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**COMMUNICATION FROM THE COMMISSION TO THE EUROPEAN COUNCIL
AND THE EUROPEAN PARLIAMENT**

AN ENERGY POLICY FOR EUROPE

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TABLE OF CONTENTS

1.	The Challenges	3
1.1.	Sustainability	3
1.2.	Security of supply	3
1.3.	Competitiveness	4
2.	A Strategic Objective to guide Europe's Energy Policy	5
3.	The Action Plan.....	5
3.1.	The Internal Energy Market	6
3.2.	Solidarity between Member States and security of supply for oil, gas and electricity	10
3.3.	A long-term commitment to greenhouse gases reduction and the EU Emissions Trading System	11
3.4.	An ambitious programme of energy efficiency measures at Community, national, local and international level	11
3.5.	A longer term target for renewable energy	12
3.6.	A European Strategic Energy Technology Plan.....	14
3.7.	Towards a low CO ₂ fossil fuel future.....	15
3.8.	The future of nuclear	16
3.9.	An International Energy Policy that actively pursues Europe's interests.....	17
3.10	Effective monitoring and reporting	19
4.	Taking work forward.....	20

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AN ENERGY POLICY FOR EUROPE

"To these ends, the ministers have agreed on the following objectives:... putting more abundant energy at a cheaper price at the disposal of the European economies...".

The Messina declaration, 1955

1. THE CHALLENGES

Energy is essential for Europe to function. But the days of cheap energy for Europe seem to be over. The challenges of climate change, increasing import dependence and higher energy prices are faced by all EU members. Moreover the interdependence of EU Member States in energy, as in many other areas, is increasing – a power failure in one country has immediate effects in others.

Europe needs to act now, together, to deliver sustainable, secure and competitive energy. In doing so the EU would return to its roots. In 1952 with the Coal and Steel Treaty and 1957 with the Euratom Treaty, the founding Member States saw the need for a common approach to energy. Energy markets and geopolitical considerations have changed significantly since then. But the need for EU action is stronger than ever. Without this, the EU's objectives in other areas, including the Lisbon Strategy for growth and jobs and the Millennium Development Goals, will also be more difficult to achieve. A new European Energy Policy needs to be ambitious, competitive and long-term – and to the benefit of all Europeans.

1.1. Sustainability

Energy accounts for 80% of all greenhouse gas (GHG) emission in the EU¹; it is at the root of climate change and most air pollution. The EU is committed to addressing this - by reducing EU and worldwide greenhouse gas emissions at a global level to a level that would limit the global temperature increase to 2°C compared to pre-industrial levels. However, current energy and transport policies would mean EU CO₂ emissions would increase by around 5% by 2030 and global emissions would rise by 55%. The present energy policies within the EU are not sustainable.

1.2. Security of supply

Europe is becoming increasingly dependent on imported hydrocarbons. With "business as usual" the EU's energy import dependence will jump from 50% of total EU energy consumption today to 65% in 2030. Reliance on imports of gas is expected to increase from 57% to 84% by 2030, of oil from 82% to 93%.

This carries political and economic risks. The pressure on global energy resources is intense. The International Energy Agency (IEA) expects global demand for oil to grow by 41% by

¹ Source – European Environment Agency. Other data are European Commission unless otherwise stated

2030. How supply will keep up with this demand is unknown: the IEA in its 2006 World Energy Outlook stated that "the ability and willingness of major oil and gas producers to step up investment in order to meet rising global demand are particularly uncertain"². The risk of supply failure is growing.

In addition, the mechanisms to ensure solidarity between Member States in the event of an energy crisis are not yet in place and several Member States are largely or completely dependent on one single gas supplier.

At the same time, EU electricity demand is, on a business as usual scenario, rising by some 1.5% per year. Even with an effective energy efficiency policy, investment in generation alone over the next 25 years will be necessary in the order of €900 billion. Predictability and effective internal gas and electricity markets are essential to enable the necessary long term investments to take place and for user prices to be competitive. These are not yet in place.

1.3. Competitiveness

The EU is becoming increasingly exposed to the effects of price volatility and price rises on international energy markets and the consequences of the progressive concentration of hydrocarbons reserves in few hands. The potential effects are significant: if, for example, the oil price rose to 100 \$/barrel in 2030, the EU-27 energy total import bill would increase by around €170 billion, an annual increase of €350 for every EU citizen³. Very little of this wealth transfer would result in additional jobs in the EU.

Providing that the right policy and legislative frameworks are in place, the Internal Energy Market could stimulate fair and competitive energy prices and energy savings, as well as higher investment. However, all the conditions to achieve this do not yet exist. This prevents EU citizens and the EU economy from receiving the full benefits of energy liberalisation. A longer time horizon in the area of carbon constraints is required in order to promote the necessary investments in the electricity sector.

Boosting investment, in particular in energy efficiency and renewable energy should create jobs, promoting innovation and the knowledge-based economy in the EU. The European Union is already the global leader in renewable technologies, accounting for a turnover of €20 billion and employing 300 000 people⁴. It has the potential to lead the rapidly growing global market for low carbon energy technologies. In wind energy, for example, EU companies have 60% of the world market share. Europe's determination to lead the global fight against climate change creates an opportunity for us to drive the global research agenda. All options should be kept to ensure the development of emerging technologies.

At the same time, the social dimension of Europe's energy policy needs to be taken into account throughout all stages of designing and implementing the individual measures. While this policy should overall contribute to the growth and jobs in Europe on the long term, it may have a significant impact on some internationally traded products and processes in particular in the area of energy-intensive industries.

² IEA World Energy Outlook 2006.

³ Assumed dollar exchange rate of 1.25 \$ per € and compared with an oil price of 60 \$ (today's money) in 2030.

⁴ European Renewable Energy Council "Renewable Energy Targets for Europe: 20% by 2020".

2. A STRATEGIC OBJECTIVE TO GUIDE EUROPE'S ENERGY POLICY

The point of departure for a European energy policy is threefold: combating climate change, limiting the EU's external vulnerability to imported hydrocarbons, and promoting growth and jobs, thereby providing secure and affordable energy to consumers.

In the light of the many submissions received during the consultation period on its Green Paper⁵, in this Strategic Energy Review the Commission proposes that the European Energy Policy be underpinned by:

- an EU objective in international negotiations of 30% reduction in greenhouse gas emissions by developed countries by 2020 compared to 1990. In addition, 2050 global GHG emissions must be reduced by up to 50% compared to 1990, implying reductions in industrialised countries of 60-80% by 2050;
- an EU commitment now to achieve, in any event, at least a 20% reduction of greenhouse gases by 2020 compared to 1990.

These form a central part of the Commission Communication "*Limiting Climate Change to 2°C - Policy Options for the EU and the world for 2020 and beyond*"⁶.

Meeting the EU's commitment to act now on greenhouse gases should be at the centre of the new European Energy Policy for three reasons: (i) CO₂ emissions from energy make up 80 % of EU GHG emissions, reducing emissions means using less energy and using more clean, locally produced energy, (ii) limiting the EU's growing exposure to increased volatility and prices for oil and gas, and (iii) potentially bringing about a more competitive EU energy market, stimulating innovation technology and jobs.

Taken together, this strategic objective and the concrete measures set out below to make it a reality represent the core of a new **European Energy Policy**.

3. THE ACTION PLAN

To achieve the strategic energy objective set out above means transforming Europe into a highly energy efficient and low CO₂ energy economy, catalysing a **new industrial revolution**, accelerating the change to low carbon growth and, over a period of years, dramatically increasing the amount of local, low emission energy that we produce and use. The challenge is to do this in a way that maximises the potential competitiveness gains for Europe, and limits the potential costs.

Existing measures on areas such as renewable electricity, biofuels, energy efficiency and the Internal Energy Market have achieved important results but lack the coherence necessary to bring sustainability, security of supply and competitiveness. No one element of the policy provides all the answers – they must be taken together as a whole. Energy policy must be addressed by many different policy areas. For example, as mentioned above the social dimension of Europe's energy policy needs to be taken into account throughout all stages of

⁵ A European Strategy for Sustainable, Competitive and Secure Energy - COM(2006) 105, 8.3.2006; Commission Staff Working document, Summary report on the analysis of the debate on the green paper "A European Strategy for Sustainable, Competitive and Secure Energy" - SEC(2006) 1500.

⁶ Communication from the Commission to the Council and the European Parliament - COM(2007) 2.

designing and implementing the individual measures⁷ and it will be necessary to develop the further use of oceans and seas to promote the EU's energy goals, given their potential to support the generation of energy and to diversify energy transport routes and methods⁸. The first step is for Member States to endorse a strategic vision and an Action Plan for the next three years: with the explicit aim of moving towards an international alliance of developed countries at least with a view of reducing global Greenhouse gas emissions by 2020 by 30% and making a significant contribution to reducing the EU's greenhouse gas emissions by 2020 by 20%. This will be backed up with careful monitoring and reporting of progress, as well as the effective exchange of best practice and continued transparency - through the regular presentation by the Commission of an updated Strategic Energy Review.

The measures outlined below will not only put the EU on the path to becoming a low carbon knowledge-based energy economy, but will at the same time improve its security of supply and make a progressively more significant contribution to competitiveness.

3.1. The Internal Energy Market

A real Internal Energy Market is essential to meet all three of Europe's energy challenges:

- **Competitiveness:** a competitive market will cut costs for citizens and companies and stimulate energy efficiency and investment.
- **Sustainability:** A competitive market is vital to allow for the effective application of economic instruments, including the emissions trading mechanism to work properly. Furthermore, transmission system operators must have an interest in promoting connection by renewable, combined heat and power and micro generation, stimulating innovation and encouraging smaller companies and individuals to consider non-conventional supply.
- **Security of supply:** an effectively functioning and competitive Internal Energy Market can provide major advantages in terms of security of supply and high standards of public service. The effective separation of networks from the competitive parts of the electricity and gas business results in real incentives for companies to invest in new infrastructure, inter-connection capacity and new generation capacity, thereby avoiding black-outs and unnecessary price surges. A true single market promotes diversity.

