterally by announcing that it would reduce GHG emissions by 20% from 1990 levels by 2020 and 30% if an effective international agreement is eventually achieved. The Commission's original proposed changes to the ETS for Phase III were far-reaching and included:

- A single EU-wide cap on emissions instead of 27 separate national caps. The annual cap will decrease by a linear factor of 1.74% *per annum* compared to the average annual total quantity of allowances for the period 2008 to 2012 and extend beyond 2020, and be equivalent to a further 21% reduction from 2005 levels by 2020. The 1.74 percentage point linear factor implies that by 2050 EU emissions will be around 70% below their 2005 levels, an amount that the Commission sees as consistent with Europe's share of the obligation of stabilising the concentration of GHG in the atmosphere at 450ppm and possibly limiting temperature increases to 2°C above pre-industrial levels.
- Because it is cheaper and easier to reduce emissions in the sectors covered by the ETS, there will be a 21% reduction in ETS sector emissions and a 10% reduction for sectors not covered by the scheme, with 2005 as benchmark year.
- Around two-thirds of total allowances would be auctioned from 2013, and 100% of allowances for the stationary energy sector.⁶ The proportion would increase toward 100% by 2020.
- All allowances allocated for free for the industry sector would be distributed according to EU-wide rules ensuring that allocation mechanisms are harmonised across the EU. Any free allocation would be benchmarked so as not to reward the least energy-efficient producers.
- If a sector is deemed to be exposed to risk of carbon leakage, the sector will have its benchmark multiplied by 100% when calculating the amount of free allowances to a facility in the sector. For other sectors the benchmark will be multiplied by a discount factor that will start at 80% and decline annually to reach 30% in 2020.

6. The stationary energy sector includes all energy production and consumption, including electricity and direct uses of energy for heating and industrial processes, but excluding transport.

- Coverage would be extended to CO₂ emissions from petrochemicals, ammonia and aluminium, as well as N₂O emissions from the production of nitric, adipic and glyoxylic acid production and perfluorocarbons from the aluminium sector. The capture, transport and geological storage of all GHGs will also be covered.
- Member states will be allowed to remove small installations with emission of less than 25 000 tonnes of CO₂ and where they carry out combustion activities, have a rated thermal input below 35MW from the scheme if other measures are put in place to achieve equivalent reductions. Around 4 200 installations (0.7% of total ETS emissions) could opt out under these provisions.
- The net impact of the changes will be to increase coverage by around 7 percentage points of overall GHG emissions to 46%.
- Generally, the use of credits under the Kyoto Clean Development Mechanism (CDM) and Joint Implementation (JI) initiatives from 2008 to 2020 will be limited to credits granted by member states for 2008 and 2012, or to an amount which shall not be set below 11% of their allocation during the period 2008 to 2012, whichever is higher. For the existing sectors EU member states may allow the use of credits from CDM and JI by their operators up to 50% of the reductions achieved below 2005 levels under the ETS over the period 2008–20. In the context of an international agreement, the limit on the use of such credits would be increased, depending on the respective additional reduction effort necessary. It will not be possible to use credits from carbon sinks such as forests.

22. The originally proposed reforms for Phase III aimed at increasing the overall efficiency and equity of the scheme, especially by moving toward allocation based predominantly on auctioning emission allowances. However, from an efficiency perspective the watering down of the original Commission proposals for auctioning allowances was disappointing, but probably necessary to secure an agreement. The original proposals were for 100% auctioning for all power companies, industrial firms not exposed to international competition were to move to 100% auctioning by 2020, and there was to be a rigorous framework for determining the criteria governing which trade-exposed firms would receive free allocations. However, at the December 2008 meeting of the European Council it was agreed that subject to a number of criteria, installations for electricity production in certain member states may receive transitional free allocation until 2020. In addition, industrial firms not exposed to international competition will still receive 30% of the benchmarks by 2020, with no free allowances as from 2027. However, the total amount of free allocation to industry is limited (to the share of these industries' emissions in 2005–07) and will decline annually in line with the emissions cap. The absolute amount of free allowances will be determined by the benchmarks. If adding up all the benchmarks would lead to exceeding the maximum amount for free allocation, a correction factor will be applied. Finally, the basic criteria for allocating free allowances to industries at risk of carbon leakage were determined without a Commission impact assessment, although the final list of sectors will be subject to rigorous quantitative and qualitative assessments based on the criteria set in the directive. These decisions may somewhat reduce the efficiency and equity of the ETS compared to the Commission proposal, but it is important to note that the overall cap and the annual reductions were not modified by the Council. The environmental outcome was thus ensured. Reducing the scope of auctioning for non-trade-exposed firms will reduce the amount of revenue available that could be used for public investment in low-emission sectors and technologies and cuts in other distortive taxes. It also represents a transfer of wealth from taxpayers to industry compared to the original proposal. Countries with a lower than EU average GDP *per capita* were already set to benefit from a redistribution of 10% of allowances for auctioning.

23. The issues surrounding carbon leakage and free allowance allocation to trade-exposed firms is more vexed as carbon leakage is a genuine possibility when all firms in a global industry are not exposed

to the same carbon price (Burniaux *et al.*, 2008; Garnaut, 2008; Reinaud, 2008). Carbon leakage arises through two channels:

- A competitiveness channel whereby carbon-intensive industries in participating countries lose market share or relocate capital to non-participating countries.
- A fossil fuel price channel whereby emission reductions in participating countries reduce fossil fuel demand and global price falls that encourage more use in other countries.

OECD (2008) simulations suggest that if the EU acted alone in cutting emissions by 50% by 2050, 20% of the reduction would leak to other countries. However, if all Annex I countries acted in unison, leakage would drop to just 9%.⁷ These results underline the importance of securing an effective international agreement to reduce GHG emissions.

24. However, carbon leakage is more complicated than is sometimes made out. In addition to relative input costs, firm location decisions are based on criteria such as the quality of local infrastructure, political stability, the rule of law, and access to skilled labour. Recent research by the IEA suggests that there has been little carbon leakage from the ETS so far, in contrast to the predictions of theoretical models prior to the introduction of the scheme (Reinaud, 2008).⁸ Moreover, other research suggests that investment in countries with credible GHG pricing schemes could attract greater investment because of enhanced certainty about future carbon prices.

25. There are a number of options to respond directly to leakage, including border adjustments (tariffs on imported goods from countries that do not impose carbon prices on domestic firms), sectoral agreements and free allowances to trade-exposed sectors (Duval, 2008). Although border adjustments may reduce leakage, they may not reduce overall output losses because they raise the cost of energy imports, raise the price of non-energy inputs and raise the carbon price necessary to meet emission reduction targets. Border adjustments should, if they ever were to be introduced, be designed in a way consistent with WTO rules. Global agreements between all firms active in particular energy-intensive industries are an alternative option but reaching agreement could be complicated and it will be important to implement effective caps on emissions in any agreements.

26. Allocating free allowances to energy-intensive trade-exposed firms is the approach that has been adopted. At the December 2008 European Council, EU leaders agreed that a sector would be deemed to be at significant risk of carbon leakage if:

- The sum of direct and indirect additional costs induced by the implementation of the EU ETS would lead to an increase in production costs exceeding 5% of its gross value added and if the total value of its exports and imports divided by the total value of its turnover and imports exceeds 10%.
- The sum of the direct and indirect additional costs would lead to an increase in production costs exceeding 30% of its gross value added, or if the total value of its exports and imports divided by the total value of its turnover and imports exceeds 30%.

7. Annex 1 refers to the developed country signatories to the Kyoto Protocol that were required to reduce their greenhouse gas emissions by prescribed amounts by 2012.

8. However, it is worth noting that in contrast to the first two trading periods of the ETS where operators have been allocated allowances for free, the level of auctioning will increase significantly from 2013 onwards.

- The list may be further supplemented after completion of a qualitative assessment based on criteria set out in the Directive.

