
Strengthening the European Union Climate and Energy Package

To build a low carbon, competitive and
energy secure European Union

Synthesis report

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Authors:

Emmanuel GUERIN, Director, Climate and Energy Programme, IDDRI

Thomas SPENCER, Research fellow, Climate and Energy Policies, IDDRI

Strengthening the European Union Climate and Energy Package

To build a low carbon, competitive and energy secure European Union

Lead author

Emmanuel GUERIN
Director, Energy and Climate Programme, IDDRI
E-mail: emmanuel.guerin@iddri.org
Phone: +33 (0)1 45 49 76 68



MOVING FROM 20 TO 30% EMISSION REDUCTION BY 2020? Reaching the 80% emission reduction target while securing the benefits of transitioning towards a low carbon economy

This synthesis report builds upon the inputs from all the contributors to the project:

- The Center for International Research on Environment and Development (CIRED), on the time consistency of the EU emissions reduction pathway, and the competitiveness and leakage impact of moving to 30% by 2020
- E3G, on the global race towards low carbon technology competitiveness
- ECN, on the low carbon technology innovation and diffusion implications of moving to 30%
- ECOFYS, on the consistency on the EU emission reduction, renewable energy and energy efficiency target, and on the energy security impacts of moving to 30%
- The International Consulting on Energy (ICE) on the employment impact of climate policies
- IDDRI on the investment dynamics in the electricity sector
- The Finish institute of International Affairs (FIIA) on the energy security impacts of moving to 30% for Poland, Czech Republic and Latvia, and on the use of the EU budget to support the transition towards a low carbon economy in Central and eastern European (CEE) countries

Some of these contributions are available from:
<http://www.climatestrategies.org/research/our-reports/category/57.html>

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Executive summary

Should the EU strengthen its Climate and Energy Package (CEP) if there is no guarantee that other major countries will follow or adopt a parallel strengthening? If yes – then how and when, given that the EU is still recovering from the worst economic crisis in a generation? These questions are at the heart of current European hesitations on energy and climate and deserve a careful response.

The EU's climate and energy goals aspire to three main objectives:

- To protect the climate, including a long term goal of reducing emissions by at least 80% by 2050;
- To protect EU economic competitiveness in a world of ever-growing competition, in particular competition from emerging economies, many of which do not have the same level of ambition on climate policy;
- To protect EU energy security in a world where oil, gas and coal markets have all proved volatile, where 'easy oil' is depleting, and the real mid-term cost, availability and stability of gas supplies (including shale gas) remains uncertain.

Achieving these three goals simultaneously is not an easy task, but it is feasible. An increase of the short-term emissions reduction target is necessary but not sufficient. A stronger EU CEP is needed to send a mid-term signal consistent with the long-term goals, to focus on the right elements, and it must be backed by appropriate structural and sectoral policies. Against this backdrop, we consider the three elements in relation to current EU policies and then offer specific policy recommendations.

Climate Consistency. The EU is politically committed to reducing emissions by at least 80% by 2050. Science indicates that this is the minimum reduction for developed countries in order to have a reasonable chance of limiting the global temperature increase to less than 2°C by the mid-century.

To explore the economics of time-consistency, we used a model – Imaclim-R – that pays particular attention to inertia in the capital stock in different sectors, to macro-economic sources of inertia, such as labour market rigidity, and allows for 'imperfect foresight' in industrial investment. The results suggest that:

- The EU CEP is currently too weak to reach the EU's long-term goal at an acceptable cost. This model shows that the rapidly accelerating reduction effort implied by delivering only 20% by 2020, and moving to 80% by 2050, leads to a full decade of declining GDP at the end of the period. This is economically extremely inefficient and political implausible. The current EU CEP is therefore inconsistent with EU political commitment.

- Strengthening the EU CEP now would significantly lower the overall costs of reaching the 2050 target. Moving to 25% by 2020 (plus 5% offsets, delivering 30% overall) increases the GDP trend in the last decade by 1%/yr, at a GDP cost of 0.1 – 0.2%/yr slower growth during the first two decades.

Establishing the optimal path is obviously very complex. However, the modelling clearly indicates 20% by 2020 to be too weak, it reveals the mechanisms explaining why, and what kind of early actions are needed to ensure time consistency of the EU emissions reduction pathway. To have maximum impact, a stronger EU CEP should target sectors with high levels of inertia and long-lived capital stocks, such as the building and transport sectors, and should foster low carbon technology innovation, in addition to delivering short term abatement, e.g. through fuel shifting.

Competitiveness. In the long run, high carbon competitiveness is a contradiction in terms: high carbon growth will kill itself. But in a world of unequal global carbon prices, enhancing EU competitiveness through the implementation of climate policies is a balancing act: between the short and the long term, between market pull and technology push instruments, and between the economically optimal and politically feasible:

- Increasing the 2020 emissions reduction target and focusing on fostering low carbon goods and services innovation would increase the competitiveness of those EU firms and sectors producing low carbon technologies. Low Carbon and Environmental Goods and Services (LCEGS) is a market already worth close to 3,5 trillion Euros a year and growing faster than most other sectors (projected to grow at 4% a year for next 5 years);
- However, a stronger EU ETS target, and the resulting carbon price, could adversely affect the competitiveness of some carbon-intensive industries; this could be counter-productive, especially if it results in carbon leakage. Our research confirms that the scope of carbon leakage is narrow and, on average, its impact on the competitiveness of carbon-intensive industries is limited. Nevertheless, in spite of free allocation, some industries might be significantly impacted by an increased 2020 emissions reduction target. The order of magnitude of this impact diverges widely between studies. Incremental EU production losses from moving to a 30% target with free allocation and access to the global carbon markets varies from 0.2% to 5%, 0.5% to 3% and 0.6% to 8% for the cement, steel and aluminium industries respectively.¹

This highlights the need for policies, which enhance low-carbon, and cushion high-carbon competitiveness in the EU:

- The ability of EU firms to benefit from the large and growing market in LCEGS will depend on an ability to constantly innovate, which may be enhanced by EU

¹ The lower range comes from the Commission's impact assessment, COM(2010) 265 final, whereas the upper range comes from Monjon, S., 2011, and assumes unilateral carbon pricing in the EU. It can therefore be considered an absolute upper bound.

efforts to support energy efficient and low carbon RD&D. While the EU has long been a leader in environmental RD&D, other countries are catching up rapidly. The EU still has the highest share of global environmental patents but growth in environmental patenting has been higher in Japan over the last 10 years, and some emerging countries, such as Korea and China, have higher specialization in environmental patenting.

- Energy efficiency and low-carbon RD&D are also crucial in helping carbon-intensive industries remain competitive in a carbon-constrained world; but this will not be achieved if industries migrate abroad, *or* if policies provide long-term subsidy / exemption from carbon prices. The current approach of free allocation is not a sustainable strategy for decarbonising carbon-intensive industry; it leads to windfall profits and a distorted carbon price signal. Besides in absolute terms, the production losses from a stronger ETS target for industries at risk of leakage may be significant, even under free allocation. The risks of carbon leakage will be reassessed by 2014, an opportunity for defining more sustainable strategies.² It should be based on the comparability of mitigation efforts by other major countries at that point in time, but also on the dynamics of international actions to reduce GHG emissions.

Energy security. Traditional criteria to measure energy security, such as the ratio of energy dependence or the diversity of energy suppliers, while still relevant, need to be supplemented by other types of criteria, such as reliability and affordability of the supply of energy services to consumers.

Climate policies have mixed effects on energy security. Indeed, reaching ambitious emissions reductions targets, such as the EU long term goal of at least 80% by 2050, necessitates a massive reduction of final energy consumption in absolute terms, the electrification of a significant proportion of final energy consumption, and a transition to a near-zero GHG emissions power sector.

EU energy import dependency has increased sharply over the last decade.³ Strengthening energy efficiency, including the use of low carbon infrastructures in the building and transport sectors, would reduce EU dependence on oil and gas imports. Moving to 30% emissions reduction would reduce the EU's imports of both gas and oil by approximately 1% relative to a 20% scenario. This would save €5.5bn in oil imports and €3.6bn in gas imports by 2020. It would enable the renewables target to be met and a transition to a near zero emissions power sector to be achieved.

² A precise analysis of the most appropriate options sector by sector is beyond the scope of this report. For a detailed analysis see for example: Carbon Trust, Tackling Leakage : Sector Specific Solutions for A World of Unequal Prices, 2010.

³ Reaching a rate almost never reached seen since the first oil shock (54.8% in 2008 compared to 46.1% in 1998 (percentage of net imports in gross inland consumption and bunkers).

Recommendations

There are three main areas in which the EU CEP needs strengthening.

Energy efficiency. Current EU legislation on energy efficiency is abundant and complex, but increasingly unbalanced: it mostly targets “technical energy efficiency” (energy consumed per unit of goods or service produced). This may not compensate for an increase in demand for these goods and services, resulting in a failure to meet “absolute energy savings” targets. Under the current scenario – which includes reduced energy demand induced by the economic crisis – Europe will probably improve its energy efficiency by only 10% by 2020, and will miss the non-binding target of 20% energy savings by 2020.

On average, energy consumed per unit of goods or services produced decreased by 21% between 1990 and 2007. Industry has decreased by 30% (2% improvement rate per annum), while the households and transport sectors only decreased by 15% (1% improvement rate per annum). But in the meantime, final energy consumption in the residential sector significantly increased (by 10%), and final energy consumption of the transport sector soared (by 30%).

National, and even sub-national circumstances matter a great deal for the implementation of efficient energy efficiency policies. Energy efficiency is therefore sometimes best addressed at the MS level. Nevertheless, EU legislation on energy efficiency can be justified and can bring added value compared to uncoordinated MS actions.

The EU should set binding targets at the MS level, expressed in final energy and in energy intensity to improve the energy efficiency of the existing building stock. It should complement these targets with a combination of obligations and incentives, and adopt new legislation incentivizing transport reduction and modal shift through coordinated European transport infrastructure policies.

EU ETS. The EU ETS directive sends a post-2020 carbon price signal by including a provision for the continuation of the 1.74% annual cap decrease after 2020. But this signal is inconsistent with the EU long-term goal of reducing emissions by at least 80% by 2050, and in particular, with the almost full decarbonisation of the power sector.

The weakness of the carbon price beyond 2020 is reinforced by expectations for a low carbon price up to 2020: official projections range between Euro₀₈ 16.5 and 25/ton. Indeed, as a result of the economic crisis, and of banked surplus allowances of around 500-800 Mt, the EU ETS is likely to be over-allocated until ca. 2020.

Therefore EU ETS stringency needs to be increased. But the precise level of, and the timeframe for, the cap decrease requires careful policy design. From an economic, environmental and political perspective, setting a stringent 2030 cap is the most relevant, efficient, and realistic option.

Economically, given the long-lived capital stocks of the power sector, 2030 is the appropriate time frame for shaping investment in low carbon technologies and infrastructures, beyond short-term abatement through e.g. fuel shifting.

Environmentally, tightening the 2020 cap without providing sufficient guarantee on the level of the 2030 cap, would risk locking-in some relatively carbon-intensive technology options such as gas.

Politically, any attempt to increase the stringency of the EU ETS is likely to face some resistance from business representatives, therefore scarce political capital should be spent wisely. Simply setting aside some allowances just before phase III starts could be interpreted as changing the rules of the game and enhancing the volatility of the carbon price. Whereas setting a 2030 cap would be seen as increasing the predictability of the carbon price signal, and therefore, the credibility of the regulator.

As a consequence, EU ETS strengthening could happen in four stages:

1) For the remainder of the year, the EU should focus on designing an energy efficiency plan that would, in particular, facilitate the fulfilment of higher short and mid term emissions reduction targets under the EU ETS. This plan also should address energy security issues of CEE MS and serve as a basis for negotiations for the next multi-annual EU financial framework.

2) At the beginning of 2012, the EU should set an indicative 2030 EU ETS cap. This target should be stringent. Our analysis suggests that a 45 – 50% emissions reduction by 2030 compared to 2005 for the relevant sectors is consistent with the EU long-term goal to reduce emissions by at least 80% by 2050. It should include a provision for allowances to be banked between phase III and phase IV (2021 – 2030). And the EU ETS should move to full auctioning by the beginning of phase IV.

3) Before the end of 2012, the EU should take a firm decision on whether to strengthen the 2020 EU ETS cap and 2020 GHG target in the light of:

- The indicative 2030 EU ETS cap as part of a time-consistent and efficient trajectory towards 2050
- The assessed mid-term impact of energy efficiency and renewable energy measures on ETS price signal stringency
- The scale of the problem of surplus allowances in Phase II and other sources of windfall profits in Phase III
- International progress and the strategic impact of strengthening the EU's official target

4) In 2014, the indicative 2030 EU ETS cap should become a binding target. Sectors at risk of carbon leakage should be reassessed and, from an economic perspective, if some are seriously at risk, the first best option would be to introduce a Border Tax Adjustment (BTA). If for domestic and/or for international (risks of trade retaliation...) political reasons this option proves impossible or undesirable, sectors at

serious risks would have to be taken out of the EU ETS and directly regulated; the 2030 EU ETS cap should not be watered down.

In other words, our assessment is that the question of “whether to strengthen the EU’s 2020 target” has been back-to-front. It is our hope that this reports helps to reverse the EU debate and that it suggests an economically efficient and politically feasible way forward.

1. Diagnosis: Why is there a need to strengthen the EU CEP now?

What is the rationale for strengthening the EU CEP in the absence of any guarantee that other major countries will do the same and move to the higher end of the range of their Copenhagen/Cancun pledges? What is the rationale for strengthening the EU CEP now, when the EU is still recovering from the worst economic crisis in a generation?

In section 1 of this report, we spell out the rationale for strengthening the EU CEP now. The main reason is to ensure the time consistency of the EU emissions reduction pathway. Indeed, the EU is committed to reducing its emissions by at least 80% by 2050. The transition towards this long-term goal needs to be cost-effective (see section 1.1).

Nevertheless, a strengthening the CEP focusing on the two elements outlined in section 1.1 – fostering low carbon technology and infrastructure investments, and low carbon products and services innovation would yield some important ancillary benefits: it would enhance EU competitiveness (see section 1.2) and increase its energy security (see section 1.3).

1.1 Ensure time consistency

1.1.1 Defining time consistency

1.1.1.1 Emissions reduction rate per annum

A comparison between the current emissions reduction rate per annum and the rate needed to reach the EU long-term objective of reducing emissions by at least 80% by 2050 sheds some initial light on the time consistency of the EU emission reduction pathway (Grubb and Ward, 2009). Starting from 20% emissions reduction by 2020, the EU would need to reduce its emissions by 4.5% per annum between 2020 and 2050 to reach an 80% target by 2050.