The EC has already adopted a series of measures⁹ to create an Internal Energy Market intended to deliver real choice for all EU consumers, be they citizens or business, new business opportunities and more cross-border trade.

The Internal Energy Market Communication¹⁰ and the final Report on the Competition Sectoral Enquiry¹¹ demonstrate that the present rules and measures have not yet achieved

⁷ Communication on restructuring of 31 March 2005 - COM(2005) 120.

⁸ Communication from the Commission entitled: Towards a future maritime Policy for the Union: A European Vision for the Oceans and Seas - COM(2006) 275.

⁹ Including the second market opening Directives, the Regulations aimed at harmonising the technical standards necessary to make cross-border trade work in practice, and the Directives on security of supply.

¹⁰ Communication of the Commission to the European Parliament and the Council on prospects for the internal gas and electricity market - COM(2006) 841.

¹¹ Communication from the Commission "Sector Enquiry under Article 17 of Regulation (EC) No 1/2003 on the gas and electricity markets (final report)" - COM(2006) 851.

these objectives. There are signs that this lack of progress is leading Member States to impose generalised caps on electricity and gas prices. Depending on the level at which such price caps are set and whether they are generalised in nature, they can prevent the Internal Energy Market from functioning and suppress price signals that new capacity is needed, leading to underinvestment and future supply crunches. They can, under such circumstances make it harder for new entrants, including those offering clean energy, to enter the market.

In the light of the many submissions received during the Green Paper consultation period, the Commission considers that this situation cannot continue. A coherent series of measures now need to be taken with the objective of creating within three years a European Gas and Electricity Grid and truly competitive European-wide energy market.

In order to achieve this, the Commission has identified the following requirements:

3.1.1. Unbundling

The Internal Market Report and Sector enquiry show the danger of discrimination and abuse when companies control energy networks as well as production or sales, protecting national markets and preventing competition. Such a situation also creates a disincentive on vertically integrated companies from investing adequately in their networks, since the more they increase network capacity, the greater the competition that exists on their “home market” and the lower the market price.

The Commission considers that two options might be considered to redress this: a full Independent System Operator (where the vertically integrated company remains owner of the network assets and receives a regulated return on them, but is not responsible for their operation, maintenance or development) or ownership unbundling (where network companies are wholly separate from the supply and generation companies)¹².

Economic evidence shows that ownership unbundling is the most effective means to ensure choice for energy users and to encourage investment. This is because separate network companies are not influenced by overlapping supply/generation interests as regards investment decisions. It also avoids overly detailed and complex regulation and disproportionate administrative burdens.

The independent system operator approach would improve the status quo but would require more detailed, prescriptive and costly regulation and would be less effective in addressing the disincentives to invest in networks.

In addition, the provisions regarding the unbundling of distribution activities – which presently exempt distributors with less than 100 000 customers from most of the unbundling requirements – need to be re-examined.

3.1.2. Effective regulation

First of all, the levels of powers and independence of energy regulators need to be harmonized on the basis of the highest, not the lowest, common denominator in the EU.

¹² This already exists for electricity in the Denmark, Finland, Italy, the Netherlands, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden and The United Kingdom. And for gas in Denmark, the Netherlands, Portugal, Romania, Spain, Sweden and the United Kingdom. The unbundled TSO is also the owner of the network.

Secondly, they must be given not only the task of promoting the effective development of their national market, but also that of promoting the development of the Internal Energy Market.

In addition, the technical standards necessary for cross-border trade to function effectively need to be harmonised. Progress to date has fallen far short. The creation of the European Regulators' Group for Electricity and Gas (EREG) and the electricity and gas regulations, have not provided the governance required. Most of the relevant technical standards remain different in each Member State, making cross-border trade difficult and often impossible. Three main options merit consideration:

- **Gradually evolving the current approach:** reinforcing collaboration between national regulators by notably requiring Member States to give national regulators a Community objective, and introducing a mechanism whereby the Commission could review some decisions of national regulators which affect the Internal Energy Market¹³.
- **A European network of independent regulators (“EREG+”):** Under this mechanism, the role of EREG will be formalised, and it would be given the task to structure binding decisions for regulators and relevant market players, such as network operators, power exchanges or generators, on certain precisely defined technical issues and mechanisms relating to cross border issues. It would need the appropriate involvement of the Commission, where necessary, to ensure that due account was taken of the Community interest.
- **A new, single body at Community level** would be set up. It would in particular be granted the responsibility for adopting individual decisions for the EU electricity and gas market related to regulatory and technical issues relevant to making cross border trade work in practice¹⁴.

There is a relation between unbundling and regulation. Markets in which there is less than ownership unbundling require more detailed, complex and prescriptive regulation. In such circumstances national Regulators need in particular more intrusive and burdensome powers to prevent discrimination. However, disincentives to adequately invest in networks without ownership unbundling can not in any event be fully addressed by Regulators.

Of the three options, the Commission considers that the first, gradually developing the current approach, would not be sufficient, notably because progress would continue to be based on voluntary agreement between 27 national regulators which often have different interests. Thus, the minimum approach likely to make rapid and effective progress in harmonising the technical issues necessary to make cross-border trade work effectively would be the EREG+ approach.

¹³ As indicated above, this is based on the approach already used in the electronic communication sector and in relation to exemptions for third party access for new gas and electricity infrastructure.

¹⁴ Under the Draft Interinstitutional Agreement on the operating framework for the European regulatory agencies [COM(2005) 59], such a body may in particular be entrusted with the task of applying Community standards to specific cases, which includes the power to adopt individual decisions which are legally binding on third parties (Article 4).

In anticipation of a formal decision being taken and implemented, Regulators should be encouraged to work more closely together to use existing powers more effectively on a voluntary basis.

3.1.3. Transparency

Transparency is essential to allow the market to work properly. At present, Transmission System Operators provide varying levels of information, making some markets easier than others to compete in for new entrants. Furthermore, some regulators require generators to be more transparent regarding generation availability than others, which can help prevent price manipulation. Minimum requirements need to be established and to be respected by all EU companies, similar to that already adopted for telecommunications¹⁵.

3.1.4. Infrastructure

The Priority Interconnection Plan¹⁶ sets out five priorities:

- Identifying the most significant missing infrastructure up to 2013 and ensuring pan-European political support to fill the gaps.
- Appointing four European co-ordinators to pursue the four of the most important priority projects: the Power-Link between Germany, Poland and Lithuania; connections to off-shore wind power in Northern Europe; electricity interconnections between France and Spain; and the Nabucco pipeline, bringing gas from the Caspian to central Europe.
- Agreeing a maximum of 5 years within which planning and approval procedures must be completed for projects that are defined as being "of European interest" under Trans-European Energy Guidelines.
- Examining the need to increase funding for the Energy Trans-European networks, particularly to facilitate the integration of renewable electricity into the grid.
- Establishing a new Community mechanism and structure for Transmission System Operators (TSOs), responsible for co-ordinated network planning.

3.1.5. Network security

In order to increase the reliability of the EU's electricity system and prevent black-outs, recent experience has shown that common minimum and binding network security standards are necessary in the EU. The new Community mechanism and structure for Transmission System Operators should also be tasked with proposing common minimum security standards. These would become binding following approval by energy regulators.

3.1.6. Adequacy of electricity generation and gas supply capacity

During the next 25 years, Europe will need to invest €900 billion on new electricity generation. Gas remains a fuel of choice given its high efficiency, but even gas will need

¹⁵ Directive 2002/19/EC of the European Parliament and the Council on access for electronic communications.

¹⁶ Communication from the Commission to the European Parliament and the Council: Priority interconnection plan - COM(2006) 846.

€150 billion of investment on gas-fired power plant and an additional €220 billion on gas infrastructure. The overriding priority in terms of securing adequate new investment is a properly functioning Internal Energy Market, providing the correct investment signals. In addition, close monitoring of the demand/supply balance is also needed, to identify any potential shortfall. This will be a key role for the new Office of the Energy Observatory (see below).

3.1.7. Energy as a public service

Energy is essential for every European. Existing European legislation already requires the respect for Public Service Obligations. But the EU needs to go further in tackling energy poverty. The Commission will develop an Energy Customers' Charter with four key goals:

- assist in establishing schemes to help the most EU vulnerable citizens deal with increases in energy prices;
- improve the minimum level of information available to citizens to help them choose between suppliers and supply options;
- reduce paper work when customers change supplier; and
- protect customers from unfair selling practices.

3.2. Solidarity between Member States and security of supply for oil, gas and electricity

The Internal Energy Market increases the interdependence of Member States in energy supply for both electricity and gas. Even with the targets on energy efficiency and renewables, oil and gas will continue to meet over half the EU's energy needs, with import dependence high in both sectors (over 90 % for oil and some 80% for gas in 2030). Electricity generation will be heavily dependent on gas. Without a significant technology breakthrough, oil will continue to dominate transport. Therefore, security of supply of these fuels will continue to be paramount to the EU economy.

The EU has effective energy relationships with traditional gas suppliers from inside the European Economic Area (EEA), notably Norway and outside, Russia and Algeria. The EU is confident that these relationships will strengthen in the future. Nevertheless, it remains important for the EU to promote diversity with regard to source, supplier, transport route and transport method. In addition, effective mechanisms need to be put into place to ensure solidarity between Member States in the event of an energy crisis. This is particularly important given that a number of Member States are highly or completely reliant on a single gas supplier.