27. It is of concern that these criteria were determined without rigorous counterfactual analysis of what the most appropriate thresholds for assistance should be. Although free allocation still largely preserves incentives to abate because there is an opportunity cost to holding allowances, the criteria risk being seen as arbitrary and transfers to industries that do not need support will raise the overall cost of abatement. It is welcome that the free allocation will be based on ambitious benchmarks, but it would be better if all firms received only partial free allocations.

28. It is also the case that, as the world moves toward a global carbon price and the world price of fossil-fuel intensive goods and services increases to reflect their social cost, production in those sectors will be lower than their baseline levels. Arguably, transfers to prevent carbon leakage today should take into account the longer run adjustments that will occur in a carbon constrained world, but short-term transition issues have to be effectively dealt with. For this reason, Garnaut (2008) has argued that transfers to trade-exposed firms should be relative to the expected uplift in world product prices that would occur if all countries had imposed a carbon price, not relative to a world where no countries have imposed a carbon price. Such a framework would increase the incentives for trade-exposed firms to adjust to the coming carbon constraint, and contribute to overall abatement efforts. In practice however, the modelling requirements for calculating assistance in this way would be complicated and the results could therefore also appear arbitrary.⁹ A more radical option that would avoid the need for governments to determine optimal compensation criteria would be for governments to simply reduce the overall tax burden on households and businesses. Pricing carbon effectively introduces a new tax to the economy. Governments could therefore use carbon pricing as an opportunity to lower other more distorting taxes, thereby offsetting some of the impact of the ETS on potential output. However, such decisions on fiscal policy are a matter for individual member states. Indeed, this highlights the dilemma that plagues coherent EU-wide energy and climate change policies. Although EU institutions can shape a consensus-based area-wide strategy, member states must do the work of actual policy implementation.

29. Complex issues need to be addressed regarding how EU countries allow firms to use credits generated by emission-saving projects undertaken in third countries. Under the EU ETS, member states may allow their companies to use credits generated by emission-saving projects undertaken in third countries to cover their emissions in the same way as ETS allowances. These projects must be officially recognised under the Kyoto Protocol's Joint Implementation (JI) mechanism (covering projects carried out in countries with an emission reduction target under the Protocol) or Clean Development Mechanism (CDM) (for projects undertaken in developing countries). Credits from JI projects are known as Emission Reduction Units while those from CDM projects are called Certified Emission Reductions (CER). The Commission has set proposals for the use of CDM/JI credits depending on whether or not there is a satisfactory agreement to combat climate change post-2012. In the absence of a satisfactory international agreement, the limit on the use of JI/CDM credits has been calibrated to ensure that no more than half of the emission reductions required between 2008 and 2020 could be achieved through this mechanism.

9. The EU ETS Directive acknowledges that as the world moves toward a global carbon price, that the competitive situation and thus the risk of carbon leakage may change in case there is an international climate change agreement. Therefore, by June 2010, the Commission has to report to the European Parliament and the Council and make any appropriate proposal in the light of the outcome of the international negotiations in Copenhagen in December 2009. If the negotiations are successful, the Commission may review the levels of free allocation.

30. The use of CDM/JI credits in the EU ETS must be monitored carefully. Forthcoming OECD analysis suggests that the current CDM raises a number of concerns that, if not addressed, could undermine its ability to deliver the expected benefits in terms of actual emission reductions. For example, there are doubts whether all the emission reductions credited under the CDM reflect cuts that would not have occurred otherwise, implying that many CERs are simply income transfers to countries outside the EU and thereby generating carbon leakage. Recent estimates suggest that 40 to 50% of CDM projects may not reflect actual emission reductions (Schneider, 2007; Wara and Victor, 2008). CDM projects may create incentives to raise investment and output in carbon-intensive projects in the first stage of projects, to obtain emission credits for reducing emissions in a second stage, especially when the gap between the market price of CERs and abatement costs are large. They may also reduce the willingness of developing countries to sign up to binding emission reduction commitments. For all of these reasons the EU ETS may not be contributing to as much global emission reductions as policymakers assume, and the EU should therefore take a lead role in working toward reform of the CDM within any future international emission reduction agreements.

31. An important principle of emissions trading is that coverage should be as broad as practicable (Duval, 2008). This helps to align price signals across sectors, ensures that emission reductions occur in those sectors for which it is most efficient to do so, market liquidity is maximised and the costs of the scheme are broadly distributed. An obvious way to broaden the ETS is to include the road transport sector, which accounts for around 20% of GHG emissions, but the inclusion of road transport is complicated by the already high excise duties on transport fuels in all EU countries.¹⁰ Although these taxes were not originally put in place to price the carbon externality, they deliver an effective carbon price in this sector of well over EUR 100/t CO₂ in all EU countries, which is more than five times higher than the current price of EUAs.

32. An option that would allow road transport to be included in the ETS without further increasing the taxation bias against transport fuels would be for member states to reduce their excise rates periodically in line with the changing incentives provided by an expanded ETS. Eventually, this option would make it possible to align the price signal to the road transport sector with the signal being sent to other sectors of the economy. However, the very high current level of excise duties in many countries means that such an alignment could take decades and reduces the urgency of road transport's inclusion. In addition to the complex interaction with existing energy taxes, there are other practical barriers to including road transport in the ETS. The point of obligation for the EU ETS is at the point of emission, which in road transport means individual vehicles. This would entail excessive administrative costs and is not in line with the better regulation principles. An alternative would be to shift the point of obligation upstream to producers of transport fuel and fuel suppliers.

33. However, some question whether such a change would have a significant effect on the incentives perceived by drivers. Such a change would mean that the price of allowances would be incorporated into final prices without any possibility for the consumer to detect whether a price change comes from a variation in the cost of oil, in the price of allowances, in the level of taxation or simply in the commercial policy of fuel producers. This could also mean that any advantages in terms of visibility of the carbon price at the point of emission would be lost and could add considerable complexity as member states would have to grapple with determining how regularly to update their excise rates, and fuel producers and suppliers would face an additional regulatory burden. On the other hand, it should be remembered that in the stationary energy sector final consumers also have no simple way of separating the relative effect of these factors on retail energy prices.

10. On the other hand, excise rates on trucks are lower than for passenger vehicles in many EU countries.

34. Given all of these difficult issues, the Commission and member states should continue to reassess the most appropriate way to deal with GHG emissions in the road transport sector, and in particular how to ensure that in the longer term abatement incentives provided by the ETS are consistent with the incentives to abate provided by existing energy taxes. It would also be useful to pursue the exercise of internalisation of external costs so that prices take into account non-carbon externalities such as local pollution, traffic congestion, accidents and noise. The Commission should also take care that mandatory emission standards for passenger vehicles only counteract market failures associated with innovation and do not further increase the implicit shadow cost of abatement for the road transport sector.

The 20% renewable energy target and low-emission technologies

35. The primary aim of the target to lift the share of renewable energy in gross final energy consumption to 20% by 2020 is to complement the EU ETS in reducing GHG emissions and to improve energy security. The EU has also fixed a target for energy from renewable sources in transport to be 10% of overall transport fuels. Recognising that member states have different capacities to deploy renewable energy, national targets will be allowed to vary according to the existing share of renewable energy, and the level of GDP *per capita* to reflect fairness and cohesion, though all member states will be required to reach the transport renewable energy target. Each country will have to submit a national action plan showing how their targets will be met. Because the cost of exploiting renewable energy varies across countries, member states will be allowed to make their contributions through statistical transfers and joint projects between member states and with third countries that will sit alongside existing national renewable energy support schemes. This flexibility should help to reduce the cost of meeting the target. The scheme to boost the use of biofuels in transport will include sustainability criteria in relation to a number of environmental impacts including the GHG performance of biofuels, biodiversity and land use changes and information about impacts on soil, water, air and social issues. The European Commission will soon analyse possible ways to extend the biofuels sustainability scheme to the whole biomass area.

