



# GHG MITIGATION IN THE EU: AN OVERVIEW OF THE CURRENT POLICY LANDSCAPE

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## EXECUTIVE SUMMARY

In 2009, the European Union (EU) pledged a unilateral greenhouse gas (GHG) reduction target of 20 percent below 1990 levels by 2020, rising to 30 percent if “other developed countries commit themselves to comparable emission reductions” (European Council 2009). The EU’s GHG target forms one pillar of a so-called 20-20-20 package that, in addition to the 20 percent GHG reduction, demands a 20 percent share of renewable energy sources in gross final energy consumption along with a 20 percent improvement in energy efficiency by 2020. In addition to its 2020 targets, the EU has also set a long-term GHG reduction goal of 80 to 95 percent from 1990 levels by 2050.

In the context of these goals, this report provides a summary of existing and emerging EU policies that are likely to reduce GHG emissions across the EU. Our analysis focuses on policies that are mandatory or provide a financial incentive, such as the European Union Emissions Trading System (EU ETS) – a cornerstone of EU climate policy – the Renewable Energy Directive, and the Biofuels Directive. We discuss the relationship of these policies to the EU’s GHG and energy targets, and identify key issues to watch in the EU’s evolving policy landscape.

This report draws on projections from the “Energy Roadmap 2050” to assess whether the EU is on track to reach its GHG, renewable energy and energy efficiency targets. We find that the EU is on track to surpass its 2020 GHG reduction and renewable energy targets based on current policies, but that additional measures will be required to meet the 2020 energy efficiency target and the 2050 GHG reduction goal.

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### About this Series

This working paper is part of a series that provides an overview of the current policy landscape that key countries have pursued in the interest of GHG mitigation. For each country, the series:

- Describes the country's international mitigation pledge (e.g., QELRO, Nationally Appropriate Mitigation Action), including assumptions and conditions associated with the pledge, and in what respect – if any – it is codified domestically
- Outlines the country's key government institutions and legal authorities for mitigating climate change
- Outlines major policy instruments related to GHG mitigation, current and under development
- Explains what is known about the country's GHG trajectory
- Identifies issues to watch in the coming years

## KEY METRICS

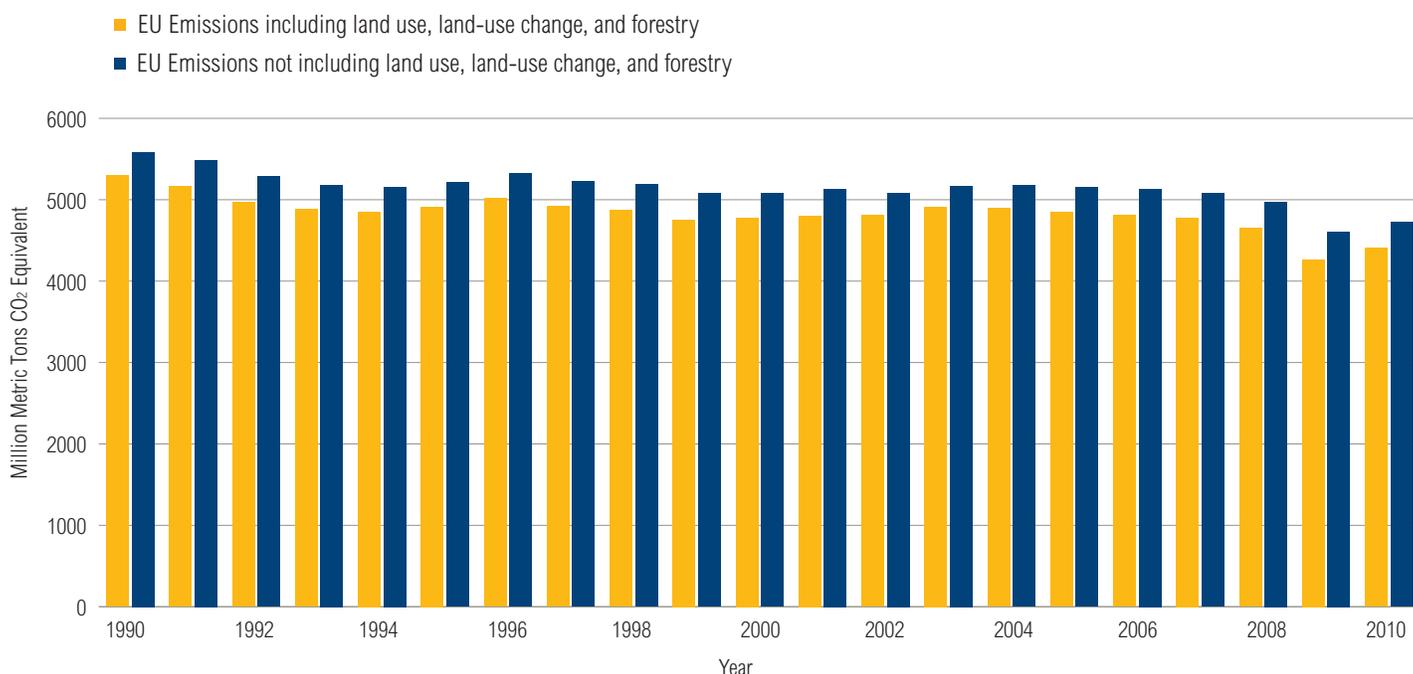
In Figure 1, European Union greenhouse gas (GHG) emissions<sup>1</sup> have decreased approximately 17 percent since 1990.

In Figure 2, EU per capita emissions in 2010 were 27 percent and 11 percent below 1990 and 2005 levels, respectively. Meanwhile, EU GHG emissions intensity<sup>2</sup> declined 42 percent between 1990 and 2010. These reductions were achieved despite a 6 percent increase in the population and a 44 percent increase in GDP<sup>3</sup> since 1990.

In Figure 3, the total consumption and share of coal and petroleum in the EU energy profile has decreased since 1990. In 2009, renewable energy (including hydro, wind, solar, geothermal, and biomass) made up 9 percent of all energy consumption in the European Union, more than doubling its share since 1990.

New and emerging policies, including the Energy Efficiency Directive, reforms to the EU ETS, and a proposed Energy Taxation Directive, which aims to restructure taxes on energy products, provide options that can begin to bridge this gap. It will be important to monitor these developments, as well as the EU's positioning in the international community vis-à-vis the possible strengthening of its 2020 target.

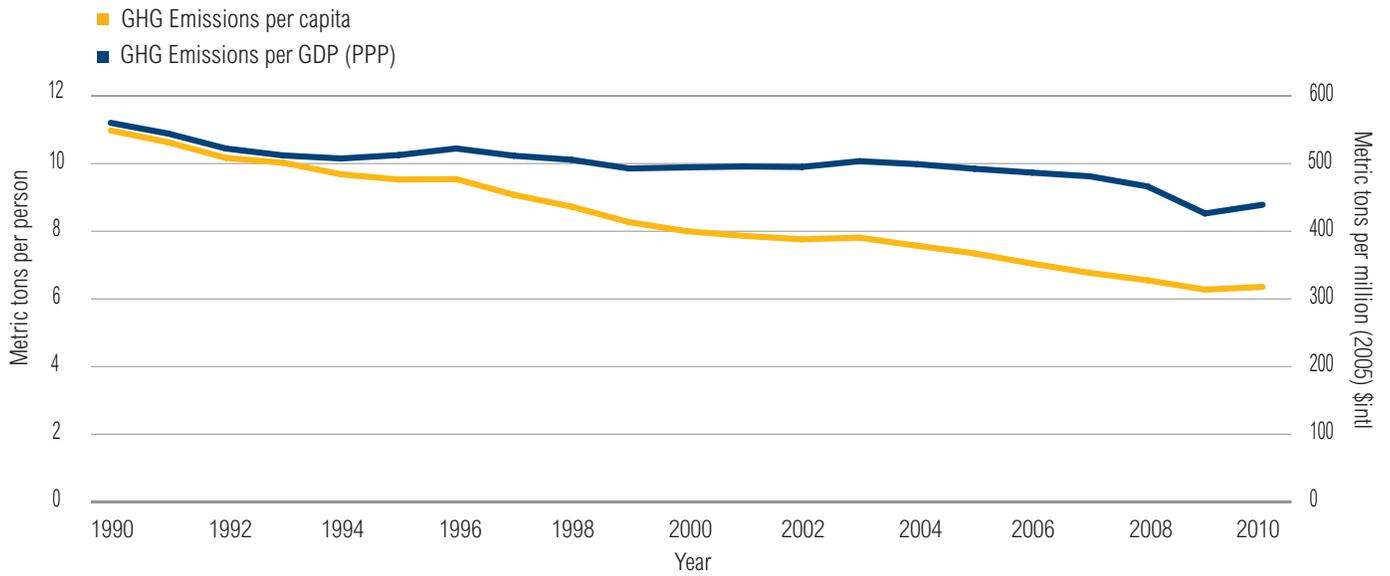
Figure 1 | **Total EU GHG Emissions**



Data Source: UNFCCC Data Interface, 2012.