Energy security should be promoted in different ways:

- Measures are needed to assist Member States that are overwhelmingly dependent on one gas supplier to diversify. The Commission will monitor implementation of the recently transposed Gas Security Directive¹⁷ and assess its effectiveness. Projects should be

¹⁷ Directive 2004/67/EC of the European Parliament and the Council of 26 April 2004 concerning measures to safeguard security of natural gas supply (OJ L 127, 29.4.2004, p. 92).

developed to bring gas from new regions, to set up new gas hubs in central Europe and the Baltic countries, to make better use of strategic storage possibilities, and to facilitate the construction of new liquid natural gas terminals. Ways to strengthen existing crisis solidarity mechanisms such as the Energy Correspondents Network and the Gas Co-ordination Group should also be examined. In addition, strategic gas stocks would help the security of gas supply. The considerable new investments in new storage and pipeline capacity that would be needed to ensure a higher degree of security will have to be balanced against the costs this will imply for the consumers.

- The EU's strategic oil stocks mechanism, effectively co-ordinated with stocks of other OECD countries through the IEA, has worked well and should be maintained. The manner in which the EU manages its contribution to this mechanism could however be improved. Reporting requirements on Member States should be reinforced, there should be more analysis of the sufficiency of the stocks, and there should be better coordination if the IEA calls for stocks to be released. The Commission will make an analysis of these issues in 2007.
- Electricity interconnections (see 3.1.4 above) and binding, enforceable reliability standards will form a third element of this approach. This will in particular help to address concerns about security of electricity supply.

3.3. A long-term commitment to greenhouse gases reduction and the EU Emissions Trading System

The EU traditionally favours the use of economic instruments to internalise external costs as the allow the market to determine how to react most efficiently and with limited costs. More particularly, in its Communication *Limiting Climate Change to 2°C - Policy Options for the EU and the world for 2020 and beyond*, the Commission has set out how the emissions trading mechanism is and must remain a key mechanism for stimulating reductions in carbon emissions and how it could be used as a basis for international efforts to fight climate change. The Commission is reviewing the EU ETS to ensure that emissions trading reaches its full potential: this is critical to creating the incentives to stimulate changes in how Europe generates and uses its energy.

3.4. An ambitious programme of energy efficiency measures at Community, national, local and international level

For Europe's citizens, energy efficiency is the most immediate element in a European Energy Policy. Improved energy efficiency has the potential to make the most decisive contribution to achieving sustainability, competitiveness and security of supply.

On 19 October 2006 the Commission adopted the Energy Efficiency Action Plan¹⁸, containing measures that would put the EU well on the path to achieving a key goal of reducing its global primary energy use by 20% by 2020. If successful, this would mean that by 2020 the EU would use approximately 13% less energy than today, saving €100 billion and around 780 millions tonnes of CO₂ each year. However, this will require significant efforts both in terms of behavioural change and additional investment.

¹⁸ Action Plan for Energy Efficiency: Realising the Potential - COM(2006) 545, 19.10.2006.

Key measures include:

- Accelerating the use of fuel efficient vehicles for transport, making better use of public transport; and ensuring that the true costs of transport are faced by consumers¹⁹;
- Tougher standards and better labelling on appliances;
- Rapidly improving the energy performance of the EU's existing buildings and taking the lead to make very low energy houses the norm for new buildings;
- Coherent use of taxation to achieve more efficient use of energy;
- Improving the efficiency of heat and electricity generation, transmission and distribution;
- A new international agreement on energy efficiency to promote a common effort.

A new international agreement on energy efficiency

This could bring the OECD and key developing countries (such as China, India and Brazil) together to restrict the use of products failing to meet minimum standards and agree common approaches to saving energy. The EU could formally table a proposal in 2007 which could then be discussed and taken forward during a major international conference on energy efficiency during the German Presidency of the G8. The aim could be to sign the agreement during the Beijing Olympic Games. The potential energy saving and CO₂ reduction is enormous - improved energy efficiency alone could cut, according to the IEA, around 20% of current global CO₂ emissions.

3.5. A longer term target for renewable energy

In 1997, the European Union started working towards a target of a 12% share of renewable energy in its overall mix by 2010, a doubling of 1997 levels. Since then, renewable energy production has increased by 55%. Nevertheless the EU is set to fall short of its target. The share of renewable energy is unlikely to exceed 10% by 2010. The main reason for the failure to reach the agreed targets for renewable energy - besides the higher costs of renewable energy sources today compared to “traditional” energy sources - is the lack of a coherent and effective policy framework throughout the EU and a stable long-term vision. As a result, only a limited number of Member States have made serious progress in this area and the critical mass has not been reached to shift niche renewables production into the mainstream.

The EU needs a step change to provide a credible long term vision of the future of renewable energy in the EU, building on the existing instruments, notably the renewable Electricity Directive. This is essential to realise present targets²⁰ and trigger further investment, innovation and jobs. The challenge for renewables policy is to find the right balance between installing large scale renewable energy capacity today, and waiting until research lowers their cost tomorrow. Finding the right balance means taking the following factors into account:

¹⁹ See also *Keep Europe moving -Sustainable mobility for our continent - Mid-term review of the European Commission's 2001 Transport White Paper* - COM(2006) 314, 22.6.2006.

²⁰ Communication from the Commission to the European Parliament and the Council: Follow-up actions of the Green Paper: Report on progress in renewable electricity - COM(2006) 849.

- Using renewable energy today is generally more expensive than using hydrocarbons, but the gap is narrowing – particularly when the costs of climate change are factored in;
- Economies of scale can reduce the costs for renewables, but this needs major investment today;
- Renewable energy helps to improve the EU's security of energy supply by increasing the share of domestically produced energy, diversifying the fuel mix and the sources of energy imports and increasing the proportion of energy from politically stable regions as well as creating new jobs in Europe;
- Renewable energies emit few or no greenhouse gases, and most of them bring significant air quality benefits.

In the light of the information received during the public consultation and the impact assessment, the Commission proposes in its Renewable Energy Roadmap²¹ a binding target of **increasing the level of renewable energy in the EU's overall mix from less than 7% today to 20% by 2020**. Targets beyond 2020 would be assessed in the light of technological progress.

How do we get there?

Meeting the 20% target will require a massive growth in all three renewable energy sectors: electricity, biofuels and heating and cooling. But in all sectors, the policy frameworks set up in particular Member States have achieved results which show how this is possible.

Renewables has the potential to provide around a third of EU electricity by 2020. Wind power provides approximately 20% of electricity needs in Denmark, today, as well as 8% in Spain and 6% in Germany. Costs in other new technologies - photovoltaic, solar thermal power, and wave & tide, are projected to decrease from currently high levels.

In the heating and cooling sector, progress will have to come from a number of technologies. Sweden, for example, has over 185 000 installed geothermal heat pumps. Germany and Austria have led the way on solar heating. If other Member States matched these levels, the share of renewable energy in heating and cooling would jump by 50%.

As for biofuels, Sweden has already achieved a market share of 4% of the petrol market for bioethanol, and Germany is the world leader for bio-diesel, with 6% of the diesel market. Biofuels could make up to 14% of transport fuels by 2020.

This 20% target is truly ambitious and will require major efforts by all Member States. The contribution of each Member State to achieving the Union's target will need to take into account different national circumstances and starting points, including the nature of their energy mix. Member State should have the flexibility to promote the renewable energies most suited to their specific potential and priorities. The way in which Member States will meet their targets should be set out in National Action Plans to be notified to the Commission. The Plans should contain sectoral targets and measures consistent with achieving the agreed overall national targets. In practice, in implementing their Plans Member States will need to

²¹ Communication from the Commission to the European Parliament and the Council: Renewable Energy Roadmap: Renewable Energies in the 21st century; building a sustainable future - COM(2006) 848.

set their own specific objectives for electricity, biofuels, heating and cooling, which would be verified by the Commission to ensure that the overall target is being met. The Commission will set out this architecture in a new renewables legislative package in 2007.

A particular feature of this framework is the need for a minimum and coordinated development of biofuels throughout the EU. While biofuels are today and in the near future more expensive than other forms of renewable energy, over the next 15 years they are the only way to significantly reduce oil dependence in the transport sector. In its Renewable Energy Roadmap and Biofuels Progress Report²², the Commission therefore proposes to set a binding minimum target for biofuels of 10% of vehicle fuel by 2020 and to ensure that the biofuels used are sustainable in nature, inside and outside the EU. The EU should engage third countries and their producers to achieve this. In addition, the 2007 renewables legislative package will include specific measures to facilitate the market penetration of both biofuels and heating & cooling from renewables. The Commission will also continue and intensify the use of renewable energy through other policies and flanking measures with the aim of creating a real internal market for renewables in the EU.

How much will it cost?

To achieve a 20% share for renewables will result in an additional average annual cost of approximately € 18 billion – around 6% extra on the EU's total expected energy import bill in 2020. But this assumes oil prices of \$ 48/barrel by 2020. If these rose to \$ 78/barrel, the average annual cost would fall to € 10.6 billion. If a carbon price of more than € 20 is factored in, the 20% would cost practically no more than relying on “traditional” energy sources, but create many jobs in Europe and develop new, technology driven European companies.

3.6. A European Strategic Energy Technology Plan

Europe has two key objectives for energy technology: to lower the cost of clean energy and to put EU industry at the forefront of the rapidly growing low carbon technology sector. To meet these objectives, the Commission will present a European Strategic Energy Technology Plan²³ in 2007. This Plan will need a long term vision to match the long term challenge of moving towards a low carbon energy system in a competitive manner:

- By 2020, technologies will have to make the 20% renewable target a reality by permitting a sharp increase in the share of lower cost renewables (including the roll-out of off-shore wind and 2nd generation biofuels);
- By 2030, electricity and heat will increasingly need to be produced from low carbon sources and extensive near-zero emission fossil fuel power plants with CO₂ capture and storage. Transport will need to increasingly adapt to using 2nd generation biofuels and hydrogen fuel cells;
- For 2050 and beyond, the switch to low carbon in the European energy system should be completed, with an overall European energy mix that could include large shares for

²² Communication from the Commission to the European Parliament and the Council: Biofuels progress report - COM(2006) 845.

²³ See also the Communication from the Commission : Towards a European Strategic Energy Technology Plan - COM(2006) 847.

renewables, sustainable coal and gas, sustainable hydrogen, and, for those member states that want, Generation IV fission power and fusion energy.