36. The rationale for the target is that pricing carbon through the ETS may not be sufficient to overcome a variety of market failures that limit the use of renewable energy (Duval, 2008). For example:

- Learning effects imply that large deployment costs may be incurred before renewable energy technologies can become competitive.
- Network effects can make it difficult to displace carbon-intensive technologies.
- The homogeneity of energy infrastructures may keep the demand for renewables low until they are price competitive.
- Carbon-intensive energy technologies may be locked into energy systems without deployment subsidies.

In short, deployment subsidies and other policies to boost the use of renewable energy raise the short-term cost of emissions abatement, but by smoothing the transition to a low-carbon economy, may reduce the long-run cost of abatement.

37. Meeting these targets will be a significant challenge. In 2007, renewable energy represented 8.5% of final energy consumption in the EU, 3 percentage points higher than in 1990 (IEA, 2008a). Biofuels represented just under 3% of petrol and diesel consumption. Renewables are most heavily used in the electricity sector, accounting for around 15% of total production. To meet the 20% target by 2020 will require a dramatic increase in renewable electricity production to as much as 35% and require major

upgrades to electricity grids (IEA, 2008a). Reaching the EU-wide target will also be complicated by the fact that energy policy is a shared competency between the Community and member states.

38. A number of separate initiatives will contribute to reaching the renewable target. The EU ETS will reduce the relative price of renewable energy, encouraging substitution in production processes and investment in low-emission R&D. More directly, many member states already offer substantial deployment subsidies to renewable energy producers in the form of feed-in-tariffs and tradable renewable energy certificates. At the Community level, in addition to providing a new legislative framework, the most important policies to directly support the development for the renewable sector are EU funds (including European Regional Development Funds, Cohesion Fund), the Intelligent Energy Europe programme (part of the Competitiveness and Innovation programme, which strongly supports the market introduction of renewables) and two further programmes to support additional funding for low-emission technology R&D: the 7th Framework Programme for Research Funding (FP7) and the Strategic Energy Technology Plan (SET). An enabling framework is also provided by the guidelines on state aid for environmental protection.

39. In addition, a “lead market initiative” (LMI) aims to accelerate the conversion of research findings into commercially valuable innovations and stimulate markets for innovative goods and services. The LMI hopes to generate more rapid returns on investments, encourage more private investment in R&D, and raise productivity, exports, economic growth and employment. Renewables were one of the six lead markets chosen by the EU, in particular because they: are highly innovative; are not dependent on a single product or technology; already have a strong technology and production base in Europe; provide solutions to broad strategic, societal, environmental and economic challenges; have largely demand-driven market potential; and depend on favourable framework conditions. Support for lead markets makes use of demand-side instruments such as innovation-friendly public procurement practices, more consistent technical, performance and product standards, business and innovation support services, training and communication. A mid-term review of the implementation of the LMI is due by late 2009. Although it seems likely that the growth of the renewable energy sector faces demand-side constraints, care should be taken to ensure that the benefits of such policies exceed their costs. For example, public procurement policies that actively favour renewables could increase the cost of providing government goods and services. In addition, the renewables sector already receives effective support through the ETS, public funding for R&D and deployment subsidies in some countries.

40. The decision to allow statistical transfers and joint projects within Europe is expected to reduce the cost of meeting the 20% renewable target substantially. However, because of concerns about the likely impact of trading on the development of higher cost renewables, the impact on existing support systems in member states, and the possibility that windfall profits will accrue to existing low-cost renewable producers, it will be for member states to manage and control the use of these mechanisms, which will potentially limit trading (IEA, 2008a).

41. Support for renewable energy deployment raises a number of concerns such as the magnitude of subsidies exceeding the magnitude of externalities or locking in the wrong technologies and thus raising the cost of GHG abatement. Existing subsidies to renewable electricity in some countries exceed EUR 250 per ton of CO₂ abated for wind power and EUR 1 000 for photovoltaics (Burniaux *et al.*, 2008). Price support mechanisms in European countries come in two forms: feed-in-tariffs used in Germany and Spain, which provide a fixed-price per unit of electricity produced over a particular period; and tradable renewable energy certificates used in Italy and the United Kingdom, which require a fixed share of electricity to be generated from renewable sources and force firms to purchase certificates on an open market to make up for shortfalls in production (Duval, 2008). Such schemes have to be designed carefully when they sit alongside an ETS. If they are ramped up too quickly, they can lead to most abatement occurring through the renewable support scheme, rather than the ETS, raise electricity prices beyond what

is necessary to meet emission reduction targets, and reduce incentives to invest in other low-emission technologies (Garnaut, 2008). An alternative way of providing support for demonstration and commercialisation of renewables and other low-emission technologies is through matched funding to private firms, financed through the auctioning of emission allowances. Matched funding has the advantage of maintaining firms' risk exposure because they still bear and manage the risks of bringing a new technology to market (Garnaut, 2008).

42. In the longer term, consideration should be given to harmonising existing national renewable energy support mechanisms and, if appropriate, moving toward a single European support mechanism, a possibility supported by the Commission. This would help to ensure that the European renewable energy target is met at least cost and would also help the development of the single electricity market. One potential model for this would be Australia's mandatory renewable energy target. This scheme requires electricity retailers to purchase a rising proportion of their electricity from renewable generators in the form of tradable renewable energy certificates. The price of a renewable energy certificate is determined in the tradable market and depends on the difference in cost between producing renewable energy and the average wholesale price of electricity. Although the scheme offers an implicit subsidy to renewable energy producers, it is technology neutral within the renewable sector and investment flows to those renewable technologies that can produce electricity most cheaply. To maintain incentives to invest in all low-emission technologies such as carbon capture and storage (Box 4), a European mandatory renewable energy target could be expanded to include all low-emission technologies. However, it may be that there is no single optimal instrument appropriate in all countries, situations and for all technologies. As an alternative pathway, the Commission could encourage member states to replace domestic feed-in tariffs with tradable renewable certificates in those countries, where appropriate. Once renewable energy technologies compete fairly (that is, once all external costs and market failures other than climate change are addressed) in the energy market, consideration should be given to phasing out all price support mechanisms to ensure that the ETS operates as efficiently as possible.

43. The EU thinks of the 10% target for renewable transport fuels as a way to ensure sustainability, security of supply and competitiveness objectives of the EU energy and climate change policy, particularly by addressing GHG emissions from the transport sector through the sustainability criteria that have been imposed and by replacing some of the fossil fuel use in this sector. Although the 10% target for renewable transport fuels covers all renewable energy and not just biofuels, it is still expected that biofuels will make a very large contribution to meeting the target. The implicit costs of abatement measures in the transport sector are frequently higher than in other sectors. For instance, some ethanol subsidies exceed EUR 250/t of CO₂ avoided, although other types of biofuels may reduce greenhouse gas emissions at costs of as little as EUR 20/t CO₂ avoided. The EU has established the world's first sustainability regime for biofuel use and a monitoring regime whereby companies, member states or the Commission will closely assess land use change consequences as well as social, biodiversity and other possible negative impacts. The Commission is working on how to include indirect land use change in the sustainability criteria for biofuels. On the basis of this monitoring, the regime will be reviewed in 2014. Given the high cost of some biofuel technologies, it will be important to ensure that the 10% renewable transport fuel target efficiently achieves its objectives of sustainability and security of supply. The 38% tariff rate that applies to undenatured ethyl alcohol effectively restricts imports from countries such as Brazil, where biofuels can be produced far more cheaply than in Europe. Biofuel subsidies may also encourage the conversion of land used for food production to land for energy production, contributing to higher food prices (World Bank, 2008). Overall, because it is extremely unclear whether the benefits of the transport fuels target in terms of improved energy security justify its large costs, the EU should consider scrapping the biofuels target altogether. The EU should consider reducing tariffs on biofuels and ensure that production within the EU takes place where it is cheapest to obtain sustainable biofuels.

Box 4. Carbon capture and storage

Coal and gas-fired power stations are the dominant sources of electricity in most countries due to their abundance and low cost relative to other energy sources. The use of coal and gas has also been growing rapidly as countries such as China and India have added significant new capacity to supply energy. Because coal and gas power stations and industrial installations also make a large contribution to global greenhouse gas emissions there is a significant international effort investigating and demonstrating technologies that have the potential to reduce those emissions cost effectively.* This effort falls into the following categories: improving the efficiency of these installations; determining the viability of carbon capture technologies; and determining the viability of carbon storage (sequestration) technologies.