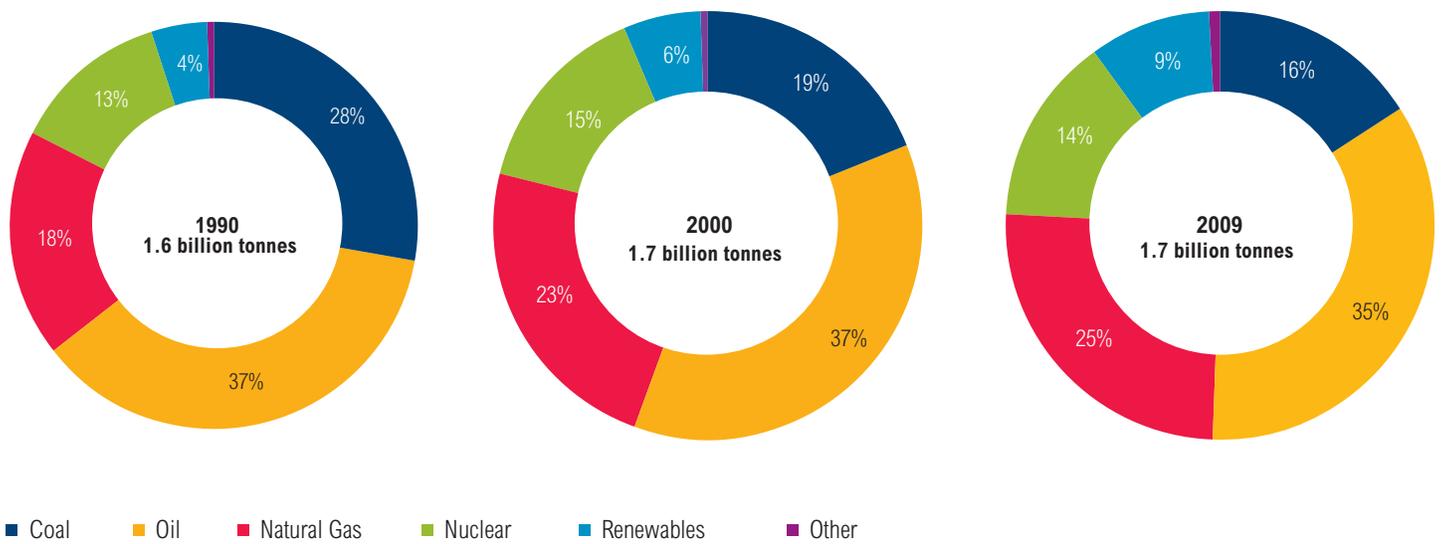
Notes: Totals include GHG emissions of all "Kyoto" gases in each reported sector, where applicable, as required by the UNFCCC for Annex I countries.

Figure 2 | **European Union GHG Emissions per Capita and GHG Emissions Intensity**



Data Source: Calculated using UNFCCC 2012 and World Bank World Development Indicators, 2012-10-14.  
 Notes: GHG emissions totals include land use, land-use change, and forestry.

Figure 3 | **EU Fuel Mix: 1990, 2000, and 2009**



Data Source: International Energy Agency.  
 Note: Size of circles indicates total consumption in billion tonnes of oil equivalent (btoe).

## I: INTERNATIONAL STATEMENTS OF FUTURE GHG MITIGATION

### International Mitigation Pledge under the UN Framework Convention on Climate Change (UNFCCC)

Under the Kyoto Protocol, the original 15 member states of the European Union (EU) committed to reducing their GHG emissions by 8 percent under a 1990 baseline by 2012 (UNFCCC 1997). In Copenhagen the EU, with its now 27 member states, communicated its commitment to reducing GHG emissions by 20 percent compared to 1990 levels by 2020, a target that will rise to 30 percent “provided that other developed countries commit themselves to comparable emission reductions and that developing countries contribute adequately according to their responsibilities and respective capabilities” (European Council 2009). These pledges were reaffirmed at the subsequent climate change conferences (UNFCCC 2011). To enable comparisons to other quantitative targets, it is instructive to examine the relative magnitude of the 20 percent reduction target according to other base years and/or additional metrics (see Table 1).<sup>4</sup> The EU has also committed to a second compliance period of the Kyoto Protocol (legally binding until either 2017 or 2020), negotiated at the last Climate Summit in Durban. The details of this compliance period are still being decided.

### Conditions and Assumptions Underlying International Pledge

The goal of reducing GHG emissions by 20 percent from 1990 levels is equivalent to a reduction of around 800 Mt CO<sub>2</sub>-eq annually. This commitment is legally binding, and the effort is shared among EU countries according to a formula based on GDP per capita. The overall amount of international offsets that may be used to achieve this target is equal to 1,400 Mt (in the sectors covered by the EU Emissions Trading System, as discussed below) plus up to 750 Mt from the “nontraded” sectors (European Environment Agency 2012a). Key features of this pledge are summarized in Box 1.

Emissions and removals in the land-use, land-use change, and forestry (LULUCF) sector are currently not part of the commitment. The EU has, however, decided that the sector’s inclusion shall be assessed (European Union 2009a).

Eastern European member states hold a considerable amount of surplus carbon credits (assigned amount units, or AAUs) accumulated after the collapse of their industrial infrastructure during the early 1990s. An estimated 3.1 billion credits are left over from the first Kyoto period.<sup>5</sup> Negotiations continue over what will happen to surplus credits, including whether they are to be cancelled or can be transferred into the next period. A decision is envisaged for December 2012 (euractiv 2012).

Table 1 | EU Pledged GHG Emissions Reductions by 2020

| BASELINE OR BASE YEAR | ABSOLUTE CHANGE                                | PER CAPITA CHANGE                              | GHG INTENSITY OF ECONOMY CHANGE                                |
|-----------------------|--|--|--|
| 1990                  | -20% including and excluding LULUCF            | -26% including and excluding LULUCF            | -47% to -54% including LULUCF<br>-47% to -53% excluding LULUCF |
| 2000                  | -11% including LULUCF<br>-12% excluding LULUCF | -16% including LULUCF<br>-17% excluding LULUCF | -46% to -52% including LULUCF<br>-43% to -49% excluding LULUCF |
| 2005                  | -13% including and excluding LULUCF            | -16% including LULUCF<br>-17% excluding LULUCF | -37% to -43% including LULUCF<br>-38% to -43% excluding LULUCF |

**Box 1 | Conditions Underlying the EU GHG Pledge****Conditions of International Reduction Goal:**

- The EU will raise its mitigation efforts to 30% if “other developed countries commit themselves to comparable emission reductions and . . . contribute adequately according to their responsibilities and respective capabilities” (European Council 2009).