But the 2008 economic crisis makes it difficult to compare this figure with emissions reductions achieved in the recent past or forecasted up to 2020. Indeed, mainly as a result of this crisis, GHG emissions dropped by 7.1% between 2008 and 2009. They were 17.4% below 1990 levels in 2009 (EEA, 2011). As a result, if the EU keeps its 20% emissions reduction target by 2020, the emissions reduction rate per annum up to 2020 would be only 0.3%.

A comparison with pre-recession emissions reduction rates per annum is more relevant. In 2007, GHG emissions were 9.3% below 1990 levels, and they fell by 1.2% between 2006 and 2007 (EEA, 2009). The comparison with the EU ETS annual cap decrease – up to and beyond 2020 – is also insightful: the year-on-year decrease is 1.74%.

Simple arithmetic therefore suggests that the approximate order of magnitude of annual emissions reduction rate needs to triple – compared to pre-recession rates – to reach the EU long-term goal of reducing emissions by at least 80% by 2050. But this result needs to be treated with caution. This does not necessarily imply that the EU emissions reduction pathway is inconsistent.

1.1.1.2 Economic analysis

A rigorous assessment of the time consistency EU emissions reduction pathway requires careful economic analysis. There is no reason why constant emissions reduction rates per annum would ensure the time consistency of the pathway. Beyond the contentious issue of the appropriate level of the discount rate (see Stern vs. Nordhaus) two main issues explain why:

- the inertia of sectors with long living capital stocks and the risk of high carbon infrastructure lock-in
- the potential to scale up and speed up existing low carbon technology diffusion and the potential for breakthrough technology innovation.

A priori, these two factors have contradictory effects on the need for early action. The need to tackle inertia in sectors with long-lived capital stocks seems to argue in favour of early action. The potential for breakthrough technology innovation seems to call for postponed action. But, as some previous research shows (Aghion et al, 2009), traditional approaches to low carbon growth largely disregard the complexity of the innovation factor. Low carbon technologies are either treated as a given, or as emerging spontaneously. Yet, technologies available tomorrow depend on what is done today.

To assess and compare the time consistency of different EU emissions reduction pathways, we used the Imaclim-R framework (CIRED). Imaclim-R is a global hybrid general equilibrium model. It represents the world economy, disaggregated into 12 regions (including Europe), and into 12 sectors. The model is hybrid, which means it combines macroeconomic consistency with technology explicitness. Moreover, this framework encompasses second best features:

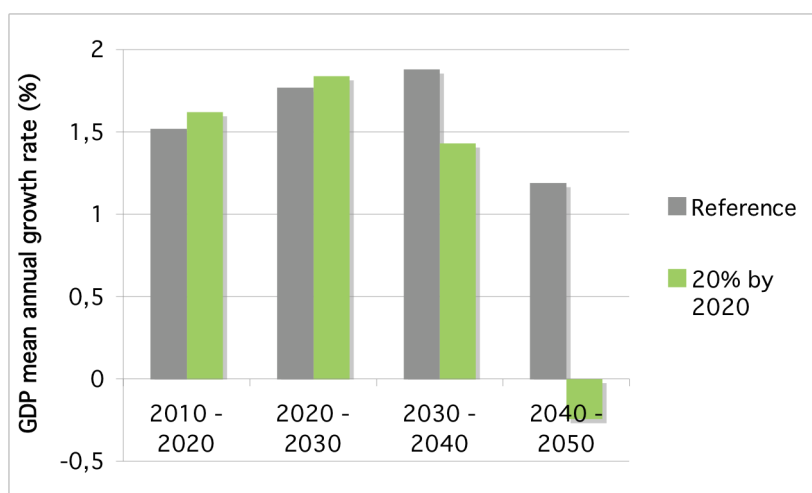
- The possible underutilization of production factors (labour and capital),
- The interplay between technological inertia and imperfect foresight,
- The rigidities of labour markets.

The main results of this modelling analysis are as follows:

1.1.2 Strengthening the EU CEP now is necessary

1.1.2.1 The current EU CEP is too weak to reach the EU long-term goal of reducing emissions by at least 80% by 2050 at acceptable costs

Figure 1. GDP mean annual growth rates (%) in the reference and 20% scenarios



Source: CIRED

Figure 1 compares the GDP mean annual growth rates of two scenarios: 1) the reference scenario 2) 20% emissions reductions by 2020 (the current EU target) and 80% emissions reductions by 2050. It shows that, while GDP mean annual growth rates in the second scenario are quite high during the first two decades up to 2030, and even slightly higher than in the reference scenario, they drop dramatically after 2030, and even fall below zero on average during the last decade up to 2050.

The reference scenario should be treated with caution. Indeed, it does not constrain GHG emissions, and neither does it take into account the economic costs resulting from climate change. It is, therefore, only a virtual counterfactual. The comparison between the two scenarios is relevant from a short-term perspective because it shows the short-term effects of climate policies. The higher GDP growth of the 20% emissions reductions by 2020 during the first two decades is mainly explained by a decrease in oil prices resulting from the implementation of climate policies.

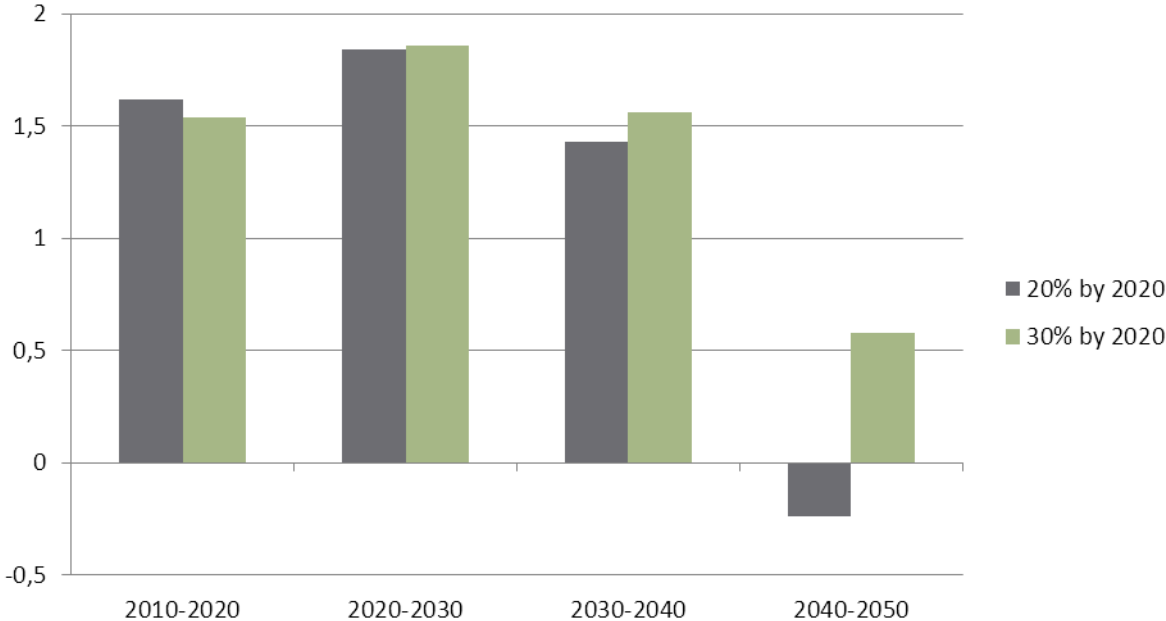
Section 1.3 will address in greater details the links between climate policies and energy security.

But this comparison is irrelevant from a long-term perspective. It cannot be used to choose one scenario over the other. The 20% emissions reductions by 2020 scenario is not consistent, not because it leads to lower GDP mean annual growth compared to the reference scenario in the last two decades, but simply because it leads to negative mean GDP annual growth rates in the last decade. Indeed, no country,

including the EU, can suffer negative mean annual growth rates for an entire decade to reach a climate objective.

1.1.2.2 Strengthening the EU CEP now would lower the overall costs of reaching this long term goal

Figure 2. GDP mean annual growth rate (%) of the 20% and 30% scenarios



Source: CIRED

As an example we have compared the GDP mean annual growth rates of two different 2020 targets: 1) 20% (current EU target) 2) 30% (25% domestic emissions reductions, as suggested by the EC in its 2050 roadmap). The 2050 emission reduction target is the same for both scenarios: 80%.

Figure 2 shows that, while the GDP mean annual growth rates of the two scenarios are broadly the same during the three first decades up to 2040, they are widely different during the last decade up to 2050. The GDP mean annual growth rates of the 30% emissions reduction scenario are slightly below the rates of the 20% scenario for the first decade, and slightly above for the two following decades. But these minor differences are insignificant from a modelling perspective.

But the growth differential of the last decade is very significant (approx 0.8%). While the GDP mean annual growth rate of the 20% emission reductions by 2020 scenario is negative (approx -0.2%), the rate of the 30% scenario is positive (approx 0.6%). This suggests that moving to a higher emissions target by 2020 (in this case and as an example, 30%) would improve the consistency of the EU emissions reduction pathway.

Again, this result should be treated with caution. Our comparison between these two scenarios does not necessarily imply that a 30% emissions reduction target by 2020 is the optimum milestone. Others (EC, 2050 roadmap) have tried to identify the cost efficient EU emissions reduction pathway up to 2050 and to quantify the milestones in 2020, 2030 and 2040. Our modelling approach does not allow us to reinforce or to invalidate these results. But it brings some key additional elements to the discussion.

The value of our modelling approach lies in the comparison of different scenarios. We have used the Imaclim-R framework to assess their consistency, but most importantly, we have complemented this approach with other quantitative and qualitative analyses to understand the differences between the scenarios.

1.1.2.3 Our comparative analysis reveals the two main reasons why strengthening the CEP now is needed to lower the overall costs of reaching this long-term goal

Emissions reduction targets are key parameters for assessing the time consistency of the EU emissions reduction pathway, but they need to be supplemented with other types of indicators. Indeed, a given emissions reduction target can be reached in many different ways. And not all short-term mitigation actions have the same effects on the time consistency of the EU emissions reduction pathway. The investment shift from high to low carbon infrastructure in the power sector, for example, does not have the same impact as fuel switching. Besides, the improvement of the time consistency of the EU emissions reduction pathway does not only depend on the implementation of mitigation actions leading to short-term emissions reductions; it also crucially depends on the activation of the low carbon innovation machine.

There are two main categories of actions that need to be undertaken now to improve the time consistency of the EU emissions reduction pathway:

1.1.2.3.1 Tackling inertia to foster low carbon infrastructure investment

There are two main reasons why early action in sectors with long living capital stocks is needed to shape low carbon investments in infrastructures:

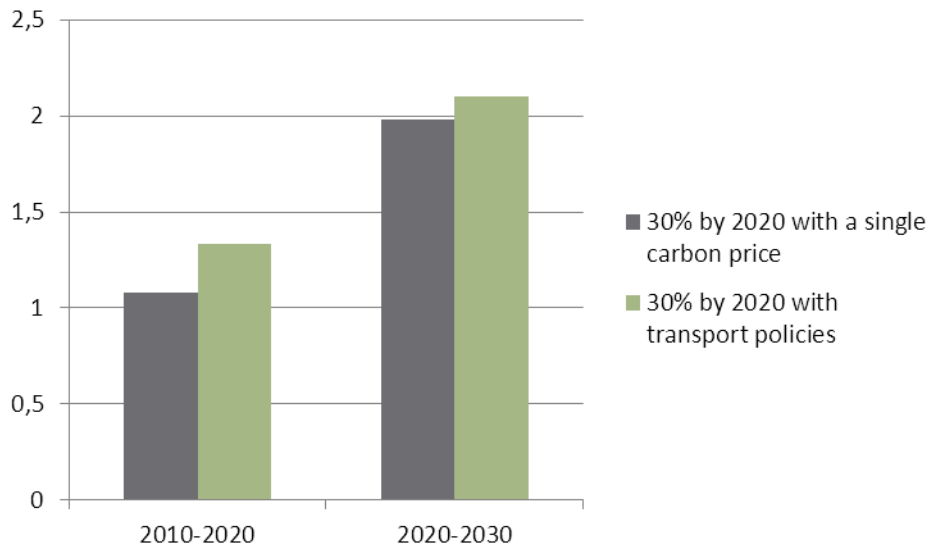
- The length of investment cycles (for example in the power sector) and the slowness of renovation rates (for example in the building sector)
- The fact that infrastructure represents the basis upon which low carbon technologies will eventually be deployed (for example in the transport sector).

Therefore delayed action risks locking in high carbon production and consumption modes. The failure to shape investment in low carbon infrastructures now would lead to the need to scrap carbon intensive capital before the end of its economic lifetime.

Not all sectors of the economy react in the same way to a carbon price. The building and transport sectors in particular, due to numerous market failures and non-market

barriers, are quite inert sectors, as opposed to the electricity sector, which is more reactive to carbon prices.

Figure 3 . GDP Mean annual growth rates (%) of the 30% single carbon price and carbon price + transport policies scenarios



Source: CIRED

As an example, we have compared the GDP mean annual growth rates of two different ways to reach the same (30%, 25% domestic emissions reductions) target by 2020: relying on a single carbon price ("single carbon price") and complementing the carbon price by policies aimed at fostering low carbon infrastructure investment in the transport sector ("carbon price + transport policies"). The 2050 emissions reduction target is the same for both scenarios: 80%.

Figure 3 shows that, with the same 2050 and 2020 emissions reduction targets, the GDP mean annual growth rates during the two decades up to 2030 of the "carbon price + transport policies" scenario are slightly higher than in the "single carbon price" scenario.

Again, this result should be treated with caution:

- Absolute GDP growth rates should not be compared with those of section 1.1.2.2. Indeed, the hypotheses of these two numerical experiments are slightly different
- This certainly does not suggest that a strengthening of the EU CEP should focus on the transport sector only. Indeed, the choice of the transport sector is only based on the limitations of Imaclim-R, and our inability to do the same for the building sector and others. We use the transport sector as an example of inert sectors with long-lived capital stocks.

The benefits of these differentiated implicit carbon prices and targeted policies in sectors with long living capital stocks are twofold:

- They are more effective to shape low carbon investments in the building and transport sectors
- They do not unnecessarily constrain the rest of the economy, and in particular industries covered by the EU ETS and at risk of competitiveness losses and carbon leakage.

Section 2.1 will examine closely how EU energy efficiency policies could be strengthened to target effectively the building and transport sectors.