There are a number of technologies for capturing the carbon from coal-fired power stations. Integrated Gasification Combined Cycle plants gasify the coal, allowing the pre-combustion capture of CO₂. Sequestration involves the pumping of liquid CO₂ into suitable geological formations deep underground. The most likely sites for carbon storage are depleted oil or gas fields, deep saline aquifers and deep coal seams. Although the technology for permanently pumping liquid CO₂ underground has been proven for some time, the technology is currently only used commercially in gas and oil fields.

Although there are no full-scale coal or gas-fired power plants in operation that demonstrate all aspects of carbon capture and storage (CCS) technology, a number of full-scale demonstration projects have been proposed in Germany, the Netherlands, Poland, Spain and the United Kingdom (IEA, 2008b).

There are a number of barriers to the commercialisation of CCS technology for coal and gas-fired power stations. The first is cost; current estimates suggest that the cost of CCS per ton of CO₂ avoided could be up to EUR 90, well above current expected allowance prices (IEA, 2008b). Although the cost of CCS technology is likely to fall over time, it is unclear by how much or how quickly. This means that additional private investment in CCS technology is unlikely to be forthcoming without substantial additional financial incentives and mandates from governments. Recognising this, the European Council and the European Parliament agreed on setting aside EUR 1.05 billion to partly fund seven CCS projects in seven countries. Additionally, proceeds from auctioning 300 million allowances from the new entrants reserve under the revised ETS will be used to support up to 12 carbon capture and storage demonstration projects and projects demonstrating innovative renewable energy technologies. There are also public opinion concerns surrounding the safety of the technology with environmental groups expressing concerns about the likelihood of CO₂ leaking from underground, undermining the emission reduction benefits and posing health risks. Investment is also being held back by regulatory uncertainty, including over future carbon prices and long-term public investment (IEA, 2008b).

All of these factors mean that major reductions in EU emissions from CCS technology are unlikely in the short term.

* CCS technologies will not only be important for the power sector. The IEA believes that by 2050 the cement, refining, pulp and paper, iron and steel, and chemicals sectors will need to deliver almost as much greenhouse gas reductions via CCS as the power sector.

44. The nuclear landscape is changing rapidly. Many countries have announced and decided to invest into nuclear energy. If stringent emission targets are to be met governments should ensure that nuclear energy will play an increasing role in the generation mix. Nuclear power is an important component of the solution to climate change, energy security as well as competitiveness. In this context, more EU countries have announced new nuclear programmes. However, even in those countries where nuclear is acceptable, financing new nuclear power plants in liberalised markets is an issue. Government actions to mitigate construction, financial and regulatory risks would be useful to move projects forward. This is especially true for “first-of-a-kind” plants and for new nuclear programmes.

45. Key actions to be considered by governments that wish to see investment in new nuclear power plants include:

- Provide clear and sustained policy support for the development of nuclear power. Strong and consistent government support is an essential prerequisite for initiating or expanding any nuclear programme. Given the long time frame involved, a broad-based political consensus is likely to be needed.
- Establish an efficient and effective regulatory system which provides adequate opportunities for public involvement in the decision making process, while also providing potential investors with the certainty they require to plan such a major investment. A one-step licensing process with pre-approval of standardised designs offers clear benefits in this regard.
- Put in place arrangements for the management of radioactive waste and spent fuel, with progress towards a solution for final disposal of waste. For investors in plants, the financial arrangements for paying their share of the costs must be clearly defined. An effective framework for nuclear insurance and liabilities must also be in effect.
- Reduce policy uncertainty over environmental objectives and in particular, where reducing greenhouse gas emissions is to act as an incentive for nuclear investment, the government may need to provide some guarantees that policy measures will keep carbon prices at sufficiently high levels.
- In some cases, provide additional financial support to investors. For countries with one or more large utilities having the financial strength to invest directly in new plants, or where there are well-resourced foreign utilities willing to make such investments, such additional support may not be necessary. But where there are no sufficiently strong established utilities, and/or the government wishes to move ahead rapidly with plant designs which have not already been built elsewhere, more direct financial support is likely to be necessary.

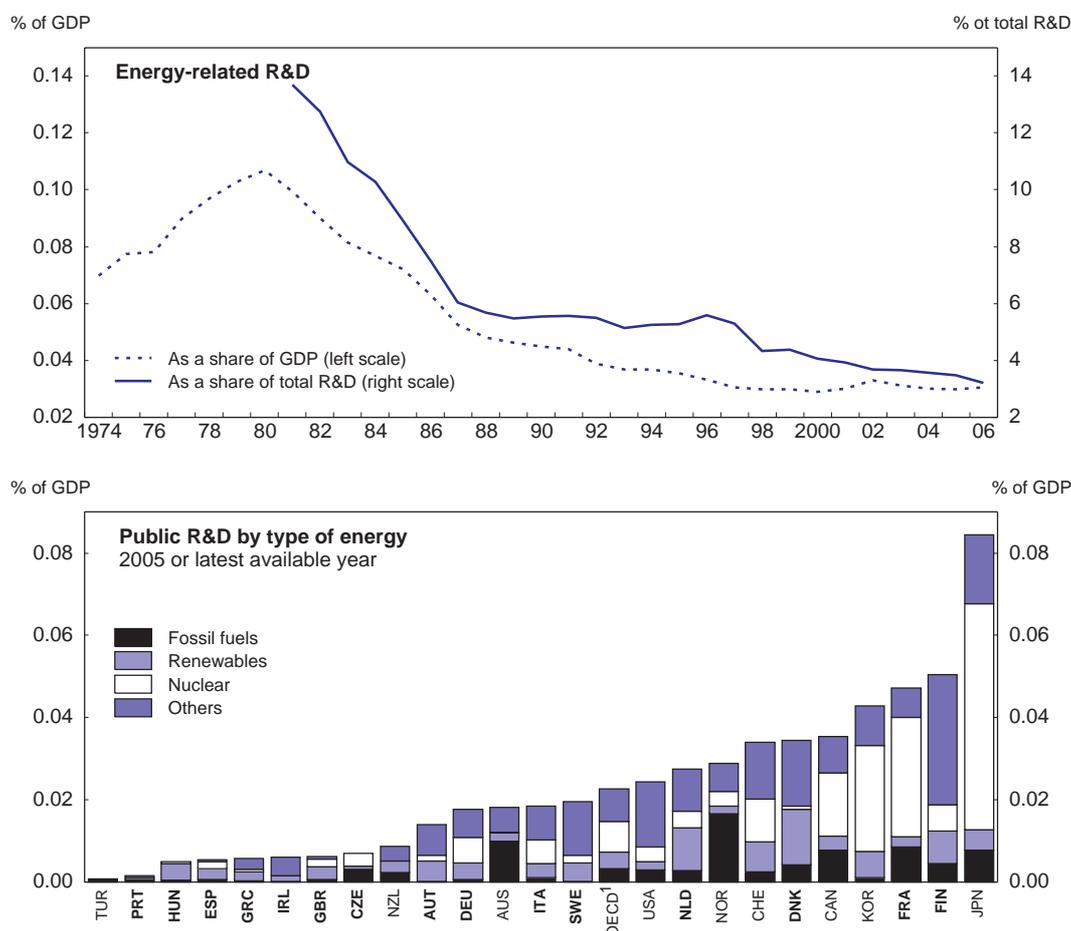
Research and development

46. Policies to increase public and private funding of R&D of climate-friendly technologies are a key element of Europe's strategy to reduce GHG emissions and support renewable energy production, as well as the Lisbon Strategy for Jobs and Growth. If Europe is to meet its long-term objectives to reduce GHG emissions by 60–80% by 2050, new technologies will be required. In most high-emission activities, low-carbon technologies are currently more expensive than fossil fuel technologies. A moderate carbon price would not change this. Anderson (2006) suggests that a carbon price of USD 80 per tonne is required to make a low-carbon portfolio in electricity, industry, transport and buildings competitive. Most technologies are also relevant to only a narrow range of economic activities – for example, solar and wind are only relevant for electricity generation – implying that a broad portfolio of technology options will need to be employed.