**Sectors Covered:**

- All IPCC sectors except LULUCF

**Gases Covered:**

- Assumption is six original Kyoto gases: CO<sub>2</sub>, CH<sub>4</sub>, N<sub>2</sub>O, HFCs, PFCs, SF<sub>6</sub>

**Use of Domestic or International Carbon Credits:**

- More than 2,000 Mt of international offsets could be used toward the 2020 target.

**Domestic Codification of the International Pledge**

The GHG emissions reduction targets were translated into a comprehensive energy and climate package, which was passed in December 2008 by the European Parliament. The so-called 20-20-20 targets envisage a reduction of GHG emissions by 20 percent under 1990 levels, an increase in the share of renewable energy sources (RES) to 20 percent of gross final energy consumption, and improvements in energy efficiency of 20 percent compared to projected trends, all of which have to be achieved by 2020 (European Commission 2010).

The goals for RES and energy efficiency were explicitly established in the context of GHG reduction. The renewable energy target is also contained in the Renewable Energy Directive (2009/28/EC) (European Union 2009b), which establishes not only the 20 percent target for RES in gross final energy consumption but also a 10 percent target for RES in transport. While the targets for renewable energy are also translated into binding targets for individual member states, the energy efficiency target has not been made mandatory.

The EU has further stated its intention to reduce GHG emissions by 80–95 percent below 1990 levels by 2050 (European Council 2009; European Parliament 2009). This target is not binding and has not been substantiated by actual policies or measures, but several studies have been launched in order to determine how this long-term emissions target could be met (European Commission 2011b).

**II: RELEVANT GOVERNMENT INSTITUTIONS AND LEGAL AUTHORITIES**

The right to devise environmental policy at the European level is enshrined in the EU treaties. Environmental issues are of “shared competence” between the EU and its member states; the EU is expected to act on areas where concerted action is more efficient than national action. The EU’s legislative bodies include the European Parliament and the Council of the European Union; the European Commission is the executive body. The European Parliament is the directly elected parliamentary institution of the EU, while the Council consists of 27 ministers representing their respective member states for the topic at hand. The presidency of the Council rotates among member states every 6 months. Usually both the Parliament and the Council have to agree on new legislation, while the Commission is responsible for proposing new laws and overseeing the implementation of decisions.

Administrative authorities in the member states and national courts and tribunals oversee the realization of rights and obligations derived from EU law. The European Commission also oversees implementation of policies and can open infringement procedures. For example, if a member state does not meet its annual emissions reduction target, its allocation of allowances for the following year will be reduced by the shortfall plus an interest rate of 8 percent. The member state also has to lay out a new action plan, which must be approved, and the state can temporarily be excluded from transferring emissions allowances or credits (European Environment Agency 2012b). A number of complementary directives and recommendations have been adopted in order to ensure enforcement of EU environmental policies, such as the Directive on Environmental Liability (European Union 2004b), the Directive on the Protection of the Environment through Criminal Law (European Union 2008), and the Recommendations for Minimum Criteria for Environmental Inspections (European Union 2001b).<sup>6</sup>

Climate policy in the EU is shaped through a number of directives and regulations. Directives must be implemented at the member state level to achieve the prescribed result, and there is usually some degree of flexibility for national implementation. In contrast, regulations are self-executing and do not need additional implementation by the member states. The process from the proposal of a directive to its implementation in the member states

can take considerable time. Directives first have to be adopted by the Parliament and Council and must then be implemented by the individual member states according to a given timetable. Usually, changes to member state law are necessary, which means another legislative process at the member state level has to be followed through. For example, the EU ETS Directive was first proposed in 2001, passed by the EU in 2003, and became operational in 2005.

The framework of the EU ETS was set up at the European level, while the allocation of emissions allowances was decided by each member state. From 2013 onward, however, rules on the allocation of allowances are to be harmonized at the European level, indicating a trend to more centralized administration of the traded sectors, while member states are still responsible for implementing policies in the nontraded sectors. Other areas that are also important for GHG emissions, such as energy (including grids) and transport infrastructure, are not of “shared competence” and therefore are subject to policy making at the member state level.

### III: OVERVIEW OF MAJOR POLICIES

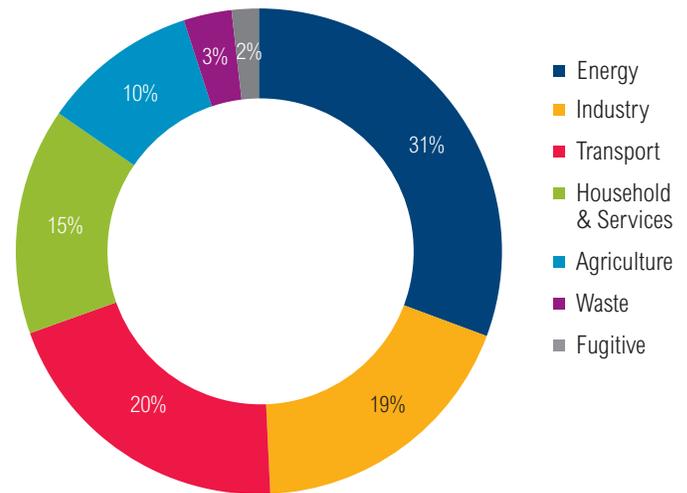
#### Introduction and Methods

In this report, we have elected to focus on two categories of EU-wide policies – mandatory requirements and financial incentives. We exclude voluntary initiatives, research and development programs, and awareness-raising efforts because, while these are also important, it is more difficult to estimate their impact on GHG emissions, and we assume that they are less likely than mandatory efforts to have a significant effect on emissions.

We further classify this subset of policies, examining existing policies that have been adopted by the European Parliament and the Council as well as policies under development. We give an outlook on “issues to watch” in the final section.

Figure 4 shows the share of different sectors of overall GHG emissions in the EU. The energy and industry sectors are jointly responsible for half of those emissions, followed by the transport sector, households and services, agriculture, waste, and fugitives. Table 2 lists selected policies, some of which will be discussed in the following sections.

Figure 4 | 2009 GHG Emissions in the EU by Sector



Source: EEA, 2010, own illustration

#### Existing Policies

##### Cross-sectoral

The **Energy and Industry Sectors** are jointly responsible for half of GHG emissions in the EU (EEA 2010). Developments in those sectors are crucial for efforts to curb emissions. The **EU Emissions Trading System** (EU ETS) (Directive 2003/87/EC), which targets these sectors, is a cornerstone of European energy and climate policy. Established in 2003, it has been operational since 2005 (European Union 2003c). The EU ETS is based on the principle of cap and trade, which sets a limit on the total amount of GHGs that can be emitted for all installations covered by the EU ETS. European Union allowances (EUAs) equivalent to the emissions cap are distributed (given out for free or auctioned) to the installations participating in the EU ETS. At the end of each year, installations are required to submit one EUA for each ton of CO<sub>2</sub> (or CO<sub>2</sub>-eq) they have emitted. Those allowances can be traded on a market, where installations with surplus allowances can sell EUAs, and installations that do not hold enough EUAs to cover their emissions can buy additional allowances. These transactions create a price per ton of CO<sub>2</sub> that provides the financial incentive for installations to either reduce their emissions (and sell their allowance surplus on the market) or buy allowances, if this