Sections 2.2 on the EU ETS and 2.3 on public finance will examine closely how the EU ETS could send a stronger signal in the mid term, and how public finance could support low carbon RD&D, to turn on the low carbon innovation machine.

The key reason why the CEP needs to be strengthened now is because it does not enable the EU to reach its long-term goal of emissions reductions by at least 80% by 2050 at acceptable costs. Nevertheless, a strengthening of the CEP by focusing on the two elements that we have outlined – fostering low carbon technology and infrastructure investments, and low carbon products and services innovation – would yield some important ancillary benefits: it would enhance EU competitiveness, and increase its energy security.

1.2 Enhance competitiveness

1.2.1 Defining competitiveness

Before discussing the links between climate policies and competitiveness, “competitiveness” needs to be precisely defined.

Competitiveness is a broad and vague concept: the OECD (1996, p.24) defines it as “... the ability of companies, (...) regions, nations, and supranational regions to generate, while being and remaining exposed to international competition, relatively high factor income and factor employment levels on a sustainable basis”.

But differentiating between competitiveness for a firm and for a country brings some clarity, and relevance, to the concept:

- For a firm, competitiveness can be defined (Business dictionary) as “the ability to offer products and services that meet the quality standards of the local and world markets at prices that are competitive and provide adequate returns on the resources employed or consumed in producing them”
- For a country, competitiveness can be defined as (EU Commission (2003, p. 21)) “... the ability of an economy to provide its population with high and rising standards of living and a high level of employment (...), on a sustainable basis”.

Some (Krugman, 1994) argue that competitiveness is, at best redundant, at worst misleading, when applied to a country: redundant, because competitiveness at the national level would be based on superior productivity performance; misleading, because, by considering that countries are like companies, competitiveness applied to a country would treat trade as a zero sum game, which it is not.

Without entering into this sophisticated, and so far unresolved, debate between economists, we will examine the link between climate policies and competitiveness at the firm and country levels. In the latter case, we will consider it to be synonymous with productivity.

There are two main categories of sectors to look at when studying the links between competitiveness and climate policies at the firm level:

- Firms within sectors with high (process GHG emissions) or indirect (GHG emissions from electricity consumption) carbon intensities, which could face competitiveness losses and carbon leakage, in the face of significant carbon prices within the EU, and unequal global carbon prices.
- Firms within sectors producing energy efficient and low carbon technologies, which directly benefit from policies promoting energy efficiency and reducing GHG emissions.

The sectoral level analysis of these two asymmetric situations is important from a policy perspective. Indeed, the minimization of short-term competitiveness losses for the former, and the maximisation of competitiveness gains for the latter, is largely policy dependent. But a narrow focus on the link between climate policies and competitiveness at the firm level misses the complexity of the structural changes associated with a transition towards a low carbon economy. We therefore complement this sectoral analysis with an examination of the temporal and geographical dimensions of the links between climate policies and competitiveness at the country level.

1.2.2 Strengthening the EU CEP by focusing on fostering low carbon technology investment and low carbon products and services innovation

1.2.2.1 The need to address the situation of sectors at risks of competitiveness losses and carbon leakage

Previous research (Climate Strategies, Cambridge Econometrics and Entec UK (2010)) shows that, while the scope for potential competitiveness losses and carbon leakage is narrow, and their scale is small on average, some sectors might be significantly negatively impacted.

Table 1. EU production impacts (%) of 4 selected climate policy scenarios:

Sector (Manufacturing of...)	EU 20% ROW Low Cph Full auctioning	EU 20% ROW Low Cph 80% free allowances	EU 30% ROW Low Cph Full auctioning	EU 30% ROW Low Cph 80% free allowances
Paper and paperboard	-0.6	-0.4	-0.8	-0.5
Other inorganic basic chemicals	-0.9	-0.6	-1.2	-0.8
Plastic in primary forms	0.1	0.1	0.1	0.1
Glue and gelatines	0.0	0.0	0.0	0.0
Flat glass	-1.2	-0.6	-1.6	-0.8
Glass fibres	-0.1	-0.1	-0.2	-0.2
Ceramic tiles and flags	-14.9	-5.1	-20.0	-6.8
Brick tiles and construction products	-0.1	0.0	-0.1	-0.1
Lime	-12.1	-4.1	-16.1	-5.5
Plaster products for construction	-0.7	-0.4	-1.0	-0.5
Basic iron and steel and ferro alloys	-11.5	-6.4	-15.4	-8.5
Casting of steel	0.0	0.0	0.0	0.0
Agricultural tractors	-0.2	-0.1	-0.3	-0.1
Motors of vehicles	0.0	0.0	0.0	0.0
(Simple) average	3%	1.2%	4%	1.7%

Source: Cambridge Econometrics, Climate Strategies and Entec (2010)

We have selected 4 different scenarios from this previous report to illustrate the sensitivity of production losses to: 1) the allocation mode for carbon allowances 2) the 2020 emissions reduction target. The comparison between these scenarios shows that:

On average, production losses resulting from unequal carbon prices are small: in the EU 20%, Rest Of the World (ROW) low carbon pledges, and full auctioning scenario, they are approximately 3%.

But a small number of industries are significantly negatively impacted: in the EU 20%, ROW low carbon pledges, and full auctioning scenario, production losses are 14.9% for ceramic tiles and flags, 12.1% for lime and 11.5% for basic iron and steel and ferro-alloys manufacturing.

Distributing (80% of) allowances for free⁴ lowers, but does not completely remove, production losses resulting from unequal global carbon prices: in the EU 20%, ROW low carbon pledges, and full auctioning scenario, it reduces production losses from 3% to 1.2% on average, and from 14.9% to 5.1%, 12.1% to 4.1%, 11.5% to 6.4% from ceramic tiles and flags, lime, and basic iron and steel and ferro-alloys manufacturing respectively.

Moving to 30% by 2020 only slightly increases production losses: they only increase by 0.5% on average between the EU 20 and 30%, ROW low carbon pledges, 80% free allocation scenarios. For ceramic tiles and flags, lime, and basic iron and steel and ferro-alloys manufacturing, they increase by 1,7%, 1,4% and 2,1% respectively.

But they remain significant in absolute terms: 6.8%, 5.5% and 8.5% for ceramic tiles and flags, lime and basic iron and steel and ferro-alloys manufacturing respectively. It therefore suggests that the current EU approach towards competitiveness and leakage, i.e. distributing allowances for free for sectors at risk, is an efficient but not complete solution to production losses resulting from unequal global carbon prices.

Again, these results should be treated with caution:

- This analysis ignores any surplus allowances held by firms in these sectors from Phase II of the EU ETS. If these surplus allowances were used to compensate businesses for not passing through their higher production costs, the degree of leakage would be lower.
- Previous research (CE Delft, 2010) examined evidence of cost pass-through of firms in the steel, refineries and chemicals sectors. It found evidence that the cost of freely allocated allowances were passed through into consumers' prices by 50% to 100%. If firms were really able to pass through costs to the consumer, the magnitude of competitiveness losses would also be lower.

However, as we have underlined, free allowances is not a complete and sustainable solution to competitiveness and leakage. In theory, firms will face the carbon price in their production decisions regardless of whether they purchase EU allowances or receive them for free. Free allowances may compensate firms who are in highly competitive global markets, and who wish to maintain production levels during a transition period, after which other countries' sectors should face similar carbon prices.

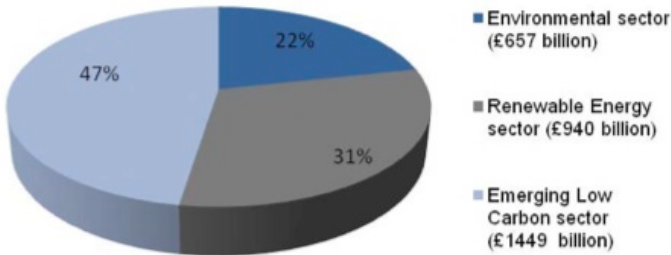
⁴ Currently industries covered by the EU ETS receive the vast majority of their allowances for free. A progressive move to full auctioning by 2027 is planned.

Section 2.2.3.2, will closely examine options to address competitiveness losses and carbon leakage if this transition period is too long, and if the carbon prices differential is too big.

1.2.2.2 Enhancing the competitiveness of sectors producing low carbon technologies:

Meanwhile, a wide range of firms and sectors would directly or indirectly benefit from the implementation of more stringent climate policies. These are sectors producing energy efficient and low carbon goods and services, and their suppliers.

Figure 4. Global market value (in British pound) of the LCGES sector (2007/2008)



Source: Innovas (2010)

According to some previous studies (Innovas, 2010), the global market for Low Carbon and Environmental Goods and Services (LCEGS) is already large, close to 3,5 trillion euros a year, and growing faster than most other sectors (projected to grow at 4% a year for next 5 years).

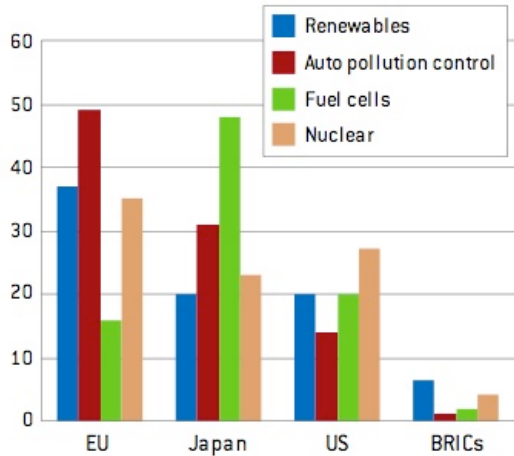
Of the 23 products and services included in this global analysis, the largest by market value are alternative fuels, 18.5% (part of the Emerging Low Carbon sector), building technologies, 12.8% (Emerging Low Carbon sector), wind power, 11.5% (Renewable Energy sector) and alternative fuels for vehicles, 11.2% (Emerging Low Carbon sector).

The EU represents a significant share of the LCGES market: 27%. Increasing the EU target for GHG emissions would increase the size of this market, but 38% of this market is already located in Asia, and 30% in the Americas. This suggests that the competitiveness of EU firms in this market is closely linked to their export performance.

Besides, the competitiveness of EU firms in the LCGES will market will depend, ultimately, on their ability to constantly innovate. This, in turn, depends on EU efforts to support energy efficient and low carbon RD&D. Initial evidence suggests that,

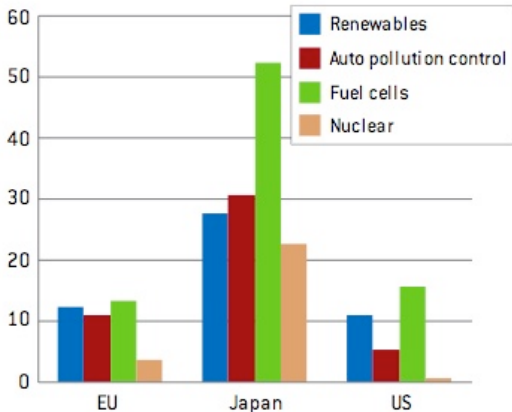
while the EU has long been a leader on environmental RD&D, other countries catch up rapidly.

Figure 5. Share (%) of environmental patents by subfield and by country



Source: OECD compendium of patents statistics, 2008

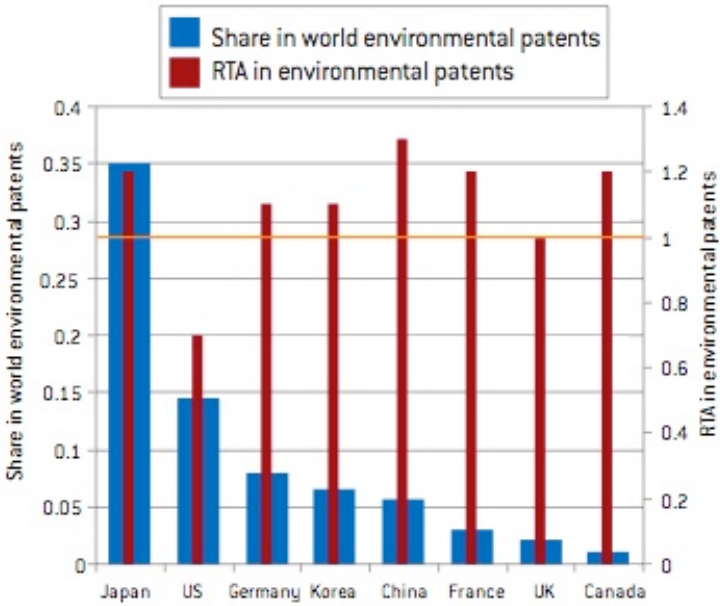
Figure 6. Average annual growth rates (%) of environmental patents by subfield and by country 1995 - 2005



Source: OECD compendium of patents statistics, 2008

Figure 5 and 6 show that, while the EU still holds the biggest share of world environmental patents, slightly ahead of Japan, and significantly ahead of the US, the average annual growth rates during the past 10 years was much higher (approximately 30%) in Japan than in the EU (approximately 10%).

Figure 7. Countries share (%) of and specialisation in environmental patents



Source: WIPO 2009

Note: The RTA is the country share of world environmental patents relative to the country share in total world patents. A RTA above 1 suggests a country specialization in environmental patents.

Figure 5, 6, 7 show that, while the BRICs (Brazil, Russia, India, China) share in world environmental patents is still low, some of them, especially Korea and China, heavily specialize in environmental innovation. In fact, China is the country with the highest specialization in environmental innovation, slightly ahead of Japan and France (with a very high specialization in nuclear), and significantly ahead of Germany and the UK.

1.2.2.3 Increasing the long term competitiveness for the EU economy as a whole

To conclude, bringing together observations of sections 1.2.2.1 and 1.2.2.2, enhancing Europe’s competitiveness through the implementation of climate policies is a balancing act:

Between the short term and the long term:

High carbon growth will kill itself. There are no other prospects for sustainable growth than low carbon growth. Europe will remain competitive only if it is able to adopt low carbon production and consumption modes. The implementation of climate policies therefore ensures Europe’s long-term competitiveness. But in the short term, the situation of sectors at risk of competitiveness losses through carbon leakage must be addressed, to limit transition costs for these sectors. A failure to

address the situation of these sectors would jeopardize the ability of the EU to move towards a low carbon and competitive future.

Between market pull and technology push policy instruments:

Increasing Europe's low carbon competitiveness necessitates the implementation of a wide portfolio of policy instruments:

- Market pull instruments (such as GHG or renewable energy targets, energy efficiency plans...)
- Technology push instruments, through direct public support (public RD&D, tax incentives, other government funds...)
- Support for the improvement of human and physical infrastructure.