47. Although a strong price signal is essential to stimulate R&D in low-emission technologies, important market failures prevent private R&D from reaching sufficient scale (Burniaux *et al.*, 2008) because: there is a wedge between the expected social and private returns from R&D; there is uncertainty about the timing and magnitude of clean energy technology markets that are created by carbon regulation; existing infrastructure can create network effects that create barriers to entry; and inadequate competition in energy markets can reduce incentives for firms to undertake R&D. These market failures, combined with long lead times in research, development, demonstration and deployment of low-emission technologies, mean that funding must be ratcheted up over the coming decade. This is especially the case

considering that average public energy-related R&D expenditure has declined significantly in Europe since the early 1980s, though there is wide variation across countries (Figure 12). European energy firms now spend less than 1% of net sales on clean energy R&D.

Figure 12. Public energy-related R&D budgets in OECD countries



1. Unweighted average of OECD countries less non-IEA member countries (Iceland, Mexico, Poland and Slovak Republic). Due to lack of data, Belgium and Luxembourg are also excluded.

Source: Burniaux *et al.* (2008), "The Economics of Climate Change Mitigation: Policies and Options for the Future", *OECD Economics Department Working Paper*, No. 658.

48. Much of the EU budget for energy research is allocated through the Research Framework (FP) Programme (Chapter 2). European Technology Platforms bring together stakeholders to establish long-term strategic research agendas and contribute directly to work plans to ensure that EU-funded R&D is relevant for users. FP7, which runs from 2007 to 2013, outlines a number of areas for energy research: hydrogen and fuel cells; renewable electricity generation; renewable fuel production; renewables for heating and cooling; carbon capture and storage technologies for zero-emission power generation; clean coal and other technologies; smart energy networks; energy efficiency and savings. A shortcoming of FP7 is that insufficient funds are allocated to low-carbon technologies because the allocations were determined before accelerating the development of low-carbon technologies became a priority. Of the more than EUR 5 billion allocated to energy under FP7, just EUR 2.35 billion was allocated to non-nuclear research.

49. To overcome this funding shortfall, the European Strategic Energy Technology Plan (SET) was adopted in 2007. The plan aims to mobilise private funding for a broad technology portfolio that should avoid locking in inefficient technologies. European Industrial Initiatives are being created that aim to

strengthen energy research and innovation by bringing together resources and actors in a particular industrial sector. They will have measurable objectives in terms of cost reduction or improved performance, and will bring together the efforts of the EU level, member states and industry. A European Energy Research Alliance will also be created to enable greater co-operation across Europe of the research work going on in universities, research institutes and specialised centres. The priorities under the plan include:

- Making second generation biofuels competitive alternatives to fossil fuels, while respecting the sustainability of their production.
- Enabling commercial use of CCS.
- Doubling the power generation capacity of the largest wind turbines.
- Demonstrating the commercial readiness of large-scale photovoltaics.
- Developing a single smart European electricity grid able to accommodate the integration of renewable and decentralised energy sources.
- Bring to mass market more efficient energy conversion and end-use devices and systems, in buildings, transport and industry, such as poly-generation and fuel cells.
- Maintain competitiveness in fission technologies.

However, as of April 2009, no announcements have been made by the Commission on exactly how greater funding will be mobilised to reach the ambitious objectives of FP7 and the SET Plan. Given the externalities from R&D spending and the difficulty of firms to mobilise funding in the current economic climate, the absence of substantial funding measures and instruments makes achieving the goals of these plans less likely.

The 20% energy savings target

50. Sitting alongside the 20% GHG emissions reduction target and the 20% renewable energy target is a 20% energy savings target for 2020. Unlike the other targets, the energy savings target is not binding on member states. Although improving energy efficiency is a means of achieving energy savings, the energy savings target is more stringent than an energy efficiency target; an energy efficiency target would allow an increased use of energy overall, whereas the energy saving target requires energy consumption to fall in absolute terms. The primary objective of the energy savings target is to help firms and households cope with the rising relative price of energy. It also aims to raise productivity and economic growth, and improve energy security. The Commission believes that the energy savings target is achievable because there are cost-effective opportunities for improving energy efficiency in all sectors of the economy, particularly in transport. Indeed, it has been argued that many of these opportunities – such as improving building insulation, increasing fuel efficiency of vehicles, making more use of sugarcane biofuels, and improving lighting systems – might raise energy efficiency and reduce GHG emissions at a negative cost of emissions abatement; that is, some options for improving energy efficiency and reducing GHG emissions are profitable for firms and households now, even without a carbon price (Enkvist *et al.*, 2007).

51. A number of market failures might explain the sub-optimal take-up of energy efficiency measures (Duval, 2008):

- With asymmetric information and adverse selection, efficient investments may not take place. For example, developers and owners may not install efficient lighting and heating systems in buildings because they may not be able to pass on the higher costs to tenants.
- Imperfect competition in energy markets can dull price signals. For example, in many countries, retail electricity prices are regulated and prices faced by users rarely depend on whether consumption occurs during peak periods when it is more expensive to generate.
- Capital market imperfections may make it harder for households and firms to finance the up-front cost of investments in energy efficiency measures.
- Households and firms may apply excessively high discount rates to future savings on energy bills, or inaccurate rules of thumb when making decisions.
- Households and firms may lack the information required to adopt efficient technologies and practices when the information has public goods characteristics that mean it is underprovided by the private sector.

52. The European Energy Efficiency Action Plan (EEAP) came into effect in 2006, as an instrument to contribute to the 20% energy savings target, endorsed by heads of states and governments in March 2007. The EEAP identified six areas with the highest potential for energy savings: products, buildings and services; transport; energy transformation; financing; energy behaviour and international partnerships. The implementation of the action plan should be completed by 2012 and involves 85 specific actions and measures to be undertaken at the EU and national levels. The Plan will be evaluated in 2009. National Energy Efficiency Action Plans have also been prepared to show how each member state will achieve its energy savings objective. To date the Commission is satisfied with the progress of member states in transposing Community law into national legislation and with the speed with which financial support has been provided. To overcome capital market failures, the Commission is working with international financial institutions to explore avenues to increase funding for investments in energy efficiency.

53. To ensure that the energy savings target is reached by 2020, the EU has also launched an Energy Efficiency Package with the following elements:

- A proposal to recast the Energy Performance of Buildings Directive (EPBD).
- A proposal to revise the Energy Labelling Directive.
- The already adopted Directive that introduces a labelling scheme for tyres.
- Guidelines clarifying the calculation of the amount of electricity from cogeneration.
- A Communication on Cogeneration arguing that energy can be saved by combining heat and power generation.

In addition to these measures, the EU legislature has adopted mandatory EU-wide fuel efficiency standards for passenger cars, and further action is envisaged for light commercial road transport vehicles.

54. To overcome information asymmetries and other market failures there may be a role for command and control mechanisms such as labelling, technology and performance standards for some goods and services, to complement emissions trading and deliver an overall lower cost of abatement. Mandatory disclosure through labelling requirements on appliances can be particularly effective because it helps to overcome information barriers and makes it easier to act on the price signal provided by the ETS (Garnaut, 2008). After more than a decade the Commission is currently revising the Energy Labelling Directive. The existing labelling classifications will be upgraded and reviewed regularly following technological developments. The proposal for a recast of the Directive enlarges the scope to products used in the commercial and industrial sectors and to products which do not consume energy but allow for significant energy savings once in use (*e.g.* windows).