This is a vision of Europe with a thriving and sustainable energy economy, that has grasped the opportunities behind the threats of climate change and globalisation, gained world leadership in a diverse portfolio of clean, efficient and low-emission energy technologies and become a motor for prosperity and a key contributor to growth and jobs. To achieve this vision the European Union must act jointly and urgently, agreeing and implementing a European Strategic Energy Technology Plan accompanied with realistic resources. Under the 7th Framework Research Programme, annual spending on energy research over the next 7 years at EU level will increase by 50%, but even this will not provide the progress needed. The Technology Plan must be ambitious; it needs to better coordinate spending at Community and national level, and set clear targets with precise roadmaps and milestones. It should use all available EU tools, including Joint Technology Initiatives and the European Institute for Technology.

Priorities of such a targeted initiative could include:

- More energy efficient buildings, appliances, equipment, industrial processes and transport systems;
- Developing biofuels, in particular second generation biofuels, to become fully competitive alternatives to hydrocarbons;
- Getting large scale offshore wind competitive within the short term and paving the way towards a competitive European offshore supergrid;
- Getting photovoltaic electricity competitive to harness solar energy;
- Using fuel cell and hydrogen technologies to exploit their benefits in decentralised generation and transport;
- Sustainable coal and gas technologies, particularly carbon capture and storage (see below);
- The EU should maintain its technological lead in fourth generation fission nuclear reactors and future fusion technology to boost the competitiveness, safety and security of nuclear electricity, as well as reduce the level of waste.

These sectoral objectives should be underpinned by specific milestones and an increase in energy research spending. The Commission will propose a European Strategic Energy Technology Plan for the 2008 Spring European Council.

3.7. Towards a low CO₂ fossil fuel future

Coal and gas account for 50% of the EU's electricity supply and are certain to remain an important part of our energy mix. Long-term reserves are substantial. But coal produces roughly twice the emissions of CO₂ compared to gas. Much cleaner coal generation and CO₂ abatement will be necessary. Furthermore, developing clean coal and carbon capture and storage is crucial at the international level: the IEA expects twice more electricity to be produced from coal by 2030. That would release around 5 bn tonnes of CO₂, representing 40% of the expected increase in global energy-related CO₂ emissions. In addition to the

European Strategic Energy Technology Plan, other action will be required to catalyse international research and action on CO₂ capture and storage.

To provide global leadership, the EU must provide a clear vision for the introduction of CO₂ capture and storage in the EU, establish a favourable regulatory framework for its development, invest more, and more effectively, in research, as well as taking international action. The EU Emissions Trading System will also need to incorporate capture and storage in the future.

As set out in its Sustainable Power Generation Communication²⁴, the Commission will in 2007 start work to:

- Design a mechanism to stimulate the construction and operation by 2015 of up to 12 large-scale demonstrations of sustainable fossil fuels technologies in commercial power generation in the EU²⁵.
- Provide a clear perspective when coal- and gas-fired plants will need to install CO₂ capture and storage. On the basis of existing information, the Commission believes that by 2020 all new coal-fired plants should to be fitted with CO₂ capture and storage and existing plants should then progressively follow the same approach. Whilst it is too early to reach a definite view on this, the Commission hopes to be able to make firm recommendations as soon as possible.

3.8. The future of nuclear

Currently around one third of the electricity and 15% of the energy consumed in the EU comes from nuclear which is one of the largest sources of carbon dioxide (CO₂) free energy in Europe. Nuclear power has been one of the ways of limiting CO₂ emissions within the EU and, for those Member States that wish, is also likely to form part of an energy scenario where significant emission reductions are going to be required in the coming decades.

Nuclear power is less vulnerable to fuel price changes than coal or gas-fired generation, as uranium represents a limited part of the total cost of generating nuclear electricity and is based on sources which are sufficient for many decades and widely distributed around the globe.

As can be seen from the table attached to this document which outlines the advantages and disadvantages of different sources of energy, nuclear energy is one of the cheapest sources of low carbon energy that is presently produced in the EU and also has relatively stable costs²⁶. The next generation of nuclear reactors should reduce these costs further.

²⁴ Communication from the Commission : Sustainable Power Generation from fossil fuels: aiming at near zero emission by 2020 - COM(2006) 843.

²⁵ The European Technology Platform for Zero-emission fossil fuels power plant (ZEP TP) includes in the Key Recommendations of its Strategic Research Agenda (SRA) adopted in late 2006 a call for early implementation of 10-12 integrated, large-scale CCS demonstration power plants projects in Europe.

²⁶ According to the IEA 2006 World Energy Outlook "new nuclear power plants could produce electricity at 4.9 to 5.7 \$ cents per kWh [3.9 to 4.5 Euro cents at mid November 2006 exchange rates] if construction and operating risks are mitigated" and that is, at " a price of about 10 \$ per tonne of CO₂ emitted makes nuclear competitive with coal-fired power stations".

It is for each Member State to decide whether or not to rely on nuclear electricity. However, in the event that the level of nuclear energy reduces in the EU, it is essential that this reduction is phased in with the introduction of other supplementary low-carbon energy sources for electricity production; otherwise the objective of cutting GHG emissions and improving security of energy supply will not be met.

In the current energy context, the IEA expects the world-wide use of nuclear power to increase from 368 GW in 2005 to 416 GW in 2030. There are therefore economic benefits in maintaining and developing the technological lead of the EU in this field.

As set out in a new Nuclear Illustrative Programme²⁷, at EU level, the role should be to develop further, in conformity with Community law, the most advanced framework for nuclear energy in those Member States that choose nuclear power, meeting the highest standards of safety, security and non-proliferation as required by the Euratom Treaty. However, nuclear power also raises important issues regarding waste and decommissioning so nuclear waste management and decommissioning should also be included in future Community work. The EU should also continue their efforts to ensure that such high standards are observed internationally. In order to make progress on this the Commission proposes to establish an EU High Level Group on Nuclear Safety and Security with the mandate of progressively developing common understanding and, eventually, additional European rules, on nuclear security and safety.

3.9. An International Energy Policy that actively pursues Europe's interests

The EU cannot achieve its energy and climate change objectives on its own. The EU in the future will account for only 15% of new CO₂ emissions. Furthermore by 2030, with the new objectives, the EU will consume less than 10% of the world's energy. So the challenges of security of energy supply and climate change cannot be overcome by the EC or its Member States acting individually. It needs to work with both developed and developing countries, energy consumers and producers, to ensure competitive, sustainable and secure energy.

The EU and Member States must pursue these goals with a common voice, forging effective partnerships to translate these into a meaningful external policy. Indeed, energy must become a central part of all external EU relations; it is crucial to geopolitical security, economic stability, social development and international efforts to combat climate change. The EU must therefore develop effective energy relations with all its international partners, based on mutual trust, cooperation and interdependence. This means relations broadened in geographical scope, and deepened in nature on the basis of agreements with substantial energy provisions.

The European Council has endorsed the vision of a long term framework for the external energy dimension set out jointly by the Commission and the Council²⁸ and has agreed to establish a network of energy security correspondents which will provide an early warning system and enhance the EU's capability to react in times of external energy security pressure.

²⁷ Nuclear Illustrative Programme - COM(2006) 844.

²⁸ European Commission/High Representative paper *An external policy to serve Europe's energy interests*, June 2006 S160/06; followed by *External Energy Relations - from principles to action* - COM(2006) 590.

The EU already speaks with one voice in negotiations of international agreements, notably in the field of trade. Ongoing and future international agreements, whether bilateral or with several countries at a time, can be used more effectively to establish legally binding commitments. These can extend to the reciprocal liberalisation of trading conditions and investment in upstream and downstream markets, and to the grant of access to pipelines by countries situated along transit and transport chains. Equally, they can be used to promote international trade in sustainably produced biofuels or environmental goods, or to the international pricing of carbon emissions.

The EU must therefore now follow through these principles into action. The first step towards "speaking with one voice" is to set out clear objectives, and the means to coordinate effectively. The regular Strategic Energy Reviews will provide the overall framework for frequent discussion of external energy issues in the EU institutions. The priorities to be pursued by an effective external EU Energy Policy during the next three years are:

- The EC and its Member States should be a key driver in the design of international agreements, including the future of the Energy Charter Treaty and the post-2012 climate regime.
- EU energy relations with its neighbours are fundamental to European security and stability. The EU should aim to build up a wide network of countries around the EU, acting on the basis of shared rules or principles derived from the EU energy policy.
- To enhance relations with our external energy suppliers, further developing comprehensive partnerships based on mutual interest, transparency, predictability and reciprocity.
- To continue to develop closer energy relations with other major consumers, in particular through IEA and G8 or through intensified bilateral cooperation.
- Develop the use of financial instruments, via enhanced co-operation with the EIB and EBRD and the establishment of a Neighbourhood Investment Fund, to enhance the EU's energy security.
- To improve the conditions for investments in international projects, working for example to secure a clearly defined and transparent legal framework and appointing European coordinators to represent EU interests in key international projects.
- Promote non proliferation, nuclear safety and security, in particular through a reinforced cooperation with the International Atomic Energy Agency.

The detailed manner in which these objectives will now be pursued, as discussed in detail by the European Council at the Lahti Summit and the December 2006 European Council is contained in Annex to this Review. In addition, however, the Commission considers that two additional priority actions should now be pursued:

- A comprehensive Africa-Europe Energy partnership. The importance of Africa as an energy supplier has increased greatly in recent years, but its potential is still greater. The dialogue should include security of supply, technology transfer in renewable energy, sustainable exploitation of resources, transparency of energy markets and respect for good governance. The dialogue should be launched through a joint event at the highest level.

- As already mentioned above, an international agreement on energy efficiency.