Table 2 | Selected Policies in the EU that are Likely to Reduce GHG Emissions

| POLICY TYPE                               | POLICIES  |
|---|---|
| Cross-cutting economic incentives         | <ul style="list-style-type: none"> <li>■ EU ETS Directives (2003/87/EC, 2009/29/EC) setting up the EU ETS + new provisions for third phase</li> <li>■ Linking Directive (2004/101/EC) regulating the use of offsets</li> <li>■ Energy Taxation Directive (Proposed) harmonizing energy tax rates in the EU</li> </ul>   |
| Energy supply policies                    | <ul style="list-style-type: none"> <li>■ Renewable Energy Directives (2001/77/EC, 2009/28/EC) setting mandatory goals for the share of RES in gross final energy consumption</li> </ul>   |
| Energy efficiency programs                | <ul style="list-style-type: none"> <li>■ Energy Efficiency Directive (Sept/Oct 2012) defining legally binding energy efficiency measures</li> <li>■ Energy Performance of Buildings (2002/91/EC, 2010/31/EU) setting out standards for new and renovated buildings</li> <li>■ Energy Labeling of Products (92/75/EEC, 2010/30/EU) raising consumer awareness of energy use of appliances</li> </ul> |
| Transport                                 | <ul style="list-style-type: none"> <li>■ Emissions Performance Standards (443/2009) setting fleet average CO<sub>2</sub> emissions standards for new cars</li> <li>■ Biofuels in transport (2003/30/EC, 2009/28/EC) setting a mandatory target for RES in transport</li> </ul>  |
| Waste                                     | <ul style="list-style-type: none"> <li>■ Landfill Directive (1999/31/EC)</li> <li>■ Waste Incineration Directive (2000/76/EC)</li> </ul>  |
| Agriculture, forestry, and other land use | <ul style="list-style-type: none"> <li>■ Common Agricultural Policy (1782/2003)</li> <li>■ Nitrates Directive (91/676/EEC)</li> </ul>   |

Note: Grey denotes policies currently under development.

is more cost-effective than reducing their own emissions. This should lead to emissions being reduced where it can be done at the lowest cost.

The EU ETS was initially set up to run in two phases: a pilot phase from 2005 to 2007 and a second phase coinciding with the first commitment period of the Kyoto Protocol from 2008 to 2012. In 2008 it was decided to continue the scheme beyond 2012 and under the **Revised ETS Directive 2009/29/EC** (European Union 2009c) new rules were devised. The third trading phase of the EU ETS will commence in 2013 with the introduction of an EU-wide cap on emissions (in contrast to the first two phases, when national caps were set), which will reduce at an annual rate of 1.74 percent to ensure an emissions reduction of 21 percent below 2005 levels by 2020 from all the sectors covered. Following the **Linking Directive 2004/101/EC** (European Union 2004a), covered entities are allowed to surrender international offsets created under the Clean Development Mechanism (CDM) or joint implementation (JI) instead of EUAs. The maximum amount that can be used is equal to 1,400 Mt or about 14 percent of the total free allocation in the second trading

period. About 41 percent of the allowable offsets have been used to date. The remainder can be carried over into the third trading period. The significant amount of offsets and the current oversupply of allowances have sparked discussions about delaying auctions, amending offset regulations or cancelling a percentage of allowances altogether (European Environment Agency 2012a).

The **Effort Sharing Decision 406/2009/EC** (European Union 2009a) determines the split of the reduction effort between the traded (covered by the EU ETS) and nontraded sectors, such as buildings, transport and agriculture. It demands a 10 percent reduction from 2005 emissions levels by 2020 in those sectors not covered by the EU ETS. If both the ETS and non-ETS targets are met, the goal of reducing emissions by 20 percent below 1990 levels by 2020 is also achieved. Member states are allowed to use international offsets for up to 3 percent of their 2005 non-ETS emissions to meet this target. They may trade allocations and offset entitlements.

The EU ETS covers around 40 percent of total GHG emissions in the EU (50 percent of CO<sub>2</sub> emissions). From 2013

onward, N<sub>2</sub>O and PFC will also fall under the scheme and the EU ETS will cover around 50 percent of GHG emissions in the EU. The scheme is operational in all 27 EU member states plus Norway, Iceland and Liechtenstein and covers more than 11,000 installations in the energy and most industrial sectors. Installations covered include power stations and other combustion plants, oil refineries, coke ovens, iron and steel plants and factories making cement, glass, lime, bricks, ceramics, pulp, paper and board. In 2012, aviation will come under the scheme and from 2013 onward petrochemicals, ammonia and aluminium will also be covered, as well as the capture, transport and storage of CO<sub>2</sub>.

Criticism regarding the EU ETS exists. One concern is that the cap has consistently been too generous, leading to an oversupply of allowances. This problem has been amplified by a decrease in demand as a result of the economic crisis and the significant use of international credits.

As surplus allowances and international credits can be banked into the third trading period, an oversupply of permits of up to 2.4 billion by 2020 (European Commission 2012a) has been predicted. As a consequence, the EUA price has recently dropped to below €7/t CO<sub>2</sub>. Low prices threaten the environmental effectiveness of the EU ETS, because investment in emissions reductions becomes less attractive. Inducing long-term investment in low-carbon infrastructure requires both short-term measures to strengthen the carbon price as well as clarity on the stringency of future caps.

A second criticism is that the amount of offsets allowed under the EU ETS is fairly high, which further inflates the supply of permits and means that less domestic action has to be taken. Furthermore, the environmental impact of certificates generated under the CDM (which can be used as offsets) remains doubtful. However, certain project types (HFC destruction, large hydropower and forestry) will be excluded, and only offsets generated in least developed countries will be allowed as offsets under the EU ETS from the third phase onward.

A third criticism is that the widespread free allocation of allowances has led to a considerable transfer of wealth from households to companies covered by the EU ETS, who despite the free allocation of allowances passed on the value of EUAs in the form of higher prices (e.g. Matthes, 2008). From the third phase on, however, a substantial amount of permits will be auctioned, but free allocation, especially to industry (and coal-fired power plants in

Eastern Europe), still prevails. Free allocation is based on the notion that trade-exposed industries face prices on a global market, cannot pass the price of carbon on to consumers and hence will become uncompetitive if a carbon price is introduced unilaterally. Therefore, they receive a percentage of their permit requirements for free. If, however, industries are able to pass on the costs of carbon to consumers and receive free allocation, this constitutes windfall gains to the industry and a loss of revenue to the government. This highlights the case for carefully designing rules for free allocation. In the EU ETS, free allocation will be governed by EU-wide best available technology (BAT) benchmarks from 2013 onward.

Finally, a fourth concern is that the market for EUAs has recently been subject to criminal activity. A large-scale value-added tax (VAT) fraud and the attempt of stealing and double-selling of allowances have produced major headlines. As a consequence, the security of registries is to be tightened and market oversight to be improved.

The **Energy Efficiency Action Plan** (European Commission 2006) created a framework of legislation, policies, and measures devised to achieve the goal of cutting energy consumption by 20 percent below a projected baseline by 2020. However, current projections show that the EU is on track to only achieve about half of the envisaged energy efficiency goals (European Commission 2011f). In order to further stimulate investment in energy efficiency measures, the European Commission (2011b) has adopted the **Energy Efficiency Plan** and a **Proposal for a Directive on Energy Efficiency 2020** (European Commission 2011f, see Part IV), which was passed by the Parliament in September 2012. This legislation is intended to ensure that the energy efficiency objective is achieved and to obligate member states to establish energy saving schemes. Some member states – namely, Italy, Denmark, France, and Great Britain – have already introduced White Certificates Schemes which reward energy efficiency improvements with certificates that can then be sold. As with support for renewable energy, interaction potential exists between the EU ETS and market-based energy efficiency schemes, where companies covered by both schemes might be rewarded twice for the same GHG reducing measure, thus threatening the environmental integrity of any such scheme. At the same time, such schemes can overcome barriers that a carbon price cannot, especially regarding energy consumption at the household level, and help achieve emissions reduction goals at lower cost, thus providing a rationale for the strengthening of emissions reduction goals.

## Energy Supply

The **Electricity Sector** is responsible for about one third of European GHG emissions. The **Green Electricity Directive 2001/77/EC** (European Union 2001a) of 2001 established a 21 percent target of RES in electricity by 2010 and set indicative targets for member states. Furthermore, it required member states to implement support programs for renewable energy. According to the latest data, a share of only 19 percent of RES in electricity was achieved in 2010 (European Commission 2009). In the updated **Renewable Energy Directive 2009/28/EC** (European Union 2009b), binding national targets have been set for each member state to ensure that the average share of RES in gross final energy consumption across the EU reaches 20 percent by 2020. Given that the starting point – the renewable energy potential and the energy mix – varies for each member state, the EU target of 20 percent was translated to individual targets that range from a renewables share of 10 percent in Malta to 49 percent in Sweden. The Directive also sets out sustainability requirements for biofuels and addresses administrative barriers to the installation of RES and their integration into the grid. As a consequence, a 10-Year Network Development Plan under the auspices of the European Network of Transmission System Operators for Electricity (entso-e 2010) was prepared, under which data and modeling results have to be published every 2 years providing political decision makers with information regarding investments in transmission systems.