Remark: The potential for low carbon innovation and competitiveness gains in some carbon intensive industries through smart regulation in the building sector.

Addressing the situation of sectors at risks of competitiveness losses and carbon leakage in a world of unequal prices does not always necessitate levelling the carbon price down (free allowances) or up (border carbon tax):

In the cement sector for example, there are three "traditional" options to reduce emissions per unit of output:

- higher energy efficiency of heating
- shift towards the use of low or zero carbon fuels for heating (biomass...)
- different blending practices. The cement industry combines these three options to reduce its emissions.

Interestingly, the average performance of the EU cement industry is approximately the same for plants within and outside the EU. But the relative weight of these three options is not the same in different regions of the world. Emissions reductions in Eastern Europe are mainly achieved through the shift towards the use of biomass for heating, and in China through higher energy efficiency of heating. Blending practices are very different from one country to the other due to the availability – or lack – of by-products from the steel industry and coal power plants, and due to the history of domestic regulations.

This signals the fact that the level of emissions per unit of output of the cement industry could be further reduced quite significantly, if all three options were better combined. Nevertheless, the cement industry partially depends upon regulation in other sectors to achieve its own emissions reductions (through fuel shift, or different blending practices). This has important implications in terms of policy design. Besides, even if these three options were successfully combined, the cement industry would remain a carbon intensive industry, at a level inconsistent with the need to reduce emissions by half globally by 2050.

Carbon Capture and Storage (CCS) could be a “breakthrough” technology to reduce emissions per unit of output. Nevertheless, the deployment of CCS for cement faces hurdles:

- The technical feasibility and economic profitability of carbon capture is not yet proven, and there are several environmental and social risks associated with carbon storage.
- Beyond that, since CCS for cement – by definition – represents an incremental cost for cement producers – contrary to the other three options that can be cost efficient – it is not possible to envisage CCS being deployed within the EU without it being deployed simultaneously in other regions of the world, or without some kind of border levelling mechanism.

Another kind of “breakthrough” change is often bypassed. Non-ETS sectors could also be a key driving force for emissions reduction and low carbon innovation in ETS sectors. The building sector in particular, is a focal point for low carbon innovation in many industries. A revision of building codes could, without reducing safety, incentivize the production of new types of cement, resulting in less emissions – smaller quantity – and more value added for the cement industry – higher sophistication.

1.3 Increase energy security

1.3.1 Defining energy security

Energy security must lie at the core of energy policies. Researchers have developed many quantitative indicators to measure energy security, broadly categorized (Markandya, 2005) as:

- Dependence or vulnerability indicators
- Physical or economic indicators

But energy security is a concept with many definitions that have evolved over time. Traditional criteria to measure energy security, such as the ratio of energy dependence or the diversity of energy suppliers, while they are still relevant, need to be supplemented by other types of criteria, e.g. reliability and affordability of the supply of energy services to consumers (Marignac, 2003). Since complete energy security is impossible, the notion of risk is central to the analysis of energy security issues (Grubb, 2005).

Climate policies add a new dimension to energy security, which interacts with all previous indicators. Indeed, the transformation of the energy system, both from the supply and demand sides, is at the core of GHG emissions reduction strategies. Reaching ambitious reduction targets, such as the EU long-term goal to reduce emissions by at least 80% by 2050, necessitates:

- the massive reduction of final energy consumption in absolute terms,
- the electrification of a significant proportion of final energy consumption and
- the transition to a near-zero GHG emissions power sector.

These three transformations have differentiated impacts on energy security:

- The reduction of final energy consumption interacts positively with all dimensions of energy security (e.g. reduction of energy imports and of energy poverty).
- But the transition to a near-zero GHG emissions power sector, especially when combined with the electrification of a significant proportion of final energy consumption, creates both opportunities (e.g. higher diversification of the energy mix) and challenges (e.g. security of the electricity supply system) in terms of energy security.

These challenges need to be met: in the long-term, a carbon intensive and secure energy system is a contradiction in terms, not only because of climate change but also because of diminishing fossil fuels reserves. And they can be met, in particular through investment in the grid, but only through careful policy design and implementation.

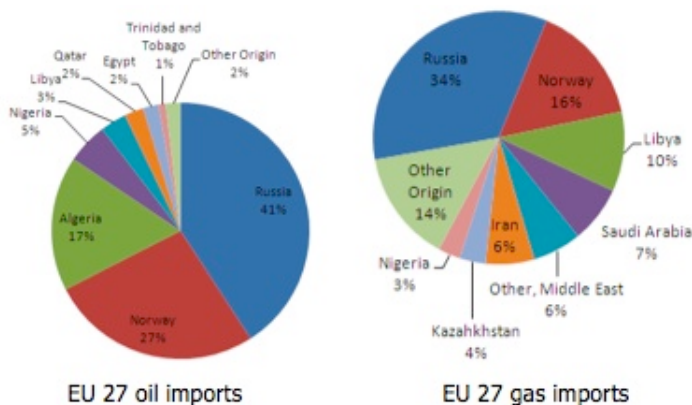
1.3.2 A strengthening of the CEP by focusing on low carbon infrastructure investment and low carbon products and services innovation would increase EU energy security by

1.3.2.1 Reducing EU energy dependency on oil and gas

1.3.2.1.1 Overall

As we have underlined, energy dependency is not the only indicator to measure energy security, and it should not be overemphasized. Trade in energy, in and of itself, is not necessarily an issue but energy dependency might become one when imports come from regions with high levels of geopolitical risks. The EU imports approximately 80% of its oil, and 60% of its gas, a big proportion of which comes from risky countries. Energy dependence is, therefore, a serious issue for the EU.

Figure 8. EU 27 oil and gas imports by source



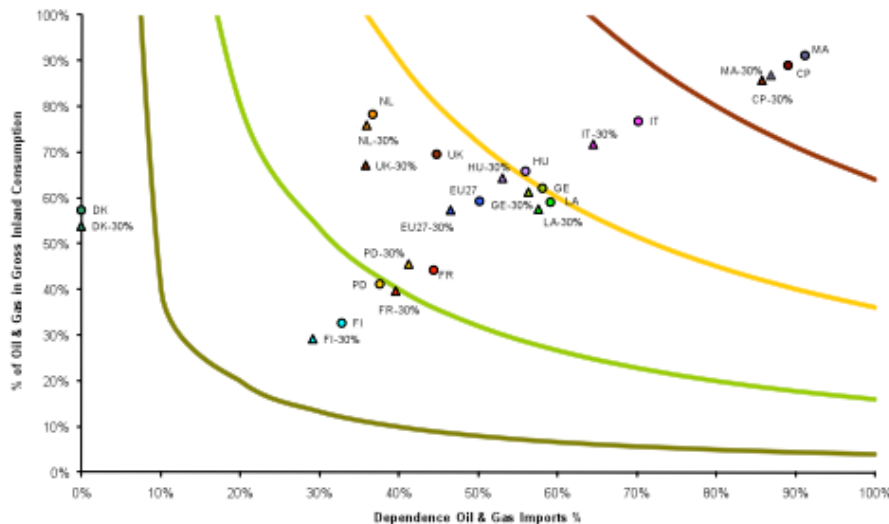
Source: European Commission, 2010.

A combination of policies aimed at reducing final energy consumption and reducing emissions from the power sector would reduce the EU oil and gas dependency.

Figure 9 brings together the level of imports of oil and gas in selected EU MS (x-axis) with the role that oil and gas play in domestic consumption (y-axis). When combined, these two dimensions give a rough approximation of the level of energy security risk associated with energy dependence on oil and gas imports for individual MS, as well as for the EU as a whole. Movements from the right to left along the x-axis, and from the top to the bottom along the y-axis therefore represent a decrease in energy dependence for oil and gas.

For illustrative purposes, in our modelling, we have chosen to compare two different scenarios: 1) BAU 2) 30% emissions reductions by 2020.

Figure 9. Energy security for selected EU MS in the BAU and 30% scenarios



Source: ECOFYS, 2011

Figure 9 shows that, for the vast majority of EU MS, as well as for the EU on average, moving to a 30% emissions reductions by 2020 reduces energy dependence on oil and gas. Nevertheless, some individual MS stand out, such as Poland. Indeed, in our model, Poland reaches a higher emissions reductions target by 2020 mainly through a decrease in coal and an increase in gas-fired electricity production.

This does not mean that reaching higher emissions reductions targets necessarily reduces the Poland's energy security, for several reasons:

- As we have underlined repeatedly, energy dependency is not the only indicator to measure energy security, and it should not be overemphasized.
- Our figure gives only a rough approximation of the level of energy security risks associated with energy dependence on oil and gas imports. In particular for Poland, while the *share* of gas imports increases when moving from BAU to 30%, the absolute level of import *decreases*.

However, this shows that the links between climate policies and energy security require a country-by-country analysis. It also proves that, for emission reduction targets to serve energy security purposes, they need to be complemented with specific policies, tailored to the national circumstances of these MS. Investing in gas regional transmission networks, coal CCS and renewable energies would reduce Poland's energy dependence.

1.3.2.1.2 For the transport sector

While the analysis of energy dependence at the economy-wide level is important, the examination of specific sectors is also relevant. A very high level of dependence on oil imports characterizes the transport sector in particular, which is, therefore, very sensitive to oil prices fluctuations.

Again, for illustrative purposes, in our model we have chosen to compare two different scenarios 1) BAU 2) 30% emissions reductions by 2020. The median price of oil up to 2020 is 108 dollars per barrel (US EIA). Moving to 30% emissions reductions by 2020 would reduce oil consumption in the transport sector by 59.5 Mtoe compared to BAU, and induce gross savings of approximately 35 billion Euros per year up to 2020. This does not represent avoided costs for drivers. Indeed, this figure excludes taxes. Net savings for drivers would therefore be higher.

1.3.2.2 Increasing the security of electricity supply

Policies aimed at reducing final energy consumption, in particular those fostering low carbon infrastructure investments in the building and transport sectors, are key to increasing the security of electricity supply.

1.3.2.2.1 Limiting the quantity of final energy demand to be electrified in the mid-term

As we have stressed, in order to reach ambitious EU emissions reduction targets, the power sector faces twin challenges (Hiroux, 2011):

- The electrification of a significant proportion of final energy demand
- The transition towards a near-zero GHG emissions power sector. Therefore an upfront reduction of final energy consumption is needed to limit the quantity of final energy demand to be electrified, and facilitate the transition towards a near-zero GHG emissions power sector

As a result, policies aimed at reducing final energy consumption must be divided between:

- Those mandating or incentivizing the energy efficiency of products (motors in the transport sector, appliances in the building sector, etc)
- Those fostering the investment in low carbon infrastructures (avoided transport and modal shift in the transport sector, deep retrofit in the building sector, etc). While both types of energy efficiency abatement potentials need to be fully captured to achieve ambitious emissions reductions targets, a short term-focus on the latter is key.

Indeed, the renewal rates for products are rather high (the lifetime of a car or a refrigerator is approximately 10 to 15 years). But they are much lower for infrastructures. The renovation rate of infrastructures in the building sector usually

does not exceed 1 or 2% per year, resulting in a slow improvement in building stock energy efficiency. The construction of infrastructures in the transport sector generates new demand making it difficult to shift to low carbon transportation modes (Guivarch, 2011).

Therefore, to avoid high carbon infrastructure lock-in, which would increase the costs of reaching the EU long term goal of reducing emissions by at least 80% by 2050, policies aimed at reducing final energy demand need to prioritize investment in low carbon infrastructures.

1.3.2.2.2 Shifting gas from energy consumption to electricity production in the short-term

These policies would also have additional benefits for the security of supply. The deep retrofit of existing building in particular would enable a gas shift, from energy consumption (gas-heating in buildings) to electricity production (gas-fired power plant). Such a shift would contribute positively to EU energy security and the achievement of the long-term goal of reducing emissions by at least 80% by 2050 (Hiroux, 2011).

2 Policy recommendations: Building a low carbon, competitive and energy secure EU

In section 1, we saw that strengthening the EU CEP now is necessary to ensure the time consistency of the EU emissions reduction pathway and, in addition, that it would have important ancillary benefits such as increasing EU competitiveness and energy security. We showed that increasing the EU short-term emissions reduction targets was an important element of this strengthening.

But we have also underlined that, to contribute to these three goals (time consistency, competitiveness, energy security) there must be a focus on shaping investment in low carbon infrastructures, and on fostering low carbon products and services innovation. An increase of the EU 2020 emissions reduction target is therefore not sufficient. The strengthening of the EU CEP needs to focus on the right elements, and to be backed by serious structural and sectoral policies.

Section 2 of this report is dedicated to concrete policy recommendations resulting from our analysis in section 1. For the sake of clarity, policy recommendations are divided between three categories:

- The complex web of EU policies promoting energy efficiency
- The EU ETS
- EU direct public financial support.

To the extent possible, we analyse how the suggested policy changes would interact with each other.

2.1 Strengthening current instruments and implementing new tools to reach the 20% energy efficiency target

As we have underlined in section 1, improving EU energy efficiency now is key to ensuring time consistency of its emissions reduction pathway, to enhancing competitiveness, and to increasing energy security. In particular, we have stressed the importance of directing investment into low carbon infrastructures in the building and transport sectors. which are characterized by inertia and long lived capital stocks.

This section

- describes the current EU legislation on energy efficiency
- assesses EU performance against its 20% energy efficiency target by 2020
- makes some precise policy recommendations, in particular to improve the energy efficiency of the existing building stocks and to limit the level of final energy consumption in the transport sectors.

2.1.1 Preliminary remarks:

2.1.1.1 Technical energy efficiency vs. absolute energy savings

Energy efficiency is a confusing term. For a sector or a firm, increasing energy efficiency means a decrease in energy consumed per unit of goods or service produced ("technical energy efficiency"). For a country or a region (in the case the EU) energy efficiency measures reduce the amount of energy consumed per unit of output produced.

In spite of uncertainties surrounding the baseline used for its calculation, the meaning of the EU 20% energy efficiency target is a 20% reduction in BAU of energy consumed. It is therefore an "absolute energy savings" target. An increase in the "technical energy efficiency" (energy consumed per unit of goods or service produced) is not always sufficient to compensate for increased demand in reaching an "absolute energy savings" targets.

In the rest of the section, we use energy efficiency as a generic term, covering both aspects, and distinguish between "technical energy efficiency" and "absolute energy savings" when appropriate.