3.9.1. *Integrating Europe's Energy and Development Policies: a win-win game*

High energy prices are particularly damaging for developing countries. Whilst a few developing countries might benefit as producer, others can find the increased costs of energy imports outstripping their development aid receipts²⁹. Africa and other developing regions have a vital interest, like Europe, to boost diversification and energy efficiency – this can make a major contribution to the Millennium Development Goals. The EU is therefore committed to support developing countries in promoting sustainable and secure energy supply and use.

To deliver on the above commitment, the EU should focus on the delivery of affordable, reliable and sustainable energy services to the poor, notably from renewable sources as well as for the development of clean and efficient technologies for gas and oil production. Africa offers a unique opportunity to install renewable energy technology in a competitive manner. It can by-pass the need to build expensive transmission grids and "leap-frog" to a new generation of clean, local low carbon energy sources and technologies – as already seen for mobile telecommunications. This is a real "win-win" opportunity, increasing the penetration of clean renewable energy and bringing electrification to some of the world's poorest citizens. A special effort will be needed in Sub-Saharan Africa, where rates of access to electricity are the lowest in the world.

The EU will also leverage the different instruments at its disposal to this end: the 10th European Development Fund, the EU-Africa Partnership on Infrastructure which addresses regional projects on the generation and transmission of electricity, the ACP-EU Energy Facility, and the EC COOPENER programme and its successor as well as the EUROSOLAR programme for Latin America.

3.10. **Effective monitoring and reporting**

Monitoring, transparency and reporting will be essential elements in progressively developing an effective European energy policy. The Commission proposes to establish an **Office of the Energy Observatory** within the Directorate General for Energy and Transport. This Office should undertake core functions regarding Europe's energy demand and supply, notably increasing transparency regarding the future investment needs in the EU for electricity and gas infrastructure and generation facilities and, via benchmarking and the exchange of best practice, the success of Member States in ensuring that their energy mix evolves in a manner that contributes effectively to the EU's energy goals.

The Commission will set out the specific responsibilities of the Observatory and propose in 2007 a legal base for financing its activities. In doing so it will examine and streamline existing energy related information and reporting obligations upon the Commission and Member States.

²⁹ 137 billion US\$ annually for developing oil importers against an ODA of 84 billion US\$ in 2005, net of additional debt relief. See "The Vulnerability of African Countries to Oil Price Shocks: Major factors and Policy Options. The Case of Oil Importing Countries". ESMAP Report 308/05, World Bank, August 2005.

4. TAKING WORK FORWARD

This Strategic Review has set out a set of policies required to achieve the goals of sustainable, secure and competitive energy. The first step is to secure clear decisions from the European Council and the European Parliament on the strategic approach, an Action Plan to enable the EU to achieve ambitious, broad and long term targets. Future Strategic Reviews can help the EU refine and update its Action Plan to take account of change – most obviously, technological advance and common international action to address climate change. The pursuit of reduced emissions in Europe and worldwide is indivisible from the European Energy Policy.

Were the EU to succeed in meeting the specific objectives proposed regarding energy efficiency and renewables, this would put it on track to meet the 2020 greenhouse gas reduction of 20 %, and provide a springboard to achieve dramatic reductions by 2050 objectives. Determined action now will mean progress towards stabilising our import dependence, timely investment, new jobs and a technological lead for Europe in low carbon technologies. **The EU would have set the pace for a new global industrial revolution.**

The Commission therefore calls on the European Council and Parliament to:

- endorse an EU objective in international negotiations of 30% reduction in greenhouse gas emissions by developed countries by 2020 compared to 1990;
- endorse already now an EU commitment to achieve, in any event, at least a 20% reduction of greenhouse gases by 2020 compared to 1990;
- confirm that additional measures are necessary to make the potential benefits of the **Internal Electricity and Gas Markets** a reality for all EU citizens and businesses and specifically:
 - Commit to further unbundling to deliver greater competition, increased investment and more choice for energy users, through ownership unbundling, or through a full Independent System Operator. In the light of the evidence the Commission considers that ownership unbundling is the most effective means to ensure choice for energy users and to encourage investment. On the basis of the conclusions of the European Council of 9 March and the position of the European Parliament, the Commission will come forward swiftly with a legislative proposal;
 - Ensure effective regulation in every Member State through the harmonisation of the powers and independence of energy regulators based the highest common denominator in the EU and tasking regulators with the development of the Internal Energy Market as well as the effective development of national markets;
 - Accelerate the harmonisation of the technical standards necessary to enable cross-border trade to work effectively, and to ensure the promotion of the European market by establishing a new single body at EU level or, at a minimum, through a European network of independent regulators which would need to take due account of the European interest and have the appropriate involvement of the Commission;

- Establish in 2007 a new Community mechanism and structure for Transmission System Operators, responsible for co-ordinated network planning, reporting to national regulators and the Commission. This should also be responsible for proposing minimum network security standards, which once approved by Regulators and the Commission, be proposed as legally binding;
- Endorse the Commission tabling in 2007 minimum standards regarding transparency;
- Welcome a new Customers' Energy Charter;
- Make further progress in realising the construction of essential new interconnectors. Confirm the need to appoint European co-ordinators to pursue the most problematic priority projects and invite the Commission to table, in 2007, a formal legislative proposal defining a maximum of 5 years within which planning and approval procedures must be completed for projects of European interest;
- Endorse the need to make further progress in ensuring solidarity between Member States in the event of an energy crisis or a disruption in supplies. Effective mechanisms need to be put in place to this end. Welcome the Commission's intention to bring forward in 2007 a Communication on strategic stocks with, where appropriate, reinforced measures;
- Underline the priority that the EU strengthens its efforts to get global action to combat climate change. Welcome the Commission's intention to take all opportunities of bilateral and multilateral international negotiations to promote the fight against climate change, to coordinate energy policies and to strengthen the cooperation on clean technologies;
- Endorse the objective of saving 20% of the EU's energy consumption in a cost-efficient manner by 2020 as presented in the Commission's Energy Efficiency Action Plan, and welcome the Commission's intention to roll out concrete measures to make this a reality, notably to:
 - establish and update on a regular basis, minimum efficiency requirements for energy-using equipment;
 - realise further energy savings in buildings, utilising and developing the framework provided by the Directive on the Energy Performance of Buildings;
 - exploit the significant energy efficiency potential in transportation, using a variety of measures including legislation as necessary;
 - Improve the energy-efficient and energy saving behaviour of all energy consumers, including by demonstrating the benefits of available energy efficient technology and behaviour;
 - continue to improve efficiency in energy generation, in particular by promoting high efficiency combined heat and power technologies;
- Endorse the binding targets of 20% for the share of renewable energy in overall EU energy consumption by 2020 and 10% minimum biofuels. Invite the Commission to table a new

Directive to put this into practice during 2007 specifying their national targets and the procedure for developing National Action Plans to meet them;

- Endorse the need for an ambitious and targeted European Strategic Energy Technology Plan and welcome the Commission's intention to formally propose such a Plan in 2007;
- Confirm the priority of making rapid progress in providing a clear perspective when coal- and gas-fired plants will need to install CO₂ capture and storage in the EU and establishing a mechanism to stimulate the construction and operation by 2015 of up to 12 large-scale demonstrations of sustainable fossil fuels technologies in commercial power generation in the EU;
- Welcomes the Commission's intention to establish an EU High Level Group on Nuclear Safety and Security with the mandate of progressively developing common understanding and, eventually, additional European rules on nuclear security and safety to support the efforts of those Member States that so choose to continue to rely on nuclear power;
- Confirm the importance of “speaking with one voice” on international energy issues. In addition to the need to now pursue in practice conclusions resulting from at the Lahti Summit and the December 2006 European Council on this issue, (i) endorse the proposal to develop a comprehensive Africa-Europe Energy partnership and welcome the Commission's initiative to launch this through a joint event at the highest level in 2007 and (ii) welcome the objective of concluding an international agreement on energy efficiency and the Commission's intention to table the basis of such an agreement during the first part of 2007 for consideration by the Council and Parliament;
- use international negotiations to encourage sustainable methods of production and to promote international trade in environmental and energy efficient goods and services;
- Welcome the Commission's intention to put forward a new Strategic Energy Review every 2 years and to propose in 2007, a formal legal base for financing the work of an Office of the Energy Observatory within the Commission to coordinate and improve transparency on EU energy markets.

Annex 1: EU International Energy Policy Priorities.

Annex 2: The advantages and disadvantages of different sources of electrical energy, based on current oil, gas and coal prices.

Annex 3: The advantages and disadvantages of different energy sources for heating.

Annex 4: The advantages and disadvantages of different energy sources for road transport.

Sources for the figures contained in the annexes can be found in the Commission's Staff Working Document: EU Energy Policy Data³⁰.