A point of criticism regarding the EU's renewable energy policy relates to the fact that the absolute emissions limit is set by the EU ETS cap, and emissions savings induced by renewable energy in sectors covered by the EU ETS will only decrease prices for EUAs but not lead to additional emissions reductions. Furthermore, overachieving in the area of renewable energy does not influence the cap. Support for RES is still needed to correct for externalities associated with developing and deploying new technologies, namely, knowledge spillovers in R&D and the task associated with reforming an inert energy system, which cannot be performed by a carbon price alone. Therefore, the promotion of RES is an integral part of a comprehensive climate policy mix and an important prerequisite for infrastructural change (Matthes 2010).

## Buildings and Appliances

**Households and Services** generate 15 percent of European GHG emissions. The **Energy Performance of Buildings Directive 2002/91/EC** (European Union 2003a) and its Recast 2010/31/EU (European Union 2010b) requires member states to set minimum efficiency standards for construction or renovation of buildings and introduces a labelling system for the energy performance of existing buildings. Furthermore, a system for regular checks of boilers and air conditioners has to be set up by each member state.

Criticism regarding the Buildings Directive exists. As the energy efficiency checks are often only carried out in the planning and not in the building phase, an incentive exists to not carry out plans as submitted to officials. Therefore, the actual energy performance of a building can be considerably worse than stated in the plans. The level of oversight depends on the individual member state. An example for good practice is Finland, where officials visit building sites regularly to ensure energy performance standards are met. Another point of criticism relates to the fact that renewable energy and combined heat and power (CHP) can be counted against a building's energy performance requirements. This can lead to a situation where requirements for the insulation of buildings receiving heat from a CHP plant or electricity from renewable energy sources may be lower than for conventional buildings.

The **Appliance Labeling Directive 92/75/EEC** (European Council 1992), subsequent implementing Directives and its Recast 2010/30/EU (European Union 2010a) introduce a common format for labels that inform about the energy consumption of household appliances, such as refrigerators and freezers, electric ovens, air conditioners, dishwashers, lamps, washing machines, and driers. They are designed to raise public awareness for differences in energy consumption and provide consumers with the necessary information to purchase efficient appliances.

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## Transport

The **Transport Sector** in Europe produces 20 percent of overall GHG emissions. As it is the sector with the most rapidly rising emissions, measures in this sector are crucial for achieving the EU's GHG reduction goals. Besides supporting a shift away from motorized transport to more environmentally friendly modes, policies that increase the efficiency of cars also help to achieve those goals. The **Biofuels Directive 2003/30/EC** (European Union 2003b) required member states to ensure that at least 5.75 percent of diesel and fuels are derived from renewable sources by 2010. As has become apparent, this goal will not be reached and the EU restated its commitment to biofuels by setting a 10 percent target for renewable energy sources in transport by 2020 as part of the **Renewable Energy Directive 2009/28/EC** (European Union 2009b). Although the Directive sets out sustainability requirements, potential problems with the large-scale introduction of biofuels are manifold and mainly concern the sustainability of their production. First, rainforest may be cleared in order to plant sugar cane or oil palms that provide inputs for biofuels production. Second, competition may arise between planting of food crops and production of biofuels, potentially leading to a shortage of food. The consequences could especially be dangerous for developing countries. Furthermore, there have been problems regarding communication between car manufacturers and fuel producers as to which models will be able to handle the new fuels. Consequently, their introduction in Europe has been complicated and delayed.

The voluntary agreement with car manufacturers to reduce CO<sub>2</sub> emissions (**ACEA agreement**) was the first attempt to reduce average CO<sub>2</sub> emissions of new passenger cars sold in the European Union and set a goal of 140 gCO<sub>2</sub>/km to be reached by 2008 (European Commission 1998). Since April 2009, a new **EU Regulation No 443/2009** (European Union 2009d) prescribes binding emissions standards for new vehicles. The regulation envisages a reduction of the average CO<sub>2</sub> emissions to 130 g CO<sub>2</sub>/km for the whole fleet of new vehicles by 2015. From 2020 onward, the standard is further tightened to 95 g CO<sub>2</sub>/km (see Table 3).

The provisional monitoring data for 2011 from the European Environment Agency (2012b) indicates that the least emitting new car registrations can be found in Portugal (122 g CO<sub>2</sub>/km) and the highest emitting car registrations in Estonia (156.9 g CO<sub>2</sub>/km). These differences stem from different size and weight of cars, as well as different shares

of gasoline and diesel vehicles. The emissions performance requirements are phased in, such that in 2012 65 percent of each manufacturer's newly registered cars must comply (on average) with the limit value set by the regulation. This will rise to 75 percent in 2013, 80 percent in 2014, and 100 percent from 2015 onward. A rough estimation based on the monitoring data of CO<sub>2</sub> emissions from new passenger cars indicates CO<sub>2</sub> emissions savings on the order of 230 Mt CO<sub>2</sub> from 2012 to 2020.

The emissions limit value is calculated taking into account the weight of vehicles, rather than the space, which means that manufacturers producing heavy cars are favored relatively to those producing spacious but lighter cars. Furthermore, the whole fleet and not individual cars have to meet the threshold. Therefore, individual models can still be highly emissions-intensive. Moreover, conditions under which average emissions of the fleet are determined, that is, in the test cycle, do not necessarily correspond to real-world conditions as they do not take into account use of lights, air conditioning or audio equipment. Finally, deployment of electric vehicles can be counted against the threshold, which means that double-counting of emissions can occur. However, the fact that electric vehicles can somewhat "offset" high-emitting cars in the fleet might lead to an incentive for car manufacturers to put electric vehicles on the market as the average emissions value is calculated taking into account the number of cars registered in a given year.

## Waste

The Waste Sector produces 3 percent of overall emissions in the EU. The Landfill Directive 1999/31/EC (European Council 1999), which entered into force in 1999, introduced binding technical standards for treatment of waste and landfill, with a view to reducing emissions and limiting adverse effects on the environment and on human health. The Directive lays down exact procedures and requirements for operating landfills. In particular, landfill sites are differentiated as to whether nonhazardous, hazardous or inert waste can be deposited there. Certain types of waste, such as liquid waste, flammable waste, and explosive or oxidising waste, are no longer permitted in landfill at all, but have to be treated separately. The Waste Incineration Directive 2000/76/EC (European Union 2000) requires operators of incineration plants to hold permits that authorize them to carry out their activities. Furthermore, it prescribes standards regarding the plant operations (e.g. acceptance of waste, incineration temperature, treatment of residues, monitoring) and sets

Table 3 | **Current Average CO<sub>2</sub> Emissions of New Cars in the EU and the Standard as Set Out under EU Regulations**

|                                   | 2011 <sup>7</sup>           | 2015                                 | 2020                                |
|-----------------------------------|-----------------------------|--------------------------------------|-------------------------------------|
| Average CO <sub>2</sub> emissions | 135.7 g CO <sub>2</sub> /km | 130 g CO <sub>2</sub> /km (standard) | 95 g CO <sub>2</sub> /km (standard) |

emissions limits. In 2008, a total of 2.62 billion tonnes of waste were generated in the EU, slightly lower than in 2004 and 2006, where waste generation amounted to 2.68 billion tonnes and 2.73 billion tonnes respectively. 49 percent of waste was landfilled in 2008.<sup>8,9</sup>