2.1.1.2 MS actions vs. EU legislation

Historically, energy efficiency is pre-eminently is matter of national competency for MS. The share of EU-level energy efficiency policies within the total of MS policies

during the last two decades is between 10% and 30%, depending on the sector, and 20% on average (MURE database). National, and even sub-national circumstances matter a great deal for the implementation of efficient policies. Thus energy efficiency is sometimes best addressed at the MS level.

Nevertheless, EU legislation on energy efficiency can be justified: they contribute to energy security, which is a regional and not only a MS issue. Besides there are also areas where EU legislation can bring added value compared to uncoordinated MS actions. This is the case in particular for the transport sector, where MS have little ability to individually influence the efficiency of cars (car manufacturing is – at least – an EU market) or the cross-border transport infrastructure network.

In this section, we concentrate on policies promoting absolute energy savings beyond technical energy efficiency by shaping investment in low carbon infrastructure in the building and transport sectors, and on areas where EU legislation has the highest leverage on MS actions.

2.1.2 Current EU legislation on energy efficiency

2.1.2.1 European legislation on energy efficiency is already abundant

The European legislation on energy efficiency is already abundant (ECOFYS Fraunhofer, 2010):

- The energy efficiency plan provides an overarching framework for improving European energy efficiency;
- Several directives also aim at improving European energy efficiency, such as the energy services, energy performance of buildings, combined heat and power, eco-design and labelling directives;
- The EU ETS also incentivizes energy efficiency for installations covered by the scheme;
- Several regulations impose technology, emissions or efficiency standards for products

2.1.2.2 It covers the whole range of possible instruments

Final energy consumption is characterized by numerous market failures, even if these market failures are less pronounced than for energy and carbon intensive industries. Therefore, explicit price signals, either through an ETS or through a carbon tax, play an important role in improving energy efficiency, but they need to be complemented by other types of instruments such as:

- Finance (loans, guarantees...)
- Information (labelling...)
- Regulation (norms, standards...)
- Innovation (RD&D, procurement...)

Public planning, at the sub-national, national and trans-national levels, also plays an important role for the development of infrastructures for energy supply (electricity grid, gas pipelines, heat networks...) or service supply (transportation).

Previous reports (Overall Energy Efficiency Trends and Policies in the EU 27, MURE, 2009) show that the combination of instruments used to improve energy efficiency varies between energy consuming sectors.

- Policies and measures in energy and carbon intensive industries are mainly financial
- Financial policies and measures are heavily supplemented by information and regulation in the household sector.
- The whole spectrum of instruments is used in the transport sector.

2.1.2.3 It covers the whole spectrum of possible competencies sharing

Table 2. competencies sharing between the EU and MS

Target		Planning, Implementation and Monitoring		
		Direct transcription into MS law	Full harmonization at the EU level	Process prescribed or recommended by the EU to MS
Set by the EU	Binding	CO2 emissions from cars	EU ETS	Renewable energy Directive
	Non Binding			Energy services Directive
Set by MS	Binding			
	Non Binding			Energy performance of building directive

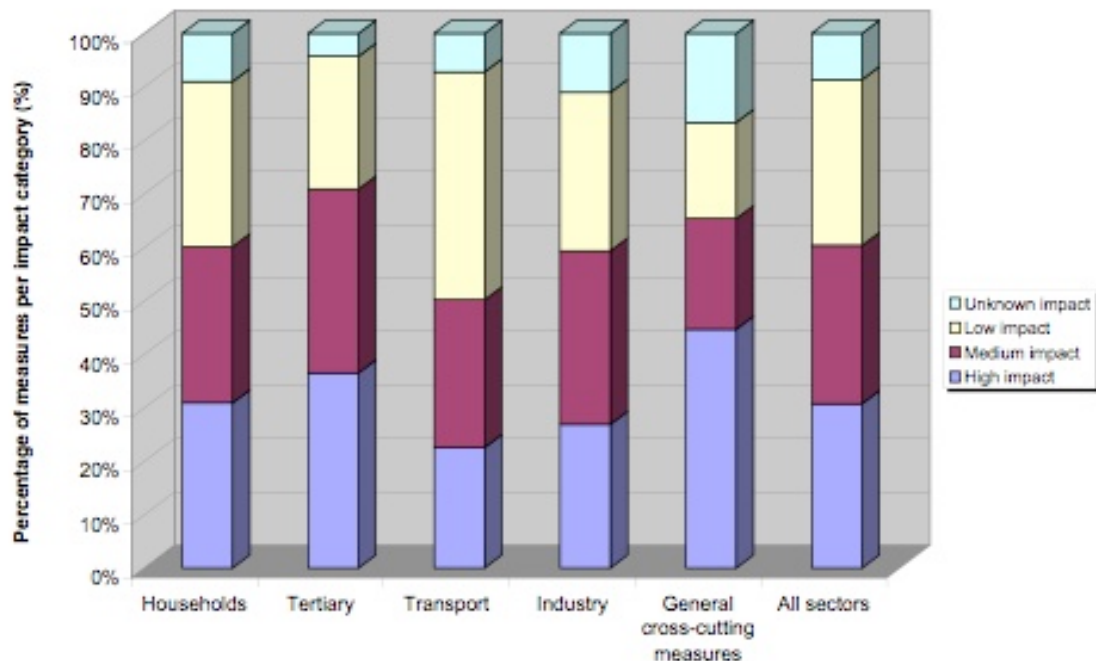
Table 2. shows that the whole spectrum of competencies sharing between the EU and MS is used. From left to right and top to bottom of the table, there is an increasing flexibility for MS in setting targets and implementing the associated policies and measures. But this does not necessarily mean that stringency of the legislation is decreasing.

2.1.3 How does the EU perform against its 20% energy efficiency target by 2020?

During the last two decades, the number of European policies and measures to improve energy efficiency has steadily increased in all sectors, from 20 to almost 150 measures per year (MURE database). But current policy framework is increasingly imbalanced: it is leaning towards technical energy efficiency and does not have sufficient impact on absolute energy savings.

2.1.3.1 Since 1990, energy efficiency gains have been much higher in energy and carbon intensive industries than in the building and transport sectors

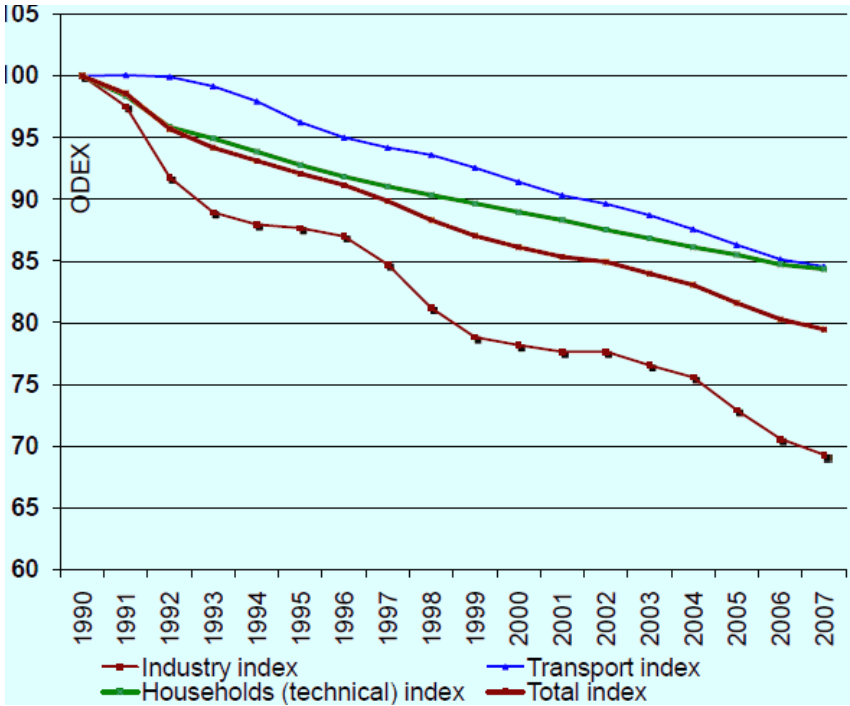
Figure 10. Distribution of energy efficiency measures by impact



Source: MURE database

Figure 10 shows that, on average, more than half of the EU policies and measures on energy efficiency have unknown, low or medium impacts on energy efficiency improvements. But transport is the sector where effectiveness is the lowest, with fewer than 20% of the measures considered to have high impact.

Figure 11. Energy efficiency index (ODEX) for final consumers (EU27)

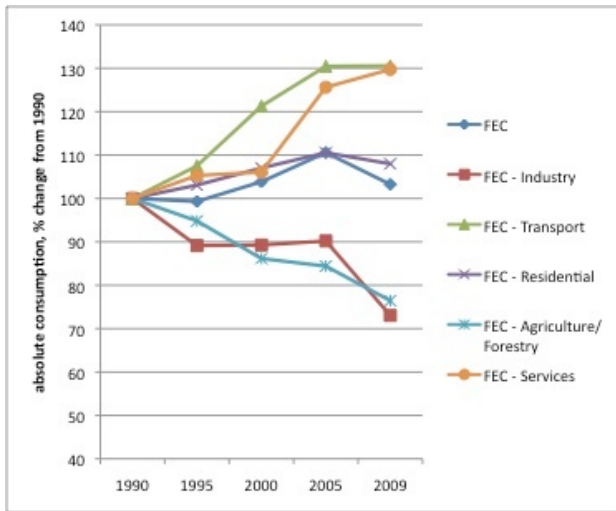


Source: ODYSSEE. Energy efficiency trends in Europe (B. Lapillonne, K. Pollier, 2009)

The Odyssee Energy Efficiency Index (ODEX) is designed to represent as closely as possible the actual trend of technical energy efficiency in final energy consumption sectors. On average, the EU ODEX decreased by 21% between 1990 and 2007. But the contributions of the different energy consuming sectors are widely different. The industry ODEX has decreased by 30 (2% improvement rate per annum), while the households and transport ODEX only decreased by 15% (1% improvement rate per annum).

But despite the importance of ODEX, it only represents the technical energy efficiency gains, and not the absolute energy savings.

Figure 12. Final energy consumption per sector in the EU – 27 1990 – 2009



Source: Eurostat

Figure 12 shows trends of final energy consumption per sector since 1990. While the decrease of industry since 1990 is of the same order of magnitude as the decrease of its ODEX (30%), this is not the case for transport and households. While the final energy consumption of the residential sector increased significantly since 1990 (by 10%), final energy consumption of the transport sector soared (by 30%). An increase in the number of kilometres travelled has overwhelmed the efficiency gains of the transport sector (energy consumed per kilometre travelled).

2.1.3.2 Under the current scenario, the EU will only improve energy efficiency by 10% by 2020.

Under the current scenario – which includes, as we have seen, numerous existing energy efficiency policies, as well as the reduced energy demand induced by the economic crisis – Europe will probably improve its energy efficiency by only 10% by 2020 (ECOFYS and Fraunhofer, 2010).

2.1.4 Policy recommendations

2.1.4.1 Pass new legislation targeting absolute energy savings in key sectors

Given the abundance of the current European legislation on energy efficiency, and given the repeated political commitments made (the last one: EU Heads of States in February, 2011) to achieve the 20% energy efficiency target by 2020, the fact that, under the current scenario, the target will be widely missed calls for a radical change in approach, not incremental reform.

Lessons from the current failure to reach the 20% energy efficiency target by 2020 need to be drawn carefully. Evidence suggests that the non-binding nature of the energy efficiency target partially explains such failure. But, for energy efficiency as for the rest, a binding target only helps if:

- It targets the appropriate action-levers
- It is associated with the appropriate means to reach the objective.

A binding total energy efficiency target, at the European as well as at the MS level, is very unlikely to pass, but most importantly, is likely to be of little help. Indeed, the actions levers to improve energy efficiency are extremely diverse and, in the absence of the appropriate EU legislation and MS policies and measures, reaching the target could prove extremely costly, if possible at all. It could even be counter productive, because it could lead to an over-emphasis on energy efficiency actions with high short-term abatement potential (heat pumps), at the expense of unavoidable but more difficult investments in low energy efficient and low carbon infrastructure (deep retrofits).

Rather, new EU legislation should primarily target sectors where current legislation and MS policies and measures have little or no impact. There are two key areas where increased action is needed in order to reach the 20% energy efficiency target: the improvement of the energy efficiency of the existing buildings stock, and the limitation of the absolute level of energy consumption in the transport sector. Binding targets should only be used when absolutely necessary and when helpful.

2.1.4.2 Set binding targets, at the Member States level, expressed in final energy, and in energy intensity, to improve the energy efficiency of the existing building stock; complement these targets with a combination of obligations and incentives.

The building sector represents 40% of energy consumption and 1/3 of GHG emissions. Households' final energy consumption is subdivided as follow: 67% for space heating; 15% for lighting and electric appliances; 14% for water heating; 4% for cooking (EC, 2011).

Binding targets – at the Member States level, expressed in final energy, and in energy intensity – to improve the energy efficiency of the existing buildings stock would give the impetus necessary to deepen and accelerate current improvements. These targets would have to be supplemented by the appropriate EU legislation and MS policies and measures:

- Obligations (e.g. obligation to improve insulation when existing buildings undergo renovation, or propriety/lending change);
- Incentives (e.g. subsidised loans), which could be financed at the EU level;

2.1.4.3 Adopt new legislation incentivizing avoided transport and modal shift, through coordinated European transport infrastructure policies.

Transport emissions now represent around 1/3 of EU total emissions. From 1990 to 2005, EU27 emissions fell by 7.9%; transport emissions rose by 27%.

As opposed to the building sector, binding targets – be it at the EU level, or even worse at the MS level – are not the appropriate tool to limit the final energy consumption of the transport sector.

The transport sector is currently the weakest link of European energy and climate policies. Energy consumption and GHG emissions from the transport sector are partly covered by European legislation. But

- Key parts of the transport sector are still uncovered or only indirectly covered by European legislation
- The approaches chosen are not always the most relevant and efficient from an energy consumption and GHG emissions perspective
- The bar – of targets and regulations – is sometimes set too low.

The European legislation on transport has progressively evolved:

- On cars, Europe progressively moved away from voluntary agreements with car makers to mandatory standards for fuel efficiency and CO2 emissions
- On fuels, Europe took a 10% bio fuels target
- On aviation, Europe will include international aviation in the EU ETS in 2012.

These new developments go in the right direction. But European legislation still misses the complexity of the transport sector and does not target all the levers to reduce energy consumption and GHG emissions of the transport sector: 1) avoided transport 2) modal shift 3) efficiency of vehicles 4) electrification of vehicles 5) bio fuels.