³⁰ SEC(2007) 12, web page: http://ec.europa.eu/energy/energy_policy/index_en.htm

Annex 1

EU International Energy Policy Priorities

The priorities to be pursued by a external EU Energy Policy during the next three years are:

- Driving forward international agreements, including the post-2012 climate regime, the extension of emissions trading to global partners, the future of the Energy Charter Treaty and the development and deployment of clean and renewable energy technologies. This means stepping up coordination between the EU and the Member States in international fora and improving collaboration with the International Energy Agency. The EU shall also be involved in multilateral initiatives such as the World Bank Global Gas Flaring Reduction Partnership and the Extractive Industries Transparency Initiative. In order to enhance further coherence the EU should also strive where appropriate for membership in relevant international organisations.
- Building up energy relations with the EU's neighbours, following up the Commission's recent proposal to strengthen the European Neighbourhood Policy (ENP)³¹ also in the field of energy, with a possible EU-ENP energy Treaty with in the long run, possibly, all of our relevant neighbours. The Energy Community Treaty already acts as the basis for an emerging regional energy market, and should seek to gradually extend beyond the EU and the Western Balkans to incorporate neighbours like Moldova, Norway, Turkey and Ukraine Enhanced energy relationships with Egypt and other Mashrek/Maghreb energy supplier and transit countries need to be developed, as well as with Libya. Both Norway and Algeria deserve special attention and tailor-made relations.
- To reduce the threat of possible disruptions or physical destruction of critical energy infrastructure beyond the EU borders through an exchange of best practice with all relevant EU partners and international organizations based on the actions for the internal infrastructure outlined in the Commission's recent Communication on a European Program for Critical Infrastructure Protection.
- Enhancing relations with Russia through the negotiation of a new robust, comprehensive framework agreement, including a fully-fledged energy partnership benefiting both sides and that creates the conditions necessary for new investments. This should emphasize the mutual long-term benefits to both Russia and the EU and be based on market principles and those of the Energy Charter Treaty and draft Transit Protocol.
- Deepening dialogue and relations with key energy producers and transit countries, whether through OPEC and the Gulf Cooperation Council or fully implementing the Memoranda of Understanding with Azerbaijan and Kazakhstan and moving on to establish new ties with other important Central Asian producers like Turkmenistan and Uzbekistan. In addition, it is imperative to facilitate the transport of the Caspian energy resources to the EU. The Commission will also present a Communication on the Cooperation with the Black Sea Council in Spring 2007. This aspect of the strategy should also look further afield to maximise the geographical diversification of EU energy supplies to areas like Latin America and the Caribbean. It should also look to new energy sources, developing a

³¹ Communication from the Commission to the Council and European Parliament on strengthening the European Neighbourhood Policy - COM(2006) 726, 4.12.2006.

dialogue with Brazil to include biofuels - and organizing in 2007 an international conference on biofuels.

- Developing a new Africa-Europe Energy partnership. The importance of Africa as an energy supplier is still growing, and relations merit a comprehensive dialogue to include security of supply, technology transfer in renewable energy, sustainable exploitation of resources, transparency of energy markets and respect for good governance. The dialogue should be launched through a joint event at the highest level.
- Enhancing relations with other major energy consumers. In particular, the scope of relations with partners like the US should continue to cover areas like promoting open and competitive global energy markets, energy efficiency, regulatory cooperation and research. The steps already taken with China should be developed with the focus on advanced “near-zero-emissions” clean coal technologies, as well as energy efficiency, savings and renewables. A similar approach should be developed with India.
- Promoting non proliferation, nuclear safety and security, in particular through a reinforced cooperation with the International Atomic Energy Agency and through the new Instrument for Nuclear Safety Cooperation.

To pursue these goals means redefining relations with these partners to put energy centre stage. In addition to promoting EU energy goals through dialogue and international negotiation, a variety of instruments at the EU's disposal should be used to best effect, which include:

- In trade negotiations, the EU already speaks with one voice and competence is well established. International trade and investment agreements, whether negotiated bilaterally or with several countries at a time, can be used more effectively to establish legally binding instruments. They can help to create the conditions necessary for increased investment, more sustainable production and competition. Armed with the right instruments and mandates, the EU will, for example, be able to better pursue the reciprocal liberalisation of investment and trading conditions to upstream and downstream markets, as well as possibly access to pipelines. The same applies to the promotion of international pricing of carbon emissions or trade in biofuels.
- Improving cooperation with the EIB and EBRD to use financial instruments to back up energy partnerships with concrete actions by financing important projects such as the Trans-Caspian energy corridor or the Sub Saharan–Maghreb–EU projects. Energy projects could be an important element in the proposed Neighbourhood Investment Fund, designed to leverage of four to five times the amount of grant funding available under the European Neighbourhood Policy Instrument.
- Promoting improved conditions for investments in international projects, with a clearly defined and transparent legal framework and with the support of European coordinators. As a first step, a European Co-coordinator should be appointed for the Nabucco gas pipeline from the Caspian basin to Austria and Hungary. Options for the future could include appointing co-coordinators for projects to bring energy supplies from partners such as Turkey, Central Asia and North Africa.

Annex 2: The advantages and disadvantages of different sources of electrical energy

Energy sources	Technology considered for the cost estimate	2005 Cost (€/ MWh)	Projected Cost 2030 (€ / MWh with €20-30/tCO2)	GHG emissions (Kg CO2eq/MWh)	EU-27 Import dependency		Efficiency	Fuel price sensitivity	Proven reserves / Annual production
		Source IEA			2005	2030			
Natural gas	Open cycle gas turbine	45 – 70	55 - 85	440	57%	84%	40%	Very high	64 years
	CCGT (Combined Cycle Gas Turbine)	35 - 45	40 - 55	400			50%	Very high	
Oil	Diesel engine	70 - 80	80 - 95	550	82%	93%	30%	Very high	42 years
Coal	PF (Pulverised Fuel with flue gas desulphurisation)	30 - 40	45 - 60	800	39%	59%	40-45%	medium	155 years
	CFBC (Circulating fluidized bed combustion)	35 - 45	50 - 65	800			40-45%	medium	
	IGCC (Integrated Gasification Combined Cycle)	40 - 50	55 - 70	750			48%	medium	
Nuclear	Light water reactor	40 - 45	40 - 45	15	Almost 100% for uranium ore		33%	low	Reasonable reserves 85 years
Biomass	Biomass generation plant	25 - 85	25 - 75	30	nil		30 - 60%	medium	Renewable available
Wind	On shore	35 - 175	28 - 170	30			95-98%	nil	
		35 – 110	28 – 80						
	Off shore	50 - 170	50 - 150	10			95-98%		
60 – 150		40 – 120							
Hydro	Large	25 - 95	25 - 90	20			95-98%		
	Small (<10MW)	45 - 90	40 - 80	5 ₂₅			95-98%		
Solar	Photovoltaic	140 - 430	55 -260	100			/		

Annex 3: The advantages and disadvantages of different energy sources for heating

Energy sources		EU-25 market share by energy source	Market price (€/toe)	Lifecycle cost (€/toe)	GHG emissions (t CO ₂ eq/toe)	EU-27 import dependence	
						2005	2030
Fossil fuels	Heating gas oil	20%	525 (€0.45/l)	300-1300	3.1	82%	93%
	Natural gas	33%	230 – 340 (€20-30/MWh)		2.1	57%	84%
	Coal	1.8%	70 (€100/tce)		4	39%	59%
Biomass	Wood chips	5.7%	280	545-1300	0.4	0	?
	Pellets		540	630-1300	0.4	0	?
Electricity		31%	550 - 660 (€50-60/MWh)	550 - 660	0 to 12	<1%	?
Solar		0.2%	/	680-2320	Very low	0	0
Geothermal		0.4%	/	230-1450	Very low	0	0

Annex 4: The advantages and disadvantages of different energy sources for road transport

	Market price (€/toe)	CO ₂ emissions (t CO ₂ /toe) ³²	Import dependence	
			2005	2030
Petrol and diesel	398-582 ³³	3.6–3.7	82%	93%
Natural gas	230–340 (NB: requires a specially adapted vehicle and a dedicated distribution system)	3.0	57%	84%
Domestic biofuel	609-742	1.9–2.4	0%	0%
Tropical bio-ethanol	327-540	0.4	100%	100%
Second-generation biofuel	898–1 109	0.3–0.9	/	15%

³² Figures given for biofuels are those for the cheapest production techniques.

³³ Assuming oil price of \$48/barrel and \$70/barrel respectively.

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EUROPEAN COMMISSION

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**COMMUNICATION FROM THE COMMISSION
TO THE EUROPEAN PARLIAMENT, THE COUNCIL, THE EUROPEAN
ECONOMIC AND SOCIAL COMMITTEE AND THE COMMITTEE OF THE
REGIONS**

A Roadmap for moving to a competitive low carbon economy in 2050

{SEC(2011) 287 final}

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1.	Europe's key challenges	3
2.	Milestones to 2050	4
3.	Low carbon innovation: a sectoral perspective.....	6
4.	Investing in a low carbon future.....	10
5.	The international dimension.....	13
6.	Conclusions	14

1. EUROPE'S KEY CHALLENGES

The EU provides its Member States with a long-term framework for dealing with the issue of sustainability and the cross-border effects of phenomena that cannot be dealt with at the national level alone. Climate change has long been recognised as one such long-term shaping factor where coherent EU action is needed, both inside the EU and internationally.

The Commission recently proposed the Europe 2020 flagship initiative for a resource-efficient Europe¹ and within this framework it is now putting forward a series of long-term policy plans in areas such as transport, energy and climate change. This Communication sets out key elements that should shape the EU's climate action helping the EU become a competitive low carbon economy by 2050. The approach is based on the view that innovative solutions are required to mobilise investments in energy, transport, industry and information and communication technologies, and that more focus is needed on energy efficiency policies.

The Europe 2020 Strategy for smart, sustainable and inclusive growth includes five headline targets that set out where the EU should be in 2020. One of them relates to climate and energy: Member States have committed themselves to reducing greenhouse gas emissions (GHG) by 20%, increasing the share of renewables in the EU's energy mix to 20%, and achieving the 20% energy efficiency target by 2020. The EU is currently on track to meet two of those targets, but will not meet its energy efficiency target unless further efforts are made². Hence, the priority remains to achieve all the targets already set for 2020.

In order to keep climate change below 2°C, the European Council reconfirmed in February 2011 the EU objective of reducing greenhouse gas emissions by 80-95% by 2050 compared to 1990, in the context of necessary reductions according to the Intergovernmental Panel on Climate Change by developed countries as a group³. This is in line with the position endorsed by world leaders in the Copenhagen and the Cancun Agreements. These agreements include the commitment to deliver long-term low carbon development strategies. Some Member States have already made steps in this direction, or are in the process of doing so, including setting emission reduction objectives for 2050.

Together with the White Paper on Transport and the Energy Efficiency Plan, this Communication is a key deliverable under the Resource Efficiency Flagship. It presents a Roadmap for possible action up to 2050 which could enable the EU to deliver greenhouse gas reductions in line with the 80 to 95% target agreed. It outlines milestones which would show whether the EU is on course for reaching its target, policy challenges, investment needs and opportunities in different sectors, bearing in mind that the 80 to 95% reduction objective in the EU will largely need to be met internally.