55. Where labelling requirements are insufficient to overcome information problems, minimum energy performance standards can also be cost effective (Duval, 2008). In light of this, the EEAP aims to improve efficiency of equipment and appliances through establishment of mandatory minimum requirements under the Eco-design of Energy-Using Products Directive. Specific measures (daughter directives) are adopted for particular product groups. One horizontal measure was adopted to require stand-by or off-mode electricity consumption of appliances to be near zero. However, because governments also have imperfect information about the factors that shape supply and demand in particular product markets, minimum standards should focus on performance rather than specific technologies, features that do not affect consumers' amenity and removing the least energy efficient products from the market. In combination with the labelling scheme, the level of the efficiency requirements should also be moving, rather than being fixed, over time to ensure ongoing incentives for innovation.

56. Because residential and commercial buildings are a source of large energy inefficiencies, the Energy Performance of Buildings Directive was adopted in 2003. It provides for:

- A general framework for guiding the calculation of the integrated performance of buildings and the establishment and regular reviews of energy performance standards.
- The requirement for minimum energy efficiency for new buildings.
- The requirement for minimum energy efficiency for the refurbishment of large existing buildings greater than 1000m².
- Requirement of energy certification of buildings when buildings are constructed, sold or rented.
- Inspection and assessment of heating and cooling installations.

57. Although the directive was supposed to be transposed by 2006, only five member states had properly done so by 2008. The EU should be commended for establishing mandatory requirements, but there may be room for strengthening the Directive further. For this reason, the Commission presented a proposal for its recast in 2008. Its main elements are the following:

- Removing the 1000m² limit on building refurbishment requirements.
- The introduction of benchmarking to achieve cost-optimal levels.
- Strengthening the role and the quality of energy performance certificates as well as of inspections for heating and air-conditioning systems.
- Addressing the public sector as a leading example.

These recommendations should be subject to rigorous cost–benefit analyses, and in particular the benefits of abolishing the limit on floor area would have to be weighed against the compliance costs for smaller businesses.

58. Although energy efficiency in the transport sector has improved over the past two decades, overall emissions in the transport sector have increased by 25% over the same period, largely because of an increase in the number of cars and an increase in the kilometres driven per car. Because the road transport sector is excluded from the ETS, the Commission has proposed emission performance standards for new passenger cars. The Regulation adopted by the Council in April 2009 set out the following:

- Set limits on emissions per kilometre.
- Define a limit value curve of emissions allowed for new vehicles according to the mass of the vehicle so that a fleet average of 130g CO₂ per km is achieved.
- Include an excess emissions premium if manufacturers' emissions lie above the limit value curve.

These standards will contribute to reducing emissions in the transport sector insofar as they are stringent enough to imply additional efforts to improve vehicle efficiency over and above those already planned by manufacturers. However, as discussed earlier, the pros and cons of including road transport in the EU ETS should be analysed in more depth. Moreover, light vehicles are just one component of the transport sector. It is important that there is further investigation to determine whether it is advisable to pursue a more integrated approach to reducing emissions in the whole transport sector so that a similar price signal would be sent to all segments (road, air, rail and water). A proposal was tabled to require the labelling of tyres (covering also replacement tyres); the labelling covers rolling resistance performance (with direct impact on fuel consumption), wet grip and rolling noise, with the view of optimising the performance of tyres on all parameters.

59. Overall, the evidence suggests that there is considerable room to improve energy efficiency in the EU and the Commission has a number of well–targeted policies and directives that should help member states to meet their 20% energy savings target. That said, care must be taken to ensure that all command and control measures are carefully designed to address specific market failures and are proportional to the size of those market failures. Moreover, because there is no EU–wide system for harmonised, quantitative monitoring of energy efficiency or energy savings goals at national level, it is extremely difficult to assess aggregate progress toward these goals.¹¹

60. More generally, it is not clear why a separate energy savings target is required. It should also be remembered that energy efficiency is not the same as economic efficiency; if measures that improve energy efficiency require more input of non–energy resources than is saved in energy, economic efficiency is reduced. New Community guidelines for state aid for environmental protection from 2007 proposing continuing state aid for renewable energy and energy efficiency also have the potential to encourage distorting policies. Some believe that there are circumstances where reduced value added tax (VAT) rates to provide for energy–friendly consumption can be beneficial, although the Commission should carefully consider the evidence before lending its support to such proposals. Concerns that current exemptions for electricity and heating fuels bias the tax system in favour of fossil–fuel intensive goods and services might

11. As regards measures adopted (or in the process of being adopted) under the Ecodesign Directive (and some for Labelling), the total estimated annual energy savings by 2020 (compared with business–as–usual) account for about 343 TWh which correspond to 12.5% of the total EU electricity consumption. Converted to primary energy it is about 74 Mtoe which is 18.8% of the annual EU saving objective by 2020 (20% saving target compared to a business–as–usual scenario).

be better addressed by ending those exemptions. In addition, the price signal coming from the EU ETS, together with the proliferation of Commission and member state initiatives supporting renewables and energy efficiency measures should provide opportunities for low-emission and energy-efficient goods and services to increase their market share without an additional tax.

Toward a single and secure electricity and gas market

61. Further liberalisation of EU electricity and gas markets is critical for delivering a number of the EU's objectives: lower barriers to entry and greater competition will put downward pressure on wholesale and retail electricity and gas prices paid by households and firms and increase incentives to innovate; more integrated and competitive energy markets will increase incentives to invest in new generation and transmission capacity, improving energy security; more competitive energy markets will allow clearer price signals to be sent through the ETS, allowing emission reductions to be achieved at lower cost; and liberalisation in energy markets will facilitate the upgrade of electricity grids so that greater renewable energy capacity can be brought online.

62. A fully competitive internal market for gas and electricity has been a long-standing goal of the EU. The first liberalisation directives for electricity (1996) and gas (1998) made some progress by allowing large customers to choose their suppliers, but did not require all countries to set up independent regulatory authorities, did not set out a regulated access framework for electricity grids, and did little to reduce the market power of vertically-integrated companies that owned transmission networks and generation plants. The second liberalisation package adopted in 2003 provided, *inter alia*, for full market opening for all customers by July 2007, stricter provisions for the unbundling of transmission networks leaving only legal unbundling and full ownership unbundling, and mandatory establishment of independent regulators. There were also provisions for market-based allocation of available transmission capacity, provisions for the use of congestion rents from auctioning and transparent and non-discriminatory procedures to calculate transmission capacity. In 2006, the Commission responded to concerns that progress on implementation of directives was slow in many countries by launching an energy sector inquiry, the largest ever study of the EU energy markets. The Commission identified serious shortcomings in the electricity and gas markets:

- Electricity markets remained national in scope, with dominant firms inhibiting competition within countries and stifling investment in the transmission and interconnection capacity needed to increase trade and competition between countries.
- Legal unbundling of vertically-integrated firms that owned both generation assets and transmission networks raised barriers to entry and inhibited investment in new capacity.
- Consumer switching at the retail level was above 5% in 2006 in only three European countries, suggesting a lack of competition in retail markets.
- There was a lack of reliable and timely information on markets, inhibiting transparency.
- Price information was not transparent and regulated tariffs discouraged entry.
- Gas markets were highly concentrated, insufficiently integrated, and there was too much vertical integration between suppliers and transmission operators of gas. New large suppliers were often in conflict with the network owners of existing pipelines and upstream supply was largely outside of EU countries' control.

63. The Commission's third liberalisation package responds to these findings, concentrating mainly on strengthening the requirements and provisions of the second directive. Crucially, it recognises that transmission system operators (TSOs) play a critical role in electricity markets because they have monopoly control of the operation of transmission systems, make investment decisions on new transmission infrastructure, influence the adaptation of transmission networks to new energy sources, and they have information advantages over regulators about the networks they operate. A particular problem in the EU is that, in some countries, vertically-integrated companies own both transmission networks and electricity generation assets, which reduces incentives to treat all players equally and increases incentives to maximise the total value of the company by extracting monopoly rents. Because regulators may be unable to overcome these problems, the Commission recommended that member states move to full ownership unbundling of TSOs. As an alternative, the Commission proposed the unbundling of system operation, with owners of supply interests allowed to keep their transmission grid assets. An Independent System Operator (ISO) would then have control over grids and investment plans.