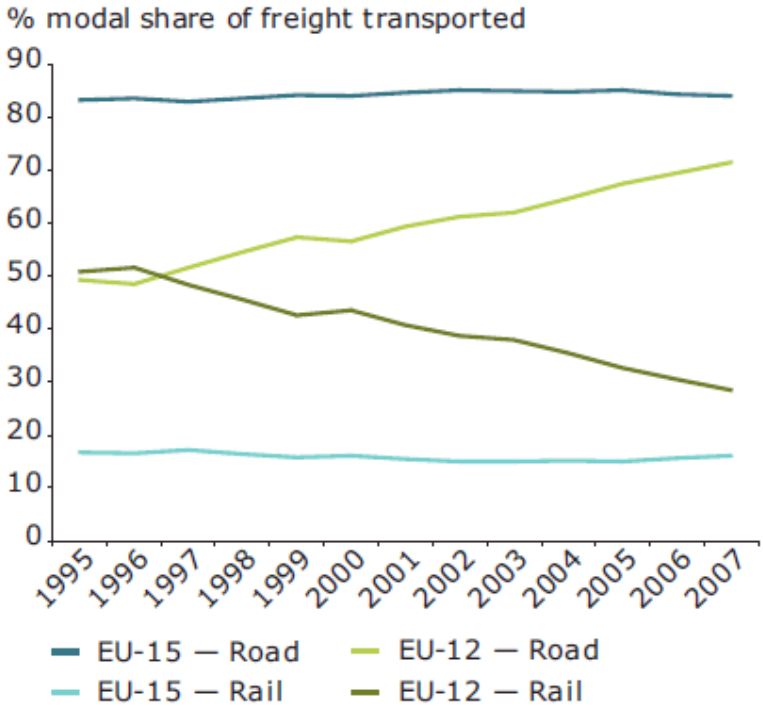
Avoided transport and modal shift have sub-national, national and regional dimensions. Modal shift can be achieved through:

- Shift public transport within cities
- Shift from road to rail and maritime for freight transport
- Shift from road and air to rail for passengers transport.

While the shift to public transport within cities is pre-eminently a matter of MS or local authorities competencies, spatial planning at the EU level could facilitate the shift from road and air to rail for cross-border freight and passenger transport.

Whereas there are several EU financed projects aiming at increasing the security of the electricity supply network (trans-national natural gas pipelines, high voltage power network...), there is currently no large scale EU financed project promoting the shift towards low carbon transportation modes.

Figure 13. EU-10's progressive preference for road over rail



Source Eurostat, TERM report by the European Environment Agency 2010.

Figure 13 shows that, since 1995, the modal split between road and rail freight transport is broadly constant for the EU-15: approximately 80% and 20% respectively. For the EU-12 (EU-10 + Malta and Cyprus) freight transport had almost an even split in between road and rail in 1995. But since then, the proportion of road freight transport has steadily increased, up to 70% by 2007 while the proportion of rail freight transport has equally steadily decreased, down to 30%.

This result needs to be treated with caution. It might seem to suggest that there is a good case for using the EU cohesion fund to reverse the trend of increasing shares

of road freight transport in the EU-10, since these countries have frozen infrastructures for rail freight transportation. But this would neglect the fact that the EU-10 is progressively converging towards the EU-15 freight transportation mode. Increasing the share of rail freight transportation needs to be coordinated at the EU level.

Besides, the modal split of freight transport is not only a matter of infrastructures. It also depends on the European industrial policy, because it is linked to the localization of industrial production. Road freight transport has increased over time with the development of long-distance transport of high value-added products. Slow modes like maritime transport could take higher shares of freight transport if industries relocate their production closer consumption centres.

2.2 Increase stringency and predictability of the EU ETS

As we have underlined in section 1, shaping investments in low carbon infrastructure and driving innovation in low carbon technologies now in the EU power sector and carbon intensive industries is key to ensure the time consistency of its emissions reduction pathway, to enhance its competitiveness, and to increase its energy security.

In this section we:

- Assess the ETS's current performance against the EU long term goal to reduce total emissions by at least 80% by 2050, taking into account the impacts of implemented and planned policies complementing the EU ETS, as well as the effects of the economic crisis;
- Make some precise policy recommendations, regarding both the steepness of and the timeframe for a necessary ETS cap decrease, the links with increased action on energy efficiency, and the reassessment of competitiveness and leakage risks.

2.2.1 Preliminary remarks

2.2.1.1 Ultimate objective of the EU ETS

The EU ETS currently covers almost 11 500 installations, in the power sector and carbon intensive industry, or about 45% of the EU CO₂ emissions. International aviation will be included in the EU ETS in 2012. The EU ETS is the European flagship instrument to "promote GHG reductions in a cost effective and economically efficient manner" (art 1 of the EU ETS directive).

This definition reflects the tension between the short-term and ultimate objectives of the EU ETS. Simply aiming at cost effectiveness in the short term would mean aiming at the lowest possible EU allowance price to reach the 2020 target. But, since the EU ETS also aims at reducing emissions in an economically efficient manner in the long run, it must shape investments in low carbon infrastructure and drive innovation in low carbon technologies in the power sector and carbon intensive industries at a scale and speed consistent with the EU ultimate objective to reduce total emissions by at least 80% by 2050.

Our assessment of the current performance of the EU ETS and our policy recommendations take into account this tension.

2.2.1.2 Interaction between the EU ETS and complementary policies

The EU ETS occupies a central position within the overall EU policy to reduce total GHG emissions. It therefore interacts with many other complementary policies. The balance between instruments is key to understand the current dynamics within the EU ETS, and is a key aim of the suggested policy reforms.

In our assessment of the performance of the EU ETS we pay particular attention to the interactions with the RES target, and in our policy recommendations to the implications of increased action on energy efficiency.

2.2.1.3 Effects of the economic crisis

The EU has been severely hit by the 2008 economic crisis. Indeed, mainly as a result of the economic crisis, total EU GHG emissions dropped by 7.1% between 2008 and 2009 (EEA, 2001). The drop in output and emissions has been especially high for sectors covered by the EU ETS. Between 2008 and 2009, production levels have dropped by 13.85%, emissions by 11.6% (European Commission and Eurostat respectively). In the cement sector, emissions have dropped by 19.97%, production levels by 18.98%; in the steel sector, by 28.98% and 27.66% respectively.

Our policy recommendations take into account the sustained effects of the economic crisis. But they do not aim at simply setting aside unused allowances resulting from the output drop in covered sectors during phase II to maintain the stringency of the EU ETS by 2020. Rather, we analyse the consequences of the economic crisis on the strength of the signal sent by the EU ETS.

2.2.1.4 Actions undertaken by other countries

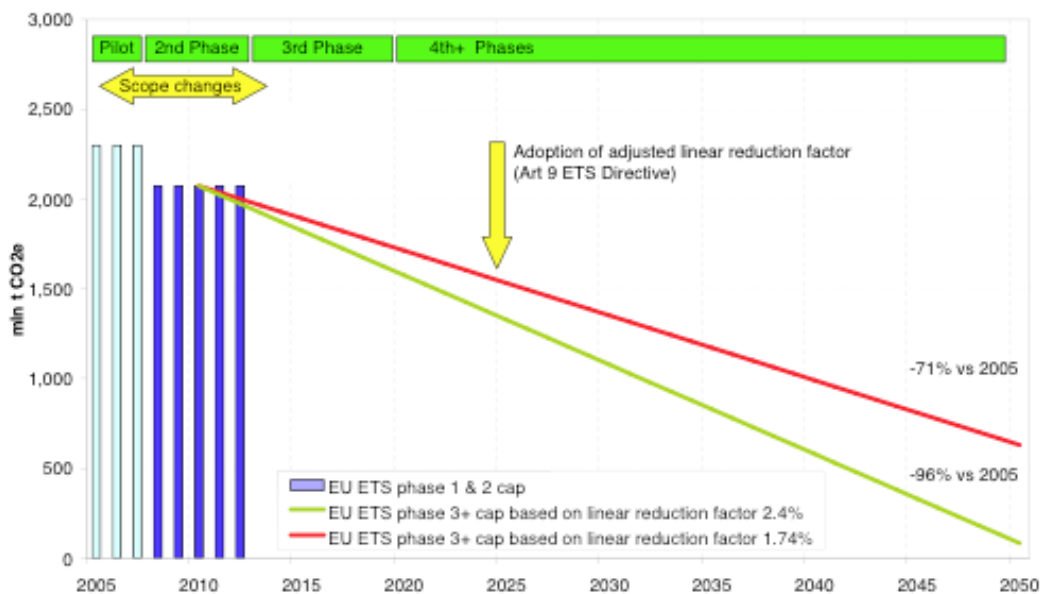
The main objective of our policy recommendations is to ensure the internal consistency of the EU emissions reduction pathway. Nevertheless, strengthening the EU CEP, and the EU ETS in particular, cannot neglect actions – or lack thereof – undertaken by other countries. The analysis of the international context is key to ensure that a strengthening of the EU CEP 1) does not translate into competitiveness losses for carbon intensive industries at risk of carbon leakage, and 2) potentially leverages actions by others.

2.2.2 How does the EU ETS perform against its ultimate objective?

2.2.2.1 The post 2020 signal send by the EU ETS is inconsistent with the EU long term goal of reducing emissions by at least 80% by 2020

The EU ETS sends a post-2020 carbon price signal: the EU ETS directive includes a provision for a continuation of the 1.74% annual cap decrease after 2020. But this signal is widely inconsistent with the EU long-term goal to reduce emissions by at least 80% by 2050, and in particular with the almost full decarbonisation of the power sector. The EC acknowledges that "revisiting the agreed linear reduction of the ETS cap" may be necessary to return the ETS trajectory and price path to one consistent with long-term objectives (EC, 2011).

Figure 14. linear reduction factor of the EU ETS and consistency with long-term objectives.



Source: adapted from Öko-Institute, 2010.

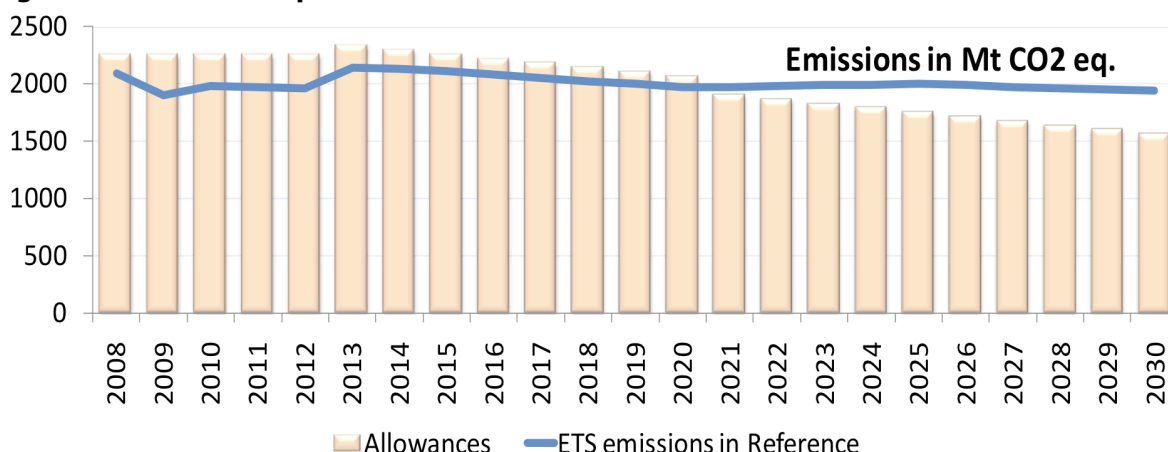
Figure 14 shows this inconsistency explicitly. The current annual linear reduction rate of 1.74% would leave ETS emissions 71% below 2005 levels by 2050, compared with the required at least 90% by 2050 for an economy wide reduction of at least 80%.

2.2.2.2 The weakness of the signal is reinforced by the expectations for a low carbon price up to 2020:

During phase II, the EU ETS has maintained a positive price, in spite of the economic crisis, and leveraged some abatement (Bloomberg)⁵ through e.g. fuel switching. But there is less evidence that it has leveraged significant transformational change in investment patterns (CICERO, 2009; Rogge and Hoffman, 2010). A Norton-Rose survey of investors finds that less than 10% consider that the EU ETS has provided a strong enough price incentive to switch from high to low-carbon investments; not a single respondent considered that the EU had provided long-term price certainty (IIGCC, 2011).

The recession will have sustained implications for the ETS price signal. As a result of banked surplus allowances of around 500-800 Mt, the EU ETS is likely to be over-allocated until ca. 2020 (see figure 16). As a consequence, the carbon price signal to 2020 is likely to remain weak: official projections range between Euro₀₈ 16.5-25/ton.

Figure 15. Emissions caps and reference scenario emissions



Source: EC.

The EU therefore faces a “lost decade”. The EU ETS emissions cap will *de facto* be met. But the short-term investments in low carbon technologies and infrastructure necessary to reach the EU long-term goal of reducing emissions by at least 80% by 2050 at acceptable costs will be delayed.

2.2.2.3 The uncertainty regarding future targets and the recognition that current targets are inconsistent with the long term goal increase the policy risk for investors

In addition, ETS firms face significant price uncertainties under the EU ETS, which risk delaying or misallocating their investment decisions. Alongside endogenous

⁵ Bloomberg estimated 148 MtCO₂ abatement in 2009 brought on by the carbon price

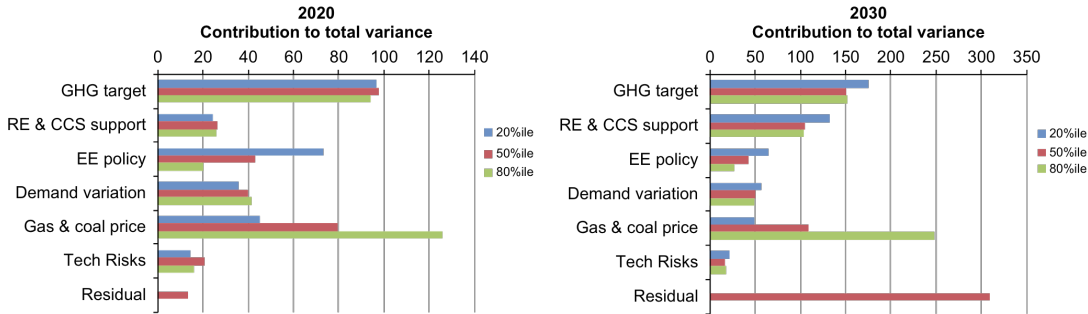
market- related uncertainties regarding e.g. fuel prices, firms are faced with very significant policy uncertainty. These include:

- Uncertainty regarding post 2020 EU ETS trajectories, exacerbated by the fact that the current 2020 EU ETS cap is acknowledged to be inconsistent with EU long-term goal of reducing emissions by at least 80% by 2050;
- Uncertainty regarding the potential move beyond the current 20% emissions reduction target by 2020;
- Uncertainty regarding the delivery of energy savings, RES and technology deployment targets, which would impact on the ETS price.