¹ COM(2011) 21, see: <http://ec.europa.eu/resource-efficient-europe>

² Energy Efficiency Plan - COM(2011) 109.

³ Taking into account necessary efforts from developing countries, this will allow a global reduction of 50% in emissions by 2050.

2. MILESTONES TO 2050

The transition towards a competitive low carbon economy means that the EU should prepare for reductions in its *domestic* emissions by 80% by 2050 compared to 1990⁴. The Commission has carried out an extensive modelling analysis with several possible scenarios showing how this could be done, as explained in the box below.

This analysis of different scenarios shows that domestic emission reductions of the order of 40% and 60% below 1990 levels would be the cost-effective pathway by 2030 and 2040, respectively. In this context, it also shows reductions of 25% in 2020. This is illustrated in Figure 1. Such a pathway would result in annual reductions compared to 1990 of roughly 1% in the first decade until 2020, 1.5% in the second decade from 2020 until 2030, and 2 % in the last two decades until 2050. The effort would become greater over time as a wider set of cost-effective technologies becomes available.

Modelling approach for the 2050 roadmap

The results and findings presented in this Communication are based on a comprehensive global and EU modelling and scenario analysis on how the EU could shift towards a low-carbon economy by 2050 against the backdrop of continued global population growth, rising global GDP and varying global trends in terms of climate action, energy and technological developments.

A set of global projections were used to look at global impacts of climate action, how it relates to the energy sector, agriculture and deforestation. Furthermore, impacts on the EU's competitive sectors were projected to assess the possible risks of ambitious actions in the context of fragmented global action on climate.

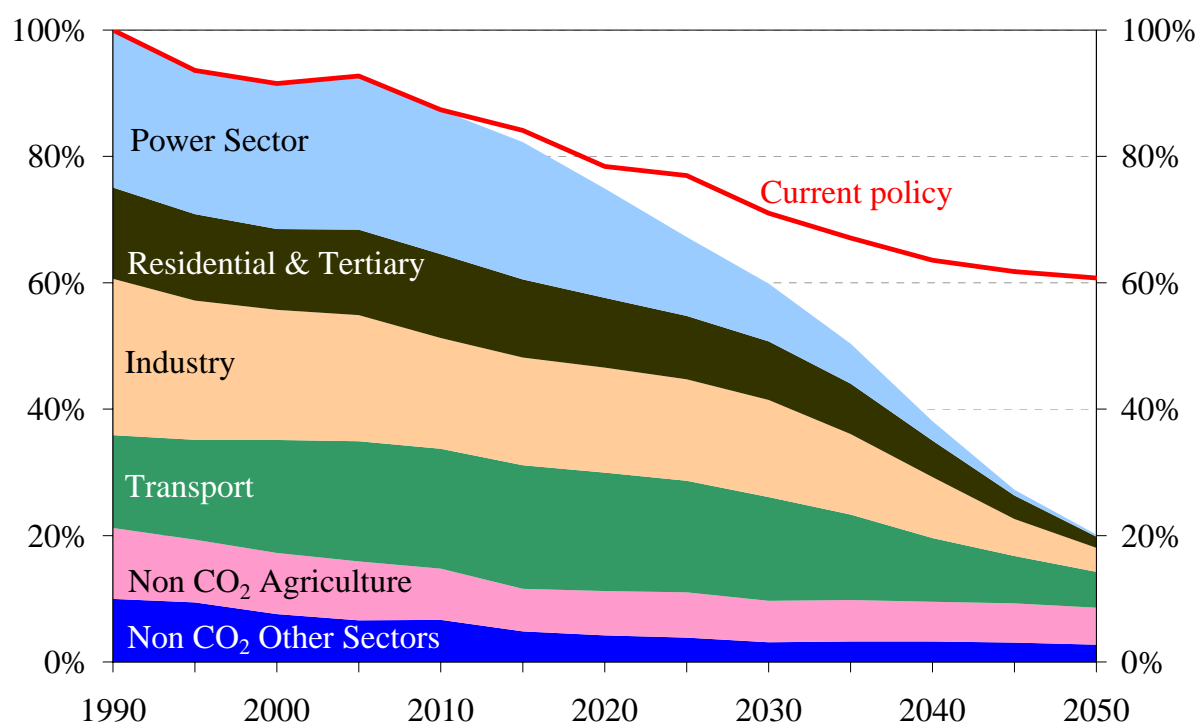
Detailed EU projections were made within a wide set of potential future scenarios, focussing on the sensitivity regarding assumptions on global fossil fuel price developments and rate of technological innovation to analyse the sectoral contribution, including from agriculture and other land uses. While there are always uncertainties relating to long term projections, results have been made more robust by developing a wide set of scenarios with different assumptions.

Future modelling improvements could consider better representation of the impacts of climate change itself, as well as energy storage and smart grid solutions for distributed generation.

Figure 1 illustrates the pathway towards an 80% reduction by 2050, shown in 5 year steps. The upper "reference" projection shows how domestic greenhouse gas emissions would develop under current policies. A scenario consistent with an 80% domestic reduction then shows how overall and sectoral emissions could evolve, if additional policies are put in place, taking into account technological options available over time.

⁴ Domestic meaning real internal reductions of EU emissions and not offsetting through the carbon market.

Figure 1: EU GHG emissions towards an 80% domestic reduction (100% =1990)



Emissions, including international aviation, were estimated to be 16% below 1990 levels in 2009. With full implementation of current policies, the EU is on track to achieve a 20% domestic reduction in 2020 below 1990 levels, and 30% in 2030. However, with current policies, only half of the 20% energy efficiency target would be met by 2020.

If the EU delivers on its current policies, including its commitment to reach 20% renewables, and achieve 20% energy efficiency by 2020, this would enable the EU to outperform the current 20% emission reduction target and achieve a 25% reduction by 2020. This would require the full implementation of the Energy Efficiency Plan⁵ presented together with this Communication, which identifies measures which would be necessary to deliver the energy efficiency target. The amount of currently allowed offsets would not be affected.⁶

The analysis also shows that a less ambitious pathway could lock in carbon intensive investments, resulting in higher carbon prices later on and significantly higher overall costs over the entire period. In addition, R&D, demonstration and early deployment of technologies, such as various forms of low carbon energy sources, carbon capture and storage, smart grids and hybrid and electric vehicle technology, are of paramount importance to ensure their cost-effective and large-scale penetration later on. Full implementation of the Strategic Energy Technology plan, requiring an additional investment in R&D and demonstration of €50 billion over the next 10 years, is indispensable. Auctioning revenue and cohesion policy are financing options that Member States should exploit. In addition, increasing resource efficiency through, for instance, waste recycling, better waste management and behavioural

⁵ Energy Efficiency Plan - COM(2011) 109.

⁶ As agreed by the emissions trading Directive 2003/87/EC (as amended by Directive 2009/29/EC) and the effort-sharing Decision (Decision 406/2009/EC).

change, as well as enhancing the resilience of ecosystems, can play an important role. Also, continued effort to strengthen research on climate mitigation and adaptation technologies will be required.

3. LOW CARBON INNOVATION: A SECTORAL PERSPECTIVE

The Commission's analysis has also explored pathways for key sectors. This analysis looked at a range of scenarios assuming different rates of technological innovation and different fossil fuel prices. They produced largely convergent results with respect to the magnitude of reductions needed in each sector in 2030 and 2050 as indicated by the ranges presented in Table 1. The development of sectoral policy options will have to go into greater depth on costs, trade-offs, and uncertainties.

Table 1: Sectoral reductions

GHG reductions compared to 1990	2005	2030	2050
Total	-7%	-40 to -44%	-79 to -82%
Sectors			
Power (CO ₂)	-7%	-54 to -68%	-93 to -99%
Industry (CO ₂)	-20%	-34 to -40%	-83 to -87%
Transport (incl. CO ₂ aviation, excl. maritime)	+30%	+20 to -9%	-54 to -67%
Residential and services (CO ₂)	-12%	-37 to -53%	-88 to -91%
Agriculture (non-CO ₂)	-20%	-36 to -37%	-42 to -49%
Other non-CO ₂ emissions	-30%	-72 to -73%	-70 to -78%

A secure, competitive and fully decarbonised power sector

Electricity will play a central role in the low carbon economy. The analysis shows that it can almost totally eliminate CO₂ emissions by 2050, and offers the prospect of partially replacing fossil fuels in transport and heating. Although electricity will increasingly be used in these 2 sectors, electricity consumption overall would only have to continue to increase at historic growth rates, thanks to continuous improvements in efficiency.

The share of low carbon technologies in the electricity mix is estimated to increase from around 45% today to around 60% in 2020, including through meeting the renewable energy target, to 75 to 80% in 2030, and nearly 100% in 2050. As a result, and without prejudging Member States' preferences for an energy mix which reflects their specific national circumstances, the EU electricity system could become more diverse and secure.

A wide range of existing technologies will need to be widely deployed, including more advanced technologies, such as photovoltaics, that will continue to become cheaper and thus more competitive over time.

Energy specific scenarios and the means of achieving such decarbonisation, while ensuring energy security and competitiveness, will be examined in the Energy 2050 Roadmap. This will build on the established EU energy policy and the EU 2020 Strategy.

The EU ETS will be critical in driving a wide range of low carbon technologies into the market, so that the power sector itself can adapt its investment and operational strategies to changing energy prices and technology. For the ETS to play this role on the identified

pathway to 2050, both a sufficient carbon price signal and long-term predictability are necessary. In this respect, appropriate measures need to be considered, including revisiting the agreed linear reduction of the ETS cap⁷. Other tools, such as energy taxation and technological support may also be appropriate to ensure that the power sector plays its full part.