64. However, because neither full unbundling, nor the ISO solution was acceptable to all member states, the Commission worked together with the Council to develop a "third way" solution: TSOs will be allowed to remain part of vertically-integrated companies, but detailed rules will govern the autonomy, independence and investment of TSOs. The Commission believes that this Independent Transmission Operator (ITO) option will provide for "effective" unbundling. The TSO will have to be certified by the national regulator, but there will not be any binding oversight from the Commission in the certification procedure. Instead, national regulators are obliged to "take the utmost account of the Commission's position". Every two years, the Commission will submit, as part of the general review required, to the European Parliament and the Council, a detailed specific report outlining the extent to which the unbundling requirements under the ITO option have been successful in ensuring full and effective independence of transmission system operators. Although the Commission does not intend to undertake a new impact assessment of the ITO proposal, a review clause was inserted into the Directive enabling the Commission to assess the efficiency of ITOs after two years. It will be critical that such a review takes place, since if the ITO option does not produce the effective unbundling expected by the Commission the internal energy market will be set back considerably.

65. An equally important issue in constructing a fully functioning internal energy market is effective cross-border co-operation and regulation. An institution is required to manage cross-border investments and supervise co-operation between national regulators. Although the European group of Regulators for Electricity and Gas has helped the development of the internal market, it does not have binding decision making powers. In light of this, the Commission's proposal for an Agency for the Co-operation of Regulators (ACER) is welcome. For ACER to be effective it will be important that it has binding powers to set common codes on cross-border infrastructure regarding third-party access, operating procedures, new capacity requests and additions, interconnection procedures and standards and transparency. To carry out all of these tasks effectively ACER needs to be adequately staffed (IEA, 2008a). The EU should also give consideration to how EU-wide oversight of the electricity and gas markets can contribute to delivering the renewable energy and energy savings targets. For example, it will be important that distribution companies have incentives to invest in "smart grids" and end-use energy efficiency as a "supply" option within an integrated resource management approach. In the longer run the EU will need to give consideration to extending the powers of ACER so that it has binding regulatory and decision making powers over national regulators. As has been demonstrated recently in financial markets, it is difficult to achieve a fully functioning single market without a strong central authority to oversee and enforce the rules of that market.

66. The third liberalisation package also contains provisions for strengthening the independence of national regulators. This is necessary to ensure that large national firms do not impede competition within and across borders. The Commission has identified a number of areas in which national regulators require more powers: all aspects of third party access to networks and gas storage; compliance with functional and

account unbundling of Distribution Service Operators; cross-border issues; information gathering; and strong sanctions for non-compliance with regulations. Amendments to the original Commission proposals to further strengthen national regulators by requiring them to approve and enforce TSOs annual investment plans, enforce consumer protection measures, monitor restrictive contractual practices, give them greater power to improve competition in supply markets, and provide for autonomous financing of regulators, are especially welcome. Given the slowness with which previous directives pushing for better regulation and integration have been implemented, it will be important for the Commission to closely monitor member states' progress.

67. Another priority is to significantly increase investment in cross-border transmission networks. Without sufficient interconnection capacity foreign suppliers cannot exert enough competitive pressure on national incumbents. The Commission has begun implementing new network projects through the Regional Initiatives programme, with the support of the European Group of Regulators for Electricity and Gas. The 2007 EU *Survey* (OECD, 2007) argued that the approach of leaving member states to voluntarily develop joint schemes for congestion management had delivered insufficient progress, and that only a small proportion of congestion revenues had been used to build new inter-connectors or reinforce grids. Under the third liberalisation package, operators of the main gas and electricity transportation networks will be obliged to co-operate and co-ordinate the operation of their networks through the European Network of Transmission System Operators. This network should also facilitate the joint implementation of cross-border transmission network projects determined through the European Investment Plan. A good model is NordPool, the integrated Nordic energy market (IEA, 2008a). The Commission will need to monitor cross-border investment and implement additional processes should investment be inadequate. Responsibility for and financing of new interconnections should be defined and facilitated by cross-border regulations.

68. Regulated energy tariffs inhibit retail competition, distort investment and consumption decisions by firms and households, and weaken the price signals coming through the EU ETS. Although the Commission acknowledges that member states have the right to regulate prices to protect vulnerable citizens, they have affirmed that regulated prices should be the exception rather than the rule. To that end, the Commission has launched infringement action against those states that retain extensively regulated prices. The Commission should be commended for undertaking these infringement actions and should continue to encourage member states to abolish tariff regulation. Member states' concerns about the impact of high or volatile energy prices on the welfare of disadvantaged groups can best be addressed through targeted transfers that do not distort investment and consumption decisions (IEA, 2008a). According to the European Group of Regulators for Electricity and Gas (2009), 15 EU countries have some form of price controls. In those countries where end-user regulated prices still exist in at least one market segment, in general, only a limited number of customers have switched from regulated prices to free market retail prices. For most countries, the share of customers supplied with regulated prices is usually greater than 80% for most market segments.

69. Legislation has been accompanied by a robust application of the competition law in energy markets. The Commission stepped up its efforts to enforce competition policy. A number of cases have led to decisions in both the electricity sector (electricity production in Greece, E.ON electricity cases on the wholesale and balancing markets in Germany) and in the gas sector (long-term retail contracts in Belgium) which should improve competition to the benefit of consumers. Further, the Commission initiated a number of new cases, in particular as regards the use of networks to favour supply affiliates (e.g. gas networks of RWE in Germany and of ENI in Italy), as regards the foreclosure of markets through long-term contracts (in the French and Belgian electricity retail markets) and as regards possible cartels (E.ON-GDF gas case). In a number of cases (e.g. generation in Greece, E.ON electricity cases, RWE gas case) remedies have been adopted which will change the structure of the market: they will do so by either

allocating new production facilities or reallocating exiting power plants to competitors or by putting network facilities in the hands of companies not active in the production and sales businesses.

Energy security

70. Security of supply is one of the core objectives of the EU's energy policy and is central to the Lisbon Strategy for Jobs and Growth. While the EU's "20-20-20 by 2020" objectives and energy market liberalisation policies will improve security of supply by reducing reliance on imported fossil fuels and raising incentives to invest in new generation and transmission capacity, the Commission considers that additional complementary policies are necessary. Consequently, in the 2nd Strategic Energy Review the Commission has proposed a five-point EU Energy Security and Solidarity Action Plan focusing on: infrastructure needs and the diversification of energy supplies; external energy relations; oil and gas stocks and crisis response mechanisms; energy efficiency; and making the best use of the EU's indigenous energy sources.

71. Of these priorities, raising investment in gas pipeline and other energy infrastructure to diversify supply is particularly important, as illustrated by the standoff between Russia and the Ukraine in winter 2008/2009 over gas supplies. For example, although gas supply is reasonably diversified for the EU as a whole, many member states rely on a single supplier for their gas (IEA, 2008c). Consequently, the Commission has identified six key infrastructure projects to be accepted as Community priorities that will help reduce countries' exposure to energy supply shocks from individual countries:

- A Baltic Interconnection Plan covering gas, electricity and storage to identify the necessary infrastructure for connecting the Baltic region with the rest of the EU.
- A Southern Gas Corridor to increase the supply of gas from the Middle East and Caucasus, including the Nabucco Pipeline project.
- A Liquefied Natural Gas (LNG) Action Plan to increase liquefaction facilities in producing countries and LNG terminals and ship-based regasification in importing countries.
- A Mediterranean Energy Ring to link Europe with the Southern Mediterranean through electricity and gas interconnections and help develop the region's solar and wind energy potential.
- North-South gas and electricity connections with Central and South-East Europe.
- A Blueprint for a North Sea offshore grid to interconnect national electricity grids in North-West Europe and facilitate the incorporation of new offshore wind projects into the grid.