## Agriculture

The **Agricultural Sector** is responsible for 10 percent of overall GHG emissions in the EU. Most of the policies regarding agriculture are decided under the framework of the **Common Agricultural Policy (CAP)**, which works through two channels: market policy and support for the development of rural areas (European Council 2003). Following a reform of the CAP, the EU is moving away from intensive agriculture to reducing livestock, supporting smaller farms and limiting use of nitrate fertilizers. Specific measures and instruments to reduce GHG emissions in the agricultural sector do not exist, but the payment of subsidies depends on compliance with environmental regulations. If the regulations are not met, subsidies are reduced or cut altogether. Since 2005, premium payments are dependent on achievement of certain environmental standards (Cross Compliance). **The Nitrates Directive 91/676/EEC** (European Council 1991), for example, regulates deployment of nitrate-based fertilizer. This is indeed desirable since those fertilizers emit GHGs both during the production process and during their usage. The extensification of agriculture is further supported by the **European Agricultural Fund for Rural Development (EAFRD)** (European Council 2005). Member states can implement national or regional measures that are then cofinanced by the EU. Subsidized projects include organic farming, reduced usage of fertilizers and ecological and animal-friendly livestock farming. The “Health Check Decisions” (European Commission 2007), which were implemented in 2008 and contain, inter alia, a restructuring of the dairy sector, had a significant effect on reducing livestock. Furthermore, resources for the development of rural areas were increased, with a focus on climate change, bioenergy and water management.

## Policies under Development

With regard to the 20-20-20 targets, the most important policy recently under discussion was the **Proposed Energy Efficiency Directive**. The European Parliament voted in favor of the Directive in September 2012 and the Council endorsed it in October 2012. The main features of the Directive are:

- Energy companies are requested to reduce sales to their customers (industrial and households) by 1.5 percent
- 3 percent renovation rate for government-owned and -used buildings
- Drawing up of national energy efficiency programs to meet the overall 20 percent target by 2020
- Additional measures for energy audits, energy management techniques by large firms, etc.

Significant departures from the initial proposal exist. First, while the proposal was going to make the efficiency targets mandatory, it is now only indicative, while the measures to reach this target will be binding. Each member state has to draw up a national energy efficiency program by April 2013. The Commission will then evaluate whether those measures are sufficient to meet the overall 20 percent target, and can impose additional binding measures if this is not the case. It is expected that current member state plans are equivalent to a target of about 15 percent. Some additional measures regarding efficient design of cars and boilers are projected to bring the target back up to 17 percent. Therefore, additional measures will have to be proposed by member states or the Commission.<sup>10</sup> Second, the recognition of early action was agreed on, which would mean that the 1.5 percent reduction target for energy companies may be reduced to close to 1 percent. Finally, the Proposal envisaged a 3 percent renovation rate for all government-owned buildings, for example, social security housing, while the Directive will demand this reduction rate of only government-used buildings.

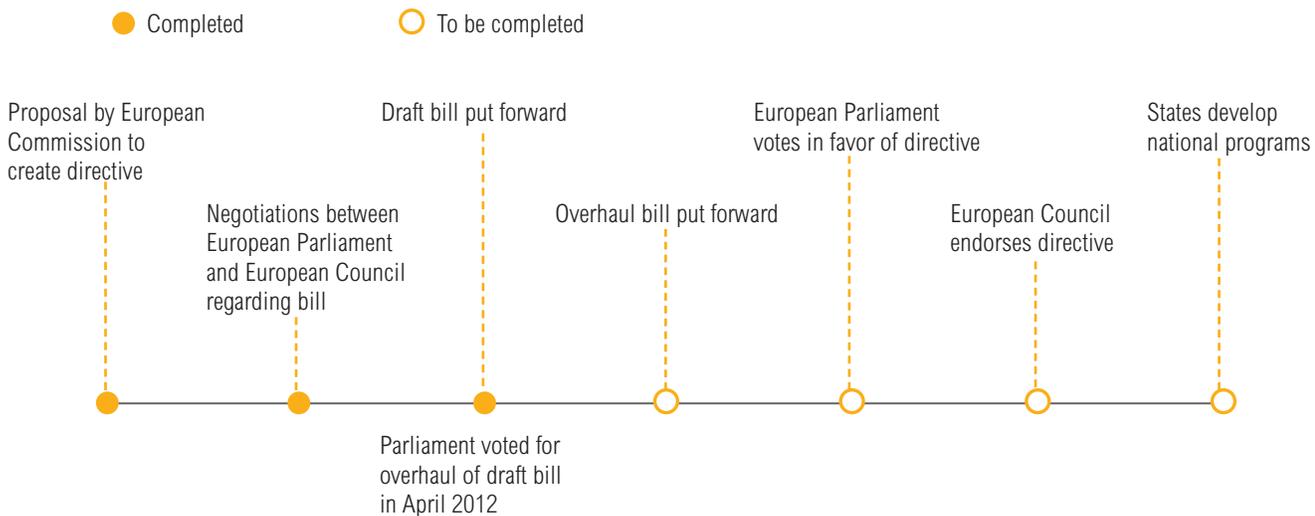
Energy saving schemes could include White Certificates Schemes, such as those already operational in Italy, Denmark, France, and Great Britain. However, as noted above, concerns over double-counting of emissions reductions and windfall profits to industry exist. On the other hand, energy efficiency measures present an opportunity to target low-income households, achieving dual goals of emissions and poverty reduction. Moreover, they represent a rationale for tightening emissions reduction targets, as those can be achieved at lower cost.

Furthermore, an **Energy Taxation Directive** is being prepared that aims to restructure the way in which energy products are taxed in the EU. Specifically, taxation shall henceforth rely on both CO<sub>2</sub> and energy content in order to remove existing imbalances and market distortions. The proposed minimum tax rates are €20/tCO<sub>2</sub> and €9.6/GJ for motor fuels, and €0.15/GJ for heating fuels. Social considerations in the Proposal (European Commission 2011e) provide member states with the option to exclude fuels used by households as well as transitional periods (up to 2023).

Finally, several “Roadmaps” have been prepared at the European level. While the “Energy Roadmap 2050” (European Commission, 2011a) focuses on the energy sector, the European Commission (2011f) has also published a roadmap for the transport sector, where CO<sub>2</sub> emissions from this sector are cut to 60 percent below 1990 levels by 2050. A roadmap for further investigation of measures in the household and services sectors is also being considered. These roadmaps serve as a first attempt to lay out specific policies needed to reach the 2050 emission reduction goal, and represent planning instruments rather than binding legislation.

Figure 5 | **Process for Implementing the Energy Efficiency Directive**



Figure 6 | **Process for Implementing the Energy Taxation Directive**

## IV: GHG PROJECTIONS

This section provides an overview of how existing policies and policies under development may affect GHG emissions and presents expected GHG emissions trajectories for several different scenarios.

Part of the European Commission’s “Energy Roadmap 2050” forms an extensive modeling exercise, the results of which can be used to assess whether the EU is on track to reach its targets regarding reduction of GHG emissions, deployment of renewable energy sources and improvements in energy efficiency. Specifically, the 20-20-20 goals by 2020 can be assessed, as well as the more long-term target of reducing GHG emissions by 80–95 percent below 1990 levels by 2050.

These projections have been chosen because they represent the most recent and comprehensive review of the impact of specific climate policies at the European level. As an officially commissioned study, the modeling approach, assumptions and results were open for public consultations and reviewed by the Impact Assessment Board so as to ensure quality (European Commission 2011c). Other studies provide modeling of various scenarios including GHG and/or CO<sub>2</sub> emissions. These include studies by the European Climate Foundation (2010), eurelectric (2010) and Greenpeace International and Erec (2010) and were conducted prior to the publication of the Energy Roadmap 2050.

Modeling in the Energy Roadmap 2050 is mainly based on PRIMES, a general equilibrium energy model, with inputs from PROMETHEUS, a model that generates fossil fuel import prices, and GEM-E3, responsible for macroeconomic indicators such as GDP, and complemented by GAINS, which models non-CO<sub>2</sub> emissions. Other inputs include Eurostat data on population and economic development.