This means that on the timeframe to 2020, exogenous policy risk factors are just as significant as endogenous market risk factors in determining allowance price expectations. In particular, under the current 20% emissions reduction target, there is high probability of low-allowance prices to 2020 and 2030 due to the interaction of a weak ETS cap with other policies (Blyth and Dunn, 2011), in particular energy efficiency.

Beyond 2020, the EU has already defined the rate of decrease in the ETS cap. However, this is a) subject to review in 2025, and b) acknowledged to be inconsistent with the EU’s long-term decarbonisation goal (EC, 2011). This undermines the credibility of the post-2020 scarcity signal. On the 2030 timeframe, policy risks concerning the trajectory of the ETS cap form the dominant source of uncertainty regarding allowance price expectations.

Figure 16. contribution of various risk factors to marginal price uncertainty to 2020 and 2030.



Source: Blyth and Dunn, 2011

The expected future carbon price path is key for driving long-term capital investments and strategic firm-level RD&D decisions. Uncertainty regarding future price paths is not necessarily an issue for policy makers; it is reasonable to expect firms to hedge market related risks. However, when the dominant source of future price uncertainty is the policy framework itself, there is clearly a need for policy-makers to step in.

Failure to do so may have several implications. Firstly, significant price uncertainty raises risk premia and risks critical delay or misallocation of investment (Helm et al, 2003). Secondly, governments may face pressure to adopt the policy risk themselves

in order to leverage investment. These dynamics are contributing to the UK implementation of a carbon-price floor, for example. In times of fiscal constraint, direct policy support from governments may become more difficult.

2.2.3 Policy recommendations

The stringency of the EU ETS therefore needs to be increased. But the precise level of and the timeframe for the cap decrease require some careful policy design. From an economic, environmental and political perspective setting a stringent 2030 cap is the most relevant, efficient, and realistic option.

2.2.3.1 Priority: set a stringent 2030 EU ETS cap

2.2.3.1.1 Economic rationale

Economically, given the long lived capital stocks of the power sector, 2030 is the appropriate time frame to shape investment in low carbon technologies and infrastructures, beyond short term abatement through e.g. fuel shifting.

Between 2010 and 2020 the EU will need to replace ca. 337 GW of capacity for a cumulative investment cost of USD₂₀₀₉ 694 billion in the power sector; between 2021 and 2035 capacity replacements rise to ca. 498 GW for a cumulative investment cost of USD₂₀₀₉ 1 080 billion (IEA, 2010). These figures take into account the impact of the economic crisis, as well as further climate policies to reduce final demand and decarbonise generation (the IEA New Policies Scenario).

Table 3. European power sector investment needs

2010-2020			2021-2035		
Replacements GW	Retirements GW	Investment USD ₂₀₀₉ bln	Replacements GW	Retirements GW	Investments USD ₂₀₀₉ bln
337	158	694	498	348	1 080

Source: IEA, 2010.

Therefore, the imperative for the EU is to shape investments in low carbon technologies and infrastructure, in both the short-term and mid-term. The assets invested 2010-2020, and 2021-2035, will have amortization periods in the range of one to several decades. Therefore the long-term policy horizon is crucial for providing investors with sufficient certainty to undertake these investments consistent with the decarbonisation of the EU power sector by 2050.

A simple setting aside of allowances for phase III may have insufficient impact in leveraging this kind of investments:

- Large scale low-carbon generation technologies are only mature on a post-2020 timeframe
- The presence of other policy instruments, especially the RES target, reduces the impact of a tighter 2020 cap on RES deployment
- While it would signal greater political commitment to a stringent trajectory, it would not in itself solve the problem of significant policy uncertainty post-2020

Tightening the 2020 cap, without providing sufficient guarantee on the level of the 2030 cap, would risk locking-in some relatively carbon intensive technology options such as gas. It also reduces the possibility to time investments to ensure the optimal allocation of abatement between 2020 and 2030, considering technology development trends and long-term decarbonisation goals.

2.2.3.1.2 Political rationale

Politically, any attempt to increase the stringency from the EU ETS is likely to face some resistance from some business representatives. Simply setting aside some allowances just before phase III starts could be interpreted as changing the rules of the game, and enhancing the volatility of the carbon price. Whereas setting a 2030 cap would be seen as increasing the predictability of the carbon price signal, and therefore the credibility of the regulator.

Moreover, there is a need from a political perspective to address the 2030 cap soon in any case. By 2015, 2030 will be just 15 years away. This is an almost similar timeframe to the original discussions on the EU's 2020 cap, which formally began in January 2007 and were adopted (in record time) in December 2008. From the perspective of political efficiency, there is thus a logic to addressing the 2030 cap directly in order to avoid two contentious debate in quick succession on the 2020 and then 2030 cap

2.2.3.2 Policy agenda

As a consequence, the strengthening of the EU ETS could happen in three stages:

- For the remainder of the year, the EU should focus on designing an energy efficiency plan that would, in particular, facilitate reaching higher short and mid term emissions reduction targets under the EU ETS
- At the beginning of 2012, the EU should set an indicative 2030 target, consistent with the EU long-term goal of reducing total emissions by 80% by 2050.
- In 2014, the indicative 2030 target should become a binding target. The situation of sectors at risks of carbon leakage should be reassessed.

2.2.3.2.1 2011: design an energy efficiency plan that would facilitate reaching higher short and mid term emissions reduction targets under the EU ETS

This plan also should address energy security issues of CEE MS and serve as a basis for the negotiations next multi-annual EU financial framework.

In section 2.1 we have underlined the need for increased actions on energy efficiency. One argument is often heard: policies promoting end use energy savings would endanger the EU ETS, because it would reduce the carbon price under the EU ETS, and consequently reduce the incentive to invest in low carbon technologies in sectors covered by the EU ETS.

This argument needs a careful response.

For a given EU ETS cap, policies promoting end-use energy savings reduce the scarcity of carbon under the EU ETS, only insofar as they reduce electricity demand and/or as they mandate energy efficiency improvements for installations covered by the EU ETS. Therefore, policies promoting end use energy savings do not always overlap with the EU ETS.

In theory, one could argue that the carbon price induced by the EU ETS already sends a signal to electricity end-users and therefore provides sufficient incentives for end-use electricity savings. But in practice a price signal alone is not sufficient to incentivize end-use electricity savings due to the relatively low price elasticity of electricity demand, as well as other market failures. Policies promoting end use electricity savings therefore complement the EU ETS.

One could also argue in theory that policies promoting end-use electricity savings are redundant, because the carbon price induced by the EU ETS sends a signal to decarbonise the electricity anyway (fuel shift, renewable, CCS, etc). But in practice, options to reduce end-use electricity demand are often cheaper than options available to the power sector to reduce the carbon intensity of electricity produced. Besides, the reduction of electricity demand lowers the investment needs and costs in the power sector, and is necessary to offset the longer-term electrification of transport and buildings.

As an example, we have looked at the contribution of different sectors and policies under the 30% reduction case: only 38% of the emission reductions attributed to the ETS have to be achieved in the ETS sector directly. 26% will be achieved in other sectors (electricity demand reduction) and 36% through the RES targets (Coveys, 2011).

This shows that policies promoting end-use electricity savings are able to facilitate the transition towards a low-carbon energy system.

This response has important policy implications, both under and outside the EU ETS:

Increased actions to improve Europe’s energy efficiency need to translate into a corresponding strengthening of the EU ETS to maintain the incentive for investing in low carbon technologies and infrastructures in sectors covered by the EU ETS.

Nevertheless, the precise correspondence between energy saving and ETS scarcity is not easy to calculate: A precise sectoral energy efficiency action plan would therefore be necessary to calculate the corresponding tightening of the EU ETS cap.

Besides, the energy efficiency target is currently non-binding, and so is part of the European legislation on energy efficiency. If the EU ETS cap were tightened to take into account the effects of increased action to reach the 20% energy efficiency target, the European framework on energy efficiency would need to provide sufficient guarantees that the target will be reached.

2.2.3.2.2 2012: set an indicative 2030 ETS cap

At the beginning of 2012, the EU should set an indicative 2030 target. This target should be stringent. Further research is needed to determine the precise level of the 2030 ETS cap. But a comparison of existing scenarios suggests that a 45 – 50% domestic emissions reduction by 2030 compared to 2005 for sectors covered by the EU ETS is broadly consistent with the EU long-term goal to reduce emissions by at least 80% by 2050.

Table 4. EU ETS cap by 2030

Scenario	ETS cap 2030, from 2005 levels	Economy wide reductions 2030, from 2005 levels	Economy wide reductions 2050, from 1990 levels
EC Roadmap 2050, 2011	-43 to -48%	-35-40%	-80% ^a
Koop-institute, 2011	-60%	-50%	-90% ^b
Euroelectric, 2011	-42%	-40%	-75% ^c
Ecofys, 2011	-45 to 50%	-45%	-80-95%

^a The EC states that the 2050 objective will need to be met largely internally, EC 2011

^b All figures refer to domestic reductions, Öko-institute 2011.

^c This refers to domestic reductions, Euroelectric 2011

It should include a provision allowing banking of allowances between phase III and phase IV (2021-2030).⁶ And, as planned, there should be a progressive move to full auctioning, to be reached by 2027.

⁶ Discussing the appropriate length of the commitment period post 2020 is beyond the scope of this report.

2.2.3.2.3 2014: take a binding 2030 target and reassess the situation of sectors at risks of carbon leakage

If some sectors prove to be seriously at risk, then, from an economic perspective, the first best option would be to introduce a Border Tax Adjustment (BTA) for these sectors. If for domestic and/or for international (risks of trade retaliation...) political reasons this option proves impossible or undesirable to implement, sectors at risks would have to be taken out of the EU ETS, and submitted to direct regulation. But the 2030 target should not be watered down to dilute these risks.

An assessment of competitiveness losses and carbon leakage risks associated with a tightening of the ETS cap should take into account 1) the trade exposure of sectors at risks, 2) the direct and indirect effects of carbon pricing on their value added, 3) but also the allowances surpluses currently owned by some industries.

The openness ratio should not be the only parameter used to determine the trade exposure of industries. Trade flows need to be carefully considered on a country by country basis, and the explicit or implicit carbon pricing policies implemented by these trading partners need to be closely examined. The economy-wide emissions reductions, emissions intensity, or deviation from Business As Usual (BAU) targets pledged by all major developed and developing countries within the context of the Copenhagen and Cancun agreements do not give a precise indication of the policies implemented or planned at a sectoral level.

In theory, a disaggregation of these national targets at the sectoral level could lead to an upward or downward reassessment of competitiveness losses and carbon leakage risks for industries covered by the EU ETS. One could discover that an ambitious economy-wide target has only small effects on industries covered by the EU ETS in Europe. One could also discover that the implicit carbon prices of trade or industrial policies targeting industries the same industries as covered by the EU ETS in third countries are significant.

The comprehensive scrutiny of all these policies in all Europe's trading partners, and the detailed analysis of their effects on competitiveness and leakage, is beyond the scope of this report. But partial analysis finds that trade and industrial policies implemented by China, for reasons sometimes going beyond the need to reduce GHG emissions – such as economic restructuring, or energy security - on industries covered by the EU ETS in Europe, induce carbon prices of an order of magnitude comparable to the EU ETS prices (Xin Wang, 2010).

Competitiveness losses and carbon leakage fears – some of them genuine, some of them exaggerated – from industries at risk currently prevent stronger and faster actions to decarbonise the power sector.

While the decarbonisation of the power sector is also challenging, the challenges are different from those faced by the industries. Most of the risks associated with the decarbonisation of the power sector can be managed by Europe through smart

European policy design, without Europe's ambitions being prevented or impeded by the lack of similar ambition in the rest of the world.

The risks of higher electricity bills for example, that would result from incremental investments to supply low or zero carbon electricity or to make sure that the electricity network can deal with a big proportion of intermittent electricity sources, can be managed through the implementation of policies reducing electricity demand.

The decarbonisation of the European power sector would yield benefits going way beyond the European contribution to the global effort to reduce GHG emissions, ranging from increased energy security to enhanced competitiveness of the economy.

The decarbonisation of the European power sector, and more broadly the transition towards a low carbon European energy sector, cannot be kept hostage by the impossibility to transform the carbon intensive industries at the same speed and at the same level by using the same tool: the EU ETS.

Therefore, in the future, if these competitiveness losses and carbon leakage risks became real for some industries, there would be only two options: 1) introduce a Border Tax Adjustment (BTA) – or any similar border levelling mechanisms compatible with WTO rules 2) remove these industries from the EU ETS and police them through direct regulation such as emissions performance standards.

A comprehensive economic and political analysis of their pros and cons is beyond the scope of this report. But initial analysis suggests that both options entail risks.

In the past, the threat brandished by Europe to impose a carbon tax at the border in the absence of comparable efforts by other major developed and developing countries seems to have been relatively efficient to prompt some – albeit not all – of them to take additional climate actions.

But the context is now different from what it was prior to Copenhagen. The vast majority of major countries are now dedicated to implement policies to reach the emissions reduction or intensity targets they have set. There is probably little international pressure can do at this stage to encourage these countries to increase their target. Rather, countries are looking for international policy cooperation to reach their targets at acceptable economic and social costs. The risks associated with a carbon tax at the border are therefore not only commercial – trade retaliation – but also environmental – it is unclear if it would induce more or less ambitious climate actions.

Direct regulation is not exempt from lobby pressure, and the risks of regulatory failure increase with the number of regulations.

2.3 Use direct public financial support to facilitate the transition towards a EU low carbon economy

As we have repeatedly underlined in sections 1 and 2, a wide portfolio of policies needs to be implemented to leverage the transition towards a EU low carbon economy. In some cases, direct public financial support is justified and efficient. In this section we 1) examine the general and sectoral rationale for direct public financial support 2) list the possible sources of money at the EU level 3) analyse how the EU budget could support the transition towards a low carbon economy in Central and Eastern European (CEE) MS.