72. Most of these priorities have already been identified under the Trans-European Networks-Energy (TEN-E) programme, which makes a small amount of public funding (EUR 21 million) available for mainly pre-feasibility studies of projects. The EU expects the energy industry itself to provide the bulk of the financing, though projects can often access funds from the EIB. The Commission has recognised that the TEN-E instrument was developed when the EU was considerably smaller and faced energy challenges of different dimension, and thus may no longer be sufficient. It has therefore begun the reflection process on whether the TEN-E instrument should be replaced by a new EU Energy Security and Infrastructure Instrument. The new instrument should make funds available for both pre-feasibility and feasibility studies, as in many cases major issues with projects can only be assessed during the feasibility phase. In addition, in its review of EU energy policy, the IEA (2008a) pointed out that as of 2007 only 16% of the TEN-E projects with a European interest had been finalised, and that incentives for investors to complete projects were inhibited by their other interests in generation and supply capacity. Any system for

unbundling of TSOs should ensure the full effectiveness of their independence, in order to provide optimal investment in cross-border supply capacity. In addition, because firms do not have an incentive to internalise the energy security externality, there may be a greater role for public funding of infrastructure projects. Some of the other policy options for fostering cross-border transmission projects include:

- Nominating a European project co-ordinator for each major project or group project.
- Harmonising multi-jurisdictional regulatory frameworks (the adoption of the 3rd internal energy market package will contribute).
- Legislating time lines for qualified major transmission projects.
- Nominating designated transmission corridors for renewable energy development allowing faster siting and permitting.

73. The standoff between Russia and the Ukraine also underlines the importance of well-functioning markets, and the need for improved procedures for dealing with gas emergencies as well as harmonised security of supply standards. The Commission intends to table a proposal for the revision of the Gas Security of Supply Directive in 2009. Recent analysis by the IEA (2009) suggests that supply disruptions in Eastern European countries at the beginning of 2009 did not result in a large surge in spot natural gas prices in Western Europe and that as a result, price signals did not lead to changed consumption, production or inventory management patterns in Western Europe. In addition, very little gas supply was redirected to affected Eastern European countries because of the lack of East-flowing interconnection capacity. The IEA points to the oil market as one where market transparency better balances supply and demand and helps to mitigate crises, and suggests that European governments should consider co-ordinating their emergency policies. The IEA's recommended options that governments can draw on to improve their gas emergency policies include:

- Agreeing on clear definitions of reliability standards governing normal market operation.
- Defining the roles and responsibilities of market players in non-normal situations.
- Defining the role of transmission system operators during emergencies.
- Improving the understanding of the interdependencies between gas and power generation and the possible options for fuel switching.
- Improving the understanding of social, economic and other consequences of prolonged or sharp gas supply disruptions.
- Facilitating supply-side responses, such as short-term LNG purchases or diversions or swap arrangements with other suppliers, involving both pipeline and LNG supplies as well as alternate fuels.
- Developing relevant organisational capacities and links to existing energy emergency capacities, including stakeholder involvement.
- Improving the transparency of gas flows, stocks and other relevant data.

74. Another important priority is enhancing the powers of the EU over external energy policy, which is underdeveloped compared to areas such as trade and competition policy. The IEA's EU energy policy review argued that it was critical for Europe to speak "with a common voice" on external energy issues, and that the lack of co-ordinated action may have contributed to delays to projects like Nabucco, and weakened its position with major supplier countries such as Russia. The IEA believes that the EU's powers should be increased beyond its existing legal responsibilities to allow for greater co-ordination of member states. The Commission is responding to this by identifying specific mechanisms for increasing transparency between member states and the EU. The Commission is also considering revising the regulation that requires member states to notify the Commission about investment projects of interest to the Community in the petroleum, natural gas and electricity sectors.

75. Although diversification of EU energy supply is an important policy goal, it should not become a cover for policies that unnecessarily raise the cost of energy inputs. Europe is a net energy importer because many non-European countries have larger energy endowments and can produce energy at lower cost than European countries. If bio-fuels derived from sugar cane can be produced more efficiently outside the EU than within the EU, then tariffs and subsidies to promote domestic production are likely to distort resource allocation and unduly raise costs for end-users. Similarly, Europe could make greater use of nuclear fuels in electricity production to help meet its emission reduction goals without endangering security of supply, because uranium production is highly diversified across largely politically-stable countries.

Conclusion

76. The EU has an extensive agenda for creating a single internal energy market, diversifying energy supply, improving energy efficiency and reducing its carbon footprint by 2020. The EU should be praised for the comprehensiveness of its strategy and for leading the world in many of these areas. The EU's 2020 goals are part of even more ambitious longer term objectives. The Commission plans to renew the Energy Policy for Europe with a 2050 "vision" and roadmap that could include: decarbonising the EU electricity supply by 2050; ending oil dependence in transport; and moving to a smart electricity network that can efficiently absorb new generation capacity from many small renewable energy producers.

77. Given the scale of its current and future ambitions, it is critical that the EU delivers its objectives in the most efficient manner. Policies to reduce European GHG emissions will lower potential growth. To keep the impact of mitigation policies on growth low, the EU must pursue least-cost abatement options and deliver a single, competitive internal energy market as soon as possible. For the most part, the EU is working towards this goal by: pricing the social cost of GHG emissions through the EU ETS, correcting market failures that cause energy to be used inefficiently and limit the development and use of renewable energy and other low-emission technologies; issuing directives that should speed progress toward the single energy market; and working closely with the member states that control many of the policy levers that determine whether the EU's objectives are met. The EU's framework for assessing the impact of Commission proposals also helps to ensure that the costs and benefits are examined carefully. Nevertheless, there are refinements that could be made to the instruments and policies that the EU has chosen to help meet its targets and goals.

Box 5. Recommendations concerning climate change and energy policies

To improve the equity and efficiency of the EU ETS during Phase III and beyond, the EU should:

- Analyse in more depth the pros and cons of broadening the ETS to include the road transport sector by shifting the point of obligation for the transport sector upstream to producers of transport fuel or fuel suppliers or the point of excise.
- Ensure that only sectors rigorously identified as being at genuine risk of carbon leakage continue to receive free allowances until 2020.

To ensure that the 20% renewable energy target is met in the most cost effective way, the EU should:

- Make sure that public procurement policies that actively favour renewables do not excessively increase the cost of providing government goods and services.
- Facilitate member states' use of statistical transfers and joint projects for renewables and maximise the cost effectiveness of renewable energy support measures.
- Move in the longer term to more co-ordinated or, if appropriate, a single harmonised European renewable energy support mechanism, and examine the options for including non-renewable, low-emission technologies.
- Assess the renewable transport fuels target in the light of further developments, in particular the future availability of second generation biofuels, reduce tariffs on imported biofuels and relax the requirement that all countries meet the target, rather than the EU as a whole.
- Increase funding for low-emission R&D.
- Consider phasing out all price support mechanisms for renewable technologies once renewable energy technologies compete fairly in the energy market to ensure that the ETS operates as efficiently as possible.

To make sure that the benefits of policies to reduce energy consumption exceed the costs, the EU should:

- Ensure that the mandatory EU-wide minimum energy performance standards for appliances are implemented effectively and focus on performance rather than specific technologies and remove the least energy-efficient products from the market. Targets should be flexible enough to ensure ongoing incentives for innovation.
- Remove reduced VAT rates that favour fossil-fuel intensive goods and services, rather than cutting rates on low-emission goods and services.

To speed progress toward a single, diversified, secure and competitive European energy market, the EU should:

- Ensure that the Commission has binding oversight over the certification procedures for TSOs.
- Undertake a review of the ITO option for effective unbundling within two years of the legislation as soon as is practicable.
- Ensure that ACER is adequately staffed to effectively carry out its responsibilities for co-ordinating cross-border access and investment issues and ensure that ACER has the powers to effectively contribute to a single energy market.
- Encourage member states to abolish tariff regulation. Member states' concerns about the impact of high or volatile energy prices on the welfare of disadvantaged groups can best be addressed through targeted transfers that do not distort investment and consumption decisions.
- Improve procedures for dealing with gas emergencies.
- Enhance the powers of the EU over external energy policy, which is underdeveloped compared to areas such as trade and competition policy.

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