Different scenarios are modeled:

- A Reference scenario, including all policies adopted by March 2010.
- A Current Policy Initiatives (CPI) scenario, which also considers policy initiatives after that date, including the Energy Efficiency Plan, the proposed Energy Taxation Directive, changes regarding the regulation and cost of nuclear energy (following the accident at the Fukushima nuclear plant) and new information on fuel prices and technological decisions.
- An assessment of different options to reach the (non-binding) goal of reducing GHG emissions in the EU 80–95 percent below 1990 levels by 2050, including several “decarbonization scenarios.” Using the CPI scenario as a starting point, they present several pathways toward the long-term goal, relying on differing technical options.

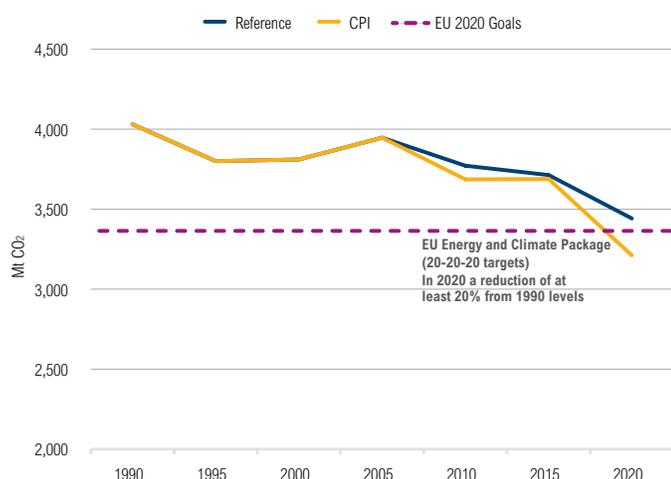
In order to assess progress toward the 20-20-20 goals, the Reference and CPI scenario are of interest. Table 4 details the most important inputs for both scenarios.<sup>11</sup>

Table 4 | **Inputs to Energy Roadmap 2050 modeling**

| ALL SCENARIOS                 |   |
|-------------------------------|---|
| <b>GDP growth rate</b>        | 1.7% pa on average  |
| <b>Population growth</b>      | 0.3% pa on average  |
| <b>Oil price</b>              | 88\$/barrel in 2020, 10 \$/barrel in 2030, and 127\$/barrel in 2050 (in 2008\$)   |
| <b>Main policies included</b> | All policies adopted by March 2010, such as ETS Directive and RES Directive, Buildings Directive and emissions standards for vehicles |
| <b>Sensitivity</b>            | Sensitivity analysis with lower/higher GDP growth and energy prices   |
| <b>CPI</b>                    | To be completed April 2013  |
| <b>Additional policies</b>    | Policies adopted after March 2010, such as the Energy Efficiency Plan   |
| <b>Additional assumptions</b> | Higher nuclear safety requirements, CCS progress revisited, uptake of electric vehicles revisited                                     |

Sources: Capros, Mantzos, Tasios, De Vita, and Kouvaritakis, 2010; European Commission, 2011d

Figure 7 | **CO<sub>2</sub> Trajectories to 2020 Reduction Goal<sup>13</sup>**



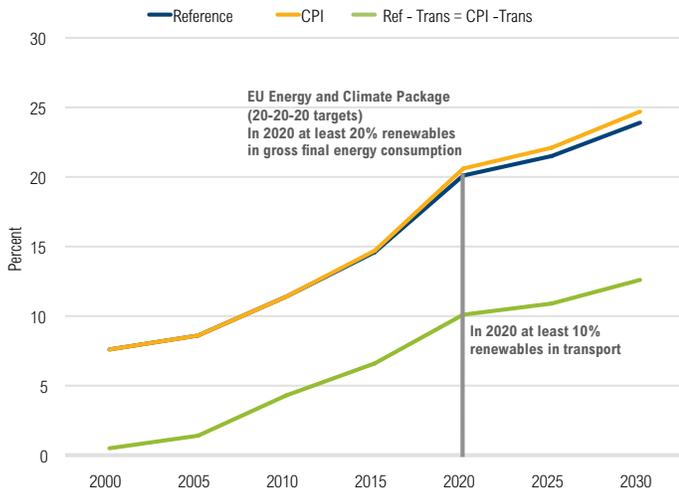
Source: European Commission 2011e, own illustration

The goal of **reducing GHG emissions 20 percent below 1990 levels by 2020** is reached, both in the Reference and in the CPI scenario. The CPI scenario even overshoots the goal, mainly due to additional energy savings induced by more rigorous energy efficiency measures. Figure 7 shows CO<sub>2</sub> emissions trajectories for both scenarios until 2030. CO<sub>2</sub> emissions projections are used as a proxy for GHG emissions, as no detailed results for GHG emissions are available.<sup>12</sup>

The target of **20 percent renewable energy sources (RES) by 2020** in gross final energy consumption and 10 percent RES in Transport by 2020 is also reached in both the Reference and the CPI scenario (Figure 8). From around 10 percent RES in gross final energy consumption today the share rises to 20 percent in both scenarios. In transport the share of RES starts from 3 percent today and reaches 10 percent in 2020. The development of the share of RES is very similar in both scenarios.

As Figure 9 shows, however, the target of a **20 percent improvement in energy efficiency by 2020** against a projected baseline will not be reached in either of the two scenarios. Although in the CPI scenario the energy efficiency performance of the EU is markedly better than in the Reference Scenario (mainly due to the inclusion of the Energy Efficiency Plan), the goal of reducing energy consumption by 20 percent against a baseline is not reached. The Reference scenario reduces consumption only by about 10 percent as compared to this baseline, while the CPI scenario reduces consumption by about 14 percent. Regarding those modeling results, the Commission notes that the “results should not be read as implying that the 20 percent energy efficiency target for 2020 cannot be reached effectively. Greater effects of the Energy Efficiency Plan are possible if the Energy Efficiency Directive is adopted swiftly and completely, followed up by vigorous implementation and marked change in the energy

Figure 8 | Share of RES in Gross Final Energy Consumption in Reference and CPI Scenarios

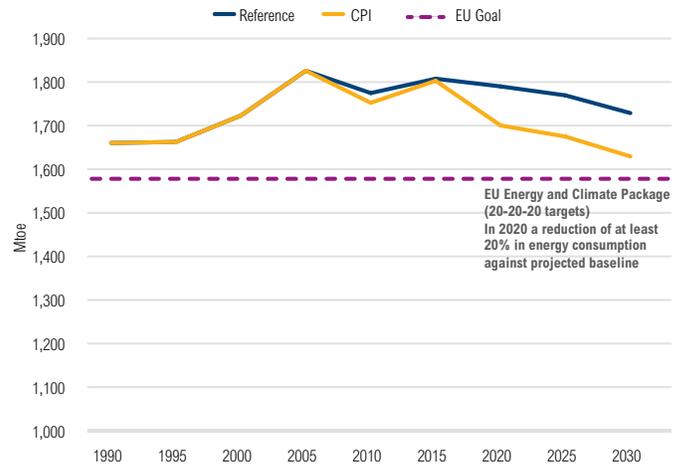


Source: European Commission, 2011e, own illustration

consumption decision making of individuals and companies” (European Commission 2011d: 26). Therefore, the implementation of the Energy Efficiency Directive seems crucial to put the EU on track to meeting its efficiency goal (and further GHG reduction goals).<sup>14</sup>