2.3.1 Preliminary remarks

2.3.1.1 General rationale for public investment

The transition to low-carbon modes of production and consumption will not be achieved by carbon pricing alone. Other market failures imply the need for complementary policies, in particular to address certain sectors. In general, the rationale for public support for low-carbon investments is three-fold:

- To support innovation in low-carbon goods and services. Knowledge spillovers in R&D can mean that private firms do not capture the full benefit of investments in innovation.
- To support infrastructure upgrades and expansion. Network externalities may mean that network development (e.g. smart-grids) is hampered by a misalignment between public and private interests. Information gaps and asymmetries may mean that economic actors lack the information to make rational economic choices (e.g. domestic energy efficiency).
- To ensure equity in the allocation of responsibility to poorer States. Within the EU, this is particularly relevant for the CEE Member States.

2.3.1.2 Sectoral rationale for public investment

2.3.1.2.1 Buildings

In the building sector, a number of market failures restrict private investment in energy efficiency. These include very high private discount rates; capital constraints and cultural debt aversion; information gaps and asymmetries; and the lack of a skilled ESCO⁷ industry. In addition, private capital markets may lack the experience in structuring and implementing financing programs among large numbers of disparate actors. Decarbonising the residential/tertiary sector is key for achieving carbon and RES goals at reasonable cost: the IEA estimates that end-use efficiency

⁷ Energy services company

and fuel switching account for some 45% of total reductions by 2050 in the ambitious Blue Map scenario (IEA, 2010).

2.3.1.2.2 Transports

In the transport sector, key market failures include network effects associated with developing infrastructure (e.g. electric charging); split incentives between producers and consumers; imperfect internalization of externalities; and perverse subsidies and incentives. In addition, public intervention will be needed to leverage non-technical measures such as spatial planning, speed enforcement, and energy efficient driving. EU fiscal, innovation and spatial planning policy have a role to play. By 2050 the gap in the transport sector between an existing policies and trends scenario and an economy-wide 80% reduction trajectory is 85 percentage points, compared to 1990 levels (EC, 2011).

2.3.1.2.3 Energy infrastructures

In the low-carbon energy infrastructure sector, the key market failures are network externalities, technology spillovers, new technology risks, and credit market failures, exacerbated by the financial crisis. Between 50-170 GW of additional transmission capacity are required by 2050 to decarbonise the EU power sector (ECF, 2010); the Commission estimates that between €1.6-2 trillion will need to be invested in the grid between now and 2050 (EC, 2011).

2.3.1.3 Focus of the section

With very significant sums to be invested, it is clear that the private sector must deliver the vast majority of funding. The overarching goal of public intervention is to lower the risk associated with low-carbon investment and increase the payoffs, thus catalyzing the involvement of the private sector. Our policy recommendations focus on the role of public finance.

Public finance can be mobilized and delivered at the MS and at the EU levels. Our policy recommendations focus on 1) EU financial instruments or revenues generated by the implementation of an EU instrument (revenues from auctioning allowances under the EU ETS) 2) and areas where EU coordinated public support would create some added value compared to individual MS actions.

2.3.2 Combining EU and MS direct public financial support

There are a number of instruments that could be deployed. A combination of EU level and nationally implemented instruments is required to support regulatory policy and leverage private investment. These include:

2.3.2.1 Auction revenues from the EU ETS

Under the current 20% target, these are on the scale of €150-190 billion to 2020; if the EU moved to a 30% target, they would be in the order of €200-310 billion. It is clear that 1) revenues accrue to MS, 2) given their scale, the revenues will not be used solely for climate change purposes, 3) but they could be pivotal to support the transition towards low carbon economies.

Table 5. Modelling results showing revenue accrued to MS following redistribution of auction rights entitlements.

Country	Final auction rights entitlement (%)	€ million in revenues during Phase III of the EU ETS			
		20% (a) scenario (€17/tCO ₂)	20% (b) scenario (€25/tCO ₂)	30% (a) scenario (€30/tCO ₂)	30% (b) scenario (€55/tCO ₂)
		Power & manufacturing not at risk			
Austria	88	1,040	1,294	1,346	2,069
Belgium	96.8	2,194	2,737	2,844	4,379
Bulgaria	150.3	3,562	4,623	4,823	7,808
Cyprus	105.6	312	404	422	684
Czech Republic	117.4	5,878	7,632	7,962	12,889
Denmark	88	2,242	2,790	2,901	4,457
Estonia	145.2	1,567	2,033	2,120	3,431
Finland	88	2,554	3,179	3,304	5,071
France	88	4,299	5,357	5,570	8,569
Germany	88	36,591	45,551	47,354	72,740
Greece	103	6,530	8,125	8,444	12,959
Hungary	120.7	1,067	1,386	1,446	2,340
Ireland	88	1,335	1,668	1,734	2,673
Italy	89.8	14,365	17,888	18,599	28,580
Latvia	196.9	181	236	246	400
Lithuania	173.6	399	519	545	882
Luxembourg	95	5	7	7	11
Netherlands	88	4,869	6,062	6,301	9,682
Poland	128	16,878	21,907	22,857	36,998
Portugal	102.1	2,121	2,640	2,744	4,214
Romania	152	3,972	5,157	5,379	8,707
Slovakia	129.2	775	1,006	1,050	1,700
Slovenia	105.6	427	553	578	936
Spain	99.4	13,300	16,563	17,217	26,461
Sweden	96.8	684	852	892	1,371
UK	88	18,537	23,077	23,987	36,847

Source: Cooper and Grubb, 2011.

Possible investment policies include helping low-income consumers and electricity intensive industry to deal with carbon cost impacts by improving electricity efficiency; supporting CCS demonstration alongside the NER300; funding R&D in the SET plan technologies; and co-financing project loans for national and transnational electricity grid infrastructure (e.g. SuperSmartGrid).

2.3.2.2 EU level public private partnerships.

There are obvious challenges of coordination between MS, which suggest the need also for EU level instruments. There are a number of existing (or proposed) initiatives, which could form models for future financing instruments, potentially supported by allocations from the EU budget. These include:

- The 2020 European Fund for Energy, Climate Change and Infrastructure (Marguerite Fund).⁸ Capitalized with €700, with a target capitalization of €1.5 billion, the fund will provide equity and debt co-financing for primarily greenfield infrastructure projects in the energy, transport and environment fields.
- The Risk-Sharing Financing Facility between the EIB and the Commission. The Facility provides debt financing to research, development and innovation programs, and has a capitalization of €2 billion, with equal shares from the Commission and EIB.
- The EU Energy Efficiency Facility. This will be capitalized with €146 million from the European Energy Program for Recovery, supplemented with €75 million from the EIB. The fund will provide a range of financial products, from subordinated loans, guarantees to equity financing. €20 million will be made available for technical assistance.
- Project bonds. Public debt guarantees or credit lines may be needed to attract private investors to large-scale European infrastructure investments. These need to be carefully coordinated with EU climate and energy policy.

2.3.3 Using the EU budget to support the transition towards a low carbon economy in CEE MS

EU Cohesion policy is divided into three objectives:

- Convergence, which aims to stimulate growth and employment in the least developed regions.
- Regional competitiveness and employment, which aims to support regions' competitiveness and attractiveness as well as employment, by anticipating economic and social changes.
- European territorial cooperation, which aims to reinforce cooperation at the cross-border, transnational and interregional level.

⁸ Core sponsors are the EIB, the KfW, Casse des Dépôts, CDP, Instituto de Crédito Oficial, PKO Bank Polski, and the EU Commission.

Preparing CEE economies to thrive in an energy and carbon constrained world would seem, *prima facie*, compatible with Cohesion policy objectives. This may be particularly relevant for the CEE Member States, which have a significantly lower level of carbon/energy efficiency, in other words a potentially greater risk exposure to systemic trends of energy and carbon constraints.

In addition, there are equity considerations. The EU already made significant equity-based concessions to CEE Member States in the 2008 Climate and Energy Package. In particular, the redistribution of 12% of auction revenues based on GDP/capita and overachievement against Kyoto targets was intended to compensate for their lower GDP/capita and “early action”. However, there may be a need for further instruments to support the *implementation* of climate and energy policy in CEE.

In this regard, EU fiscal policy could function as an intermediary instrument between EU and national-level policies, in order to support climate policy targets that are not backed by EU-level instruments such as the EU ETS in CEE Member States. There are several sectors in particular where action may be warranted.

2.3.3.1 Energy Efficiency in Buildings

Despite significant progress since 1990, there is still considerable energy efficiency potential in building sector of CEE Member States. In addition, residential energy efficiency measures can combat energy poverty, strengthen energy security, and stimulate job creation and economic growth. Energy demand from the building and tertiary sector in CEE is expected to grow strongly, as consumption patterns catch up with those of Western Europe. The nexus between latent energy demand growth; energy poverty and strong abatement potential is represented in table 5.

Table 6. Energy consumption and savings potential in the housing sector for EU27 and selected CEE countries

Country	Consumption per dwelling scaled to EU average climate, toe/dwelling 2005 ^a	% of the population reporting inadequate heat, 2008 ^b	Economic savings potential in the household sector in 2020, % of projected BAU final energy consumption in 2020 ^c
Bulgaria	0.75	34%	5.3%
Poland	1.26	20%	4.6%
Latvia	1.25	17%	6.4%
Romania	1.05	20%	4.9%
EU27	1.61	8%	5.9%

Source: a, Odyssee database b, Survey on Incomes and Living Standards, Eurostat; c, own calculations from Ecofys (2010), Energy Savings 2020

In addition, residential energy efficiency measures can combat energy poverty, strengthen energy security, and stimulate job creation and economic growth. There is thus strong demand from CEE Member States to include residential efficiency more strongly in CEE.

Several specific proposals can be made:

- The newly created European Energy Efficiency Facility should work with national public policy banks to implement energy efficiency financing programs, along the lines of the revolving energy efficiency fund established by KwF and KredEx in Estonia (see Spencer et al 2011). The EH value-add lies in supporting national institutions to structure and implement energy efficiency financing schemes, as well as in supplying co-financing.
- The threshold of 4% for residential energy efficiency investments under the European Regional Development Fund should be raised, and the guidelines relaxed to allow Member States flexibility in implementation (project and program size, gearing, ratio of technical assistance etc).
- The European Social Fund should support worker training and re-skilling to create a viable energy services company (ESCO) industry. A skilled, "low-carbon" labour market is essential reap the benefits of implementing energy efficiency policy, and climate policy more broadly.

2.3.3.2 Transport sector

The transport sector poses significant challenges for CEE climate policy. As in the building sector, there is considerable latent demand potential, as incomes catch up with those in the West. The positive socialist legacy of high penetrations of public transport is also being eroded as a result of reduced investment and private income growth (hence growth in private transport). In CEE, transport emissions are projected to increase by some 22%; oil consumption is projected to increase by some 16% by 2020 under the Baseline scenario (EC, 2010).

It's clear that purely technical measures will be insufficient to deliver ambitious emissions cuts in this sector. A coordinated combination of technical and non-technical measures is required. In addition, it is necessary to review potential perverse incentives and hidden subsidies to high carbon transport.

Specific proposals include:

- The EU currently has little leverage over spatial planning, which is largely a national or sub-national prerogative. However, EU regional (i.e. Cohesion) policy can play a role. There is the need to review the coherence between EU regional policy and climate policy in the transport sector.
- The EU needs to ensure that sufficient R&D financing is available to implement the transport related initiatives of the SET plan, in particular regarding electric vehicles and advanced biofuels.
- There is a need to internalize CO₂ externalities in a harmonized and rational way across EU Member States, transport modes and fuels. In the longer-term it is vital

to create the framework for an economic instrument to reduce transport emissions.

2.3.3.3 Energy infrastructure

CEE Member States face considerable investment needs in the area of energy infrastructure. This is driven by rapid depreciation of existing infrastructure, shifting generation centres (renewables), and international grid integration and the associated need for domestic grid reinforcement. €11-13 billion will need to be invested between 2010-2014 in projects of "European significance" in the Baltic region; €8-9 billion in Continental Central East, and €4-5 billion in Continental South East.⁹ Domestic concerns over electricity supply security and international concerns over fuel supply security mean that CEE countries are, in general, supporters of EU single market policy for energy.

Several specific proposals include:

- There is a role for strengthening energy infrastructure investment under Cohesion policy. Currently about 2.6% of Cohesion policy funds are allocated to heading 3 "European Territorial Cooperation", and only ca. €20 million/yr is dedicated to TEN-E. The role of the Cohesion fund and heading 3 should be strengthened to support energy infrastructure investment.
- The EU has also proposed EU project bonds for energy and transport investment. In principle, such an idea has merit, given the huge financing needs, higher risk premia for low-carbon projects, and current capital market constraints. However, it must be ensured that the project meets social needs and policy goals, if the public sector is to adopt some financial risk.

⁹ ENTSO-E, "Ten Year Network Development Plan", 2010, p. 16.

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Several separate papers have been produced within the framework of this project:

CIREC: Short-Term / Long-Term Coherence of Emissions Reduction Pathway
20 Apr 2011. Authors: Céline Guivarch and Julie Rozenberg

Climate Strategies: Revenue dimensions of the EU ETS Phase III
12 May 2011. Authors: Simone Cooper and Michael Grubb

E3G: The case for EU moving to 30% - Global low carbon technology race and international cooperation
08 Apr 2011. Authors: Pelin Zorlu, Shane Tomlinson and Sanjeev Kumar

ECOFYS: Consistency of policy instruments How the EU could move to a -30% greenhouse gas reduction target
13 Apr 2011. Authors: Niklas Höhne, Markus Hagemann, Sara Moltmann, Donovan Escalante

ECOFYS: Quantifying the impacts of a 30% GHG target on energy security for the EU
25 Mar 2011. Authors: Donovan Escalante, Niklas Höhne, Markus Hagemann

IDDR on the investment dynamics in the electricity sector (forthcoming)

FIIA: Linking an EU emission reduction target by 20% to Energy Security in Central and Eastern Europe
Authors: Thomas Spencer, Anna Korppoo, Kai-Olaf Lang and Martin Kremer

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Project Leader: Emmanuel Guerin, IDDRI

Contributors: Michel Colombier, Celine Marcy, IDDRI; Jean-Charles Hourcade, Stephanie Monjon, Julie Rozenberg, Celine Guivarch, CIRED; Anna Korppoo, Thomas Spencer, FIIA; Niklas Hohne, Donovan Escalante, Markus Hagemann, Sara Moltmann, Ecofys; Natalia Zugravu, ICE; Jesse Scott, Pelin Zorlu, Shane Tomlinson and Sanjeev Kumar, E3G; Jos Sijm, ECN



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