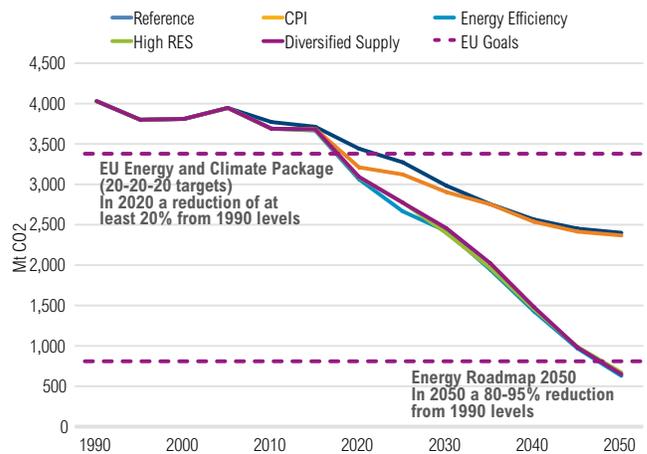
Finally, Figure 10 provides an assessment of different options to reach the (nonbinding) goal of reducing GHG emissions in the EU by 80–95 percent from 1990 levels by 2050. Along with the Reference and CPI scenario, three “decarbonization scenarios” are displayed: An Energy Efficiency scenario, driven by policies and measures mainly concerning energy efficiency; a High Renewable Energy Scenario, driven by comprehensive investment in renewable energy generation capacity; and a Diversified Supply Scenario, driven by (carbon) prices that put the EU on a path toward the desired reduction goal. The Reference and CPI scenario fall far short of reaching the 2050 reduction goal and only achieve a reduction of about 40 percent from 1990 levels, while the decarbonization scenarios not only reach this goal but would also reach a target of reducing emissions by 30 percent until 2020. Those scenarios are not designed to give concrete advice regarding policies and measures that could be adopted to reach those targets, but rather illustrate that (mainly technical) options exist to reach the given goals.

Figure 9 | Energy Demand<sup>15</sup> in Reference and CPI Scenarios



Source: European Commission, 2011e, own illustration

Figure 10 | Potential CO<sub>2</sub> Trajectories to 2050 Reduction Goal



Source: European Commission, 2011e, own illustration

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## V: LOOKING AHEAD

According to the above projections, the EU is on track to meet its 20 percent emissions reduction target by 2020. However, in order to reach the long-term targets while keeping annual reduction rates roughly constant, this target would need to be raised to 30 percent. This seems reasonable for a number of reasons. First, even with current policy initiatives the 20 percent target is overshoot. Second, prices of EUAs have fallen to record lows and do not ensure a lasting incentive for investment in low-carbon technology. Third, the envisaged energy efficiency measures will make achievement of this target even easier.

In order to provide a signal for long-term investment in low-carbon technology, it is crucial for the EU to strengthen its main climate policy tool, the EU ETS. Throughout 2012 prices per ton of CO<sub>2</sub> have consistently been below €10 and at some points during the year have even fallen to below €7, while initial projections of the Commission saw the price at a much higher level. Several options to strengthen the carbon price signal exist.

The European Commission is examining the possibility of “backloading” of allowances, that is, delaying auctions of Phase 3 EU allowances. Three options are on the table: 400Mt, 900Mt or 1,200Mt (European Commission 2012b). Such a step could probably be taken without a formal vote amongst member states. However, the question would remain whether or not those permits would be cancelled in the long term. Analysis has shown that in order to strengthen the EU ETS in the short and long term, both withholding a significant amount of permits (1,400Mt) until after 2020 or their permanent cancellation, combined with a deepening of the 1.74 percent reduction factor to 2.25 percent, 2.6 percent, or 3.9 percent (corresponding to a 30% 2020 reduction target) would have to be implemented (Öko-Institut 2012). In terms of the functioning of the EU ETS, it will also be important, whether or not China, India and the US are successful in their bid for fighting the inclusion of airlines from those countries in the scheme.

Furthermore, implementation of the Energy Efficiency Directive is crucial in determining whether the EU will be able to meet its energy efficiency target by 2020, and also in determining the level of ambition of subsequent targets, as energy efficiency is widely regarded as the lowest-cost option for reducing emissions. It remains to be seen which measures the member states propose to reach those targets. This issue is also linked to the fact that social considerations are coming into focus when climate policies are designed. Energy efficiency policies could help target the “fuel poor” in Europe. This highlights the potential of climate policies being linked more strongly to other policy goals in the future, such as an equitable society, job creation and economic growth. Government’s budgets will also be linked more strongly to the performance of climate policy, as ailing carbon prices threaten this source of government revenue in a time of fiscal austerity.

Finally, making a binding commitment to the long-term reduction goals until 2050 and increasing the 2020 target to 30 percent will depend on international climate negotiations and the political climate within the EU. The question is whether or not the EU will continue playing a pioneering role in climate policy, even in the absence of concerted international action. The EU has recently announced that it will start talks by 2014 about a midterm reduction target until 2030.<sup>16</sup>

## ABBREVIATIONS AND ACRONYMS

|        |  |
|--------|--|
| AAU    | assigned amount unit                             |
| BAT    | best available technology                        |
| CAP    | Common Agricultural Policy                       |
| CDM    | Clean Development Mechanism                      |
| CHP    | combined heat and power                          |
| CPI    | Current Policy Initiatives                       |
| EAFRD  | European Agricultural Fund for Rural Development |
| EEA    | European Environment Agency                      |
| ETS    | Emissions Trading System                         |
| EU     | European Union                                   |
| EUA    | European Union allowance                         |
| GDP    | gross domestic product                           |
| GHG    | greenhouse gas                                   |
| IPCC   | Intergovernmental Panel on Climate Change        |
| JI     | joint implementation                             |
| LULUCF | land-use, land-use change, and forestry          |
| OCN    | Open Climate Network                             |
| R&D    | research and development                         |
| RES    | renewable energy source                          |
| UNFCCC | UN Framework Convention on Climate Change        |
| VAT    | value-added tax                                  |

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## ENDNOTES

- 1 Figures reported in the text include GHG emissions from the land use, land-use change, and forestry sector unless otherwise specified.
- 2 GHG emissions intensity = total GHG emissions/total gross domestic product, PPP (\$Intl).
- 3 In purchasing power parity terms using constant 2005 international dollars.
- 4 Based on calculations by Levin and Bradley 2010.
- 5 [http://ec.europa.eu/environment/legal/implementation\\_en.htm](http://ec.europa.eu/environment/legal/implementation_en.htm)
- 6 <http://www.euractiv.com/climate-environment/eastern-eu-court-accept-30-co2-cuts-news-510043>
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- 8 [http://epp.eurostat.ec.europa.eu/statistics\\_explained/index.php/Waste\\_statistics](http://epp.eurostat.ec.europa.eu/statistics_explained/index.php/Waste_statistics)
- 9 GHG implications of policies in the waste sector are dependent on the measurement technique used. See UNEP (2010) for some indications.
- 10 <http://www.euractiv.com/energy-efficiency/european-parliament-gives-final-news-514732>
- 11 Description of the scenarios and modeling approach as well as detailed modeling results are freely available online (European Commission 2011c; European Commission 2011d). See also: [http://ec.europa.eu/energy/energy2020/roadmap/index\\_en.htm](http://ec.europa.eu/energy/energy2020/roadmap/index_en.htm)  
Table 4Inputs to Energy Roadmap 2050 Modeling (Sources: Capros, Mantzos, Tasios, De Vita, and Kouvaritakis, 2010; European Commission, 2011d)
- 12 In 2009, CO<sub>2</sub> represented 82% of overall GHG emissions in the EU (EEA 2010). Furthermore, the European Commission (2011d) states that in the model a reduction of GHG emissions by 29% in 2030 is equivalent to a 26% reduction of CO<sub>2</sub> emissions, while in 2050 both GHG and CO<sub>2</sub> emissions are reduced by 40%.
- 13 Figure 8 takes into account the fact that CO<sub>2</sub> emissions appear that they will reduce somewhat more slowly than overall GHG emissions by 2030.
- 14 The results for achievement of the 20-20-20 goals do not change significantly when sensitivity scenarios, assuming higher or lower GDP growth rates or when different import prices for fuels are considered.
- 15 Gross inland consumption
- 16 <http://www.bloomberg.com/news/2012-10-23/european-union-to-propose-2030-climate-framework-by-2014.html>

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