Given that the central role of electricity in the low carbon economy requires significant use of renewables, many of which have variable output, considerable investments in networks are required to ensure continuity of supply at all times⁸. Investment in smart grids is a key enabler for a low carbon electricity system, notably facilitating demand-side efficiency, larger shares of renewables and distributed generation and enabling electrification of transport. For grid investments, benefits do not always accrue to the grid operator, but to society at large (with co-benefits for consumers, producers, and society at large: a more reliable network, energy security and reduced emissions). In this context, future work should consider how the policy framework can foster these investments at EU, national and local level and incentivise demand-side management.

Sustainable mobility through fuel efficiency, electrification and getting prices right

Technological innovation can help the transition to a more efficient and sustainable European transport system by acting on 3 main factors: vehicle efficiency through new engines, materials and design; cleaner energy use through new fuels and propulsion systems; better use of networks and safer and more secure operation through information and communication systems. The White Paper on Transport will provide a comprehensive and combined set of measures to increase the sustainability of the transport system.

Up until 2025, the main driver for reversing the trend of increasing greenhouse gas emissions in this sector is likely to remain improved fuel efficiency. Emissions from road, rail and inland waterways could in fact be brought back to below 1990 levels in 2030, in combination with measures such as pricing schemes to tackle congestion and air pollution, infrastructure charging, intelligent city planning and improving public transport, whilst securing affordable mobility. Improved efficiency and better demand-side management, fostered through CO₂ standards and smart taxation systems, should also advance the development of hybrid engine technologies and facilitate the gradual transition towards large-scale penetration of cleaner vehicles in all transport modes, including plug-in hybrids and electric vehicles (powered by batteries or fuel cells) at a later stage.

The synergies with other sustainability objectives such as the reduction of oil dependence, the competitiveness of Europe's automotive industry as well as health benefits, especially improved air quality in cities, make a compelling case for the EU to step up its efforts to accelerate the development and early deployment of electrification, and in general, of alternative fuels and propulsion methods, for the whole transport system. In this respect, it is not surprising to see also automotive industries in the US, Japan, Korea and China increasing their investments in battery technology, electric vehicles and fuel cells.

⁷ Directive 2003/87/EC as amended by Directive 2009/29/EC foresees a linear reduction of the cap of 1.74 percentage points per year. This reduction is legally enshrined in the ETS and continues after 2020.

⁸ See also Communication "Energy infrastructure priorities for 2020 and beyond – A blueprint for an integrated European energy network" - COM(2010) 677.

Sustainable biofuels could be used as an alternative fuel especially in aviation and heavy duty trucks, with strong growth in these sectors after 2030. In case electrification would not be deployed on a large-scale, biofuels and other alternative fuels would need to play a greater role to achieve the same level of emissions reduction in the transport sector. For biofuels this could lead, directly or indirectly, to a decrease of the net greenhouse gas benefits and increased pressure on bio-diversity, water management and the environment in general. This reinforces the need to advance in 2nd and 3rd generation biofuels and to proceed with the ongoing work on indirect land use change and sustainability.

The built environment

The built environment provides low-cost and short-term opportunities to reduce emissions, first and foremost through improvement of the energy performance of buildings. The Commission's analysis shows that emissions in this area could be reduced by around 90% by 2050, a larger than average contribution over the long-term. This underlines the importance of achieving the objective of the recast Directive on energy performance of buildings⁹ that new buildings built from 2021 onwards will have to be nearly zero-energy buildings. This process has already started, with many Member States implementing stricter energy performance standards for buildings. On 4 February 2011 the European Council, taking account of the EU headline target, decided that from 2012 onwards all Member States should include energy efficiency standards in public procurement for relevant public buildings and services. By the end of 2011, the Commission will present a Communication on "Sustainable Construction" setting out a strategy on how to boost the competitiveness of this sector while improving its environmental and climate performance.

Efforts will need to be strengthened significantly over time. Today, new buildings should be designed as intelligent low- or zero-energy buildings. The extra cost of this can be recovered through fuel savings. A greater challenge, however, is the refurbishment of the existing building stock, and in particular how to finance the necessary investments. Some Member States are already pro-actively using structural funds. The analysis projects that over the next decade investments in energy-saving building components and equipment will need to be increased by up to €200 billion. Several Member States have already implemented smart financing schemes, such as preferential interest rates for leveraging private sector investments in the most efficient building solutions. Other private financing models must be explored.

As in the transport sector, shifting energy consumption towards low carbon electricity (including heat pumps and storage heaters) and renewable energy (e.g. solar heating, biogas, biomass), also provided through district heating systems, would help to protect consumers against rising fossil fuel prices and bring significant health benefits.

Industrial sectors, including energy intensive industries

The Commission's analysis shows that GHG emissions in the industrial sector could be reduced by 83 to 87% in 2050. The application of more advanced resource and energy efficient industrial processes and equipment, increased recycling, as well as abatement technologies for non-CO₂ emissions (e.g. nitrous oxide and methane), could make a major contribution by allowing the energy intensive sectors to reduce emissions by half or more. As

⁹ Directive 2010/31/EU.

solutions are sector-specific, the Commission sees a need to develop specific Roadmaps in cooperation with the sectors concerned.

In addition to the application of more advanced industrial processes and equipment, carbon capture and storage would also need to be deployed on a broad scale after 2035, notably to capture industrial process emissions (e.g. in the cement and steel sector). This would entail an annual investment of more than €10 billion. In a world of global climate action, this would not raise competitiveness concerns. But if the EU's main competitors would not engage in a similar manner, the EU would need to consider how to further address the risks of carbon leakage due to these additional costs.

As the EU develops its climate policy framework, there will be a need to continue to monitor and analyse the impacts of these measures on the competitiveness of energy-intensive industries in relation to efforts by third countries, and to consider appropriate measures where necessary. The Commission's analysis confirms earlier findings that the current measures provide adequate safe-guards in the current context and notes the findings on options for addressing carbon leakage as set out in the Communication of May 2010, including on the inclusion of imports into the ETS¹⁰. The extent to which the existing, adequate safeguards are sufficient will continue to be kept under close review in relation to efforts by third countries. The Commission remains vigilant in order to maintain a strong industrial base in the EU. The Commission will continue to update the list of sectors at risk of carbon leakage as foreseen in the EU ETS Directive¹¹. Clearly, the best protection against the risk of carbon leakage would be effective global action.

Raising land use productivity sustainably

The Commission's analysis shows that by 2050 the agriculture sector can reduce non-CO₂ emissions by between 42 and 49% compared to 1990. The sector has already achieved a significant reduction. More reductions are feasible in the next two decades. Agricultural policies should focus on options such as further sustainable efficiency gains, efficient fertiliser use, bio-gasification of organic manure, improved manure management, better fodder, local diversification and commercialisation of production and improved livestock productivity, as well as maximising the benefits of extensive farming.

Improved agricultural and forestry practices can increase the capacity of the sector to preserve and sequester carbon in soils and forests. This can be achieved, for instance, through targeted measures to maintain grasslands, restore wetlands and peat lands, low- or zero-tillage, to reduce erosion and allow for the development of forests. Agricultural and forestry are also providing the resources for bio-energy and industrial feedstocks, and this contribution is bound to increase further.

The above elements will be further addressed in the Common Agriculture Policy legislative proposals for 2013, of which the positive impacts have not yet been taken into account in the analysis, as well as the forthcoming Bio-economy Communication¹².

¹⁰ COM(2010) 265.

¹¹ Article 10a (13) of Directive 2003/87/EC as amended by Directive 2009/29/EC.

¹² Commission Work Programme 2011, European Strategy and Action plan towards a sustainable bio-based economy by 2020.

After 2030, the rate of emission reductions in the agricultural sector could slow down, in part because of increased agricultural production due to the growing global population. However, it is important to note that, by 2050, agriculture is projected to represent a third of total EU emissions, tripling its share compared to today. Its importance in terms of climate policy is, therefore, set to increase: if it does not achieve the projected emissions reductions, other sectors would need to reduce even more, which would come at a high cost. The farming sector is also potentially at some risk of carbon leakage, so changes in production and trade patterns should not in the longer-term undermine global reduction of emissions.

The analysis also considers implications for the agricultural and forestry sector in a global perspective. In 2050, the world will have to feed around 9 billion people. At the same time, tropical forests will have to be preserved as an essential component of tackling climate change and preserving world biodiversity. In addition, mitigation efforts are expected to increase demand for bio-energy alongside existing and increasing demand for feed for animals, timber, paper production and bio-industries. The dual challenges of global food security and action on climate change need to be pursued together. In order to cope with these increased land use requirements in the EU and on a global scale sustainable increases in the productivity delivered by diverse agricultural and forestry systems (both intensive and extensive) will need to continue at rapid pace, not least in developing countries. Any negative impacts on other resources (e.g. water, soil and biodiversity) will need careful management. Accelerating climate change could endanger these productivity improvements in a world of insufficient action on climate change.

This also underscores the need to consider all land uses in a holistic manner and address Land Use, Land Use Change and Forestry (LULUCF) in EU climate policy. The Commission is preparing an initiative on this issue later this year. In addition, paper and wood products should be reused and recycled more to reduce pressure on land use.

The analysis took account of global trends towards a greater share of animal products in nutrition. Reversing existing trends of food waste and re-orienting consumption towards less carbon intensive food would be desirable.

4. INVESTING IN A LOW CARBON FUTURE

A major increase in capital investments

Various forms of low carbon energy sources, their supporting systems and infrastructure, including smart grids, passive housing, carbon capture and storage, advanced industrial processes and electrification of transport (including energy storage technologies) are key components which are starting to form the backbone of efficient, low carbon energy and transport systems after 2020. This will require major and sustained investment: on average over the coming 40 years, the increase in public and private investment is calculated to amount to around €270 billion annually. This represents an additional investment of around 1.5% of EU GDP per annum on top of the overall current investment representing 19% of GDP in 2009¹³. It would take us back to the investment levels before the economic crisis. Investments today will determine the future competitiveness of economies. In this context, it is interesting to note the much larger shares of GDP allocated to investments in China (48%),

¹³ Eurostat, National accounts.

India (35%), and Korea (26%) in 2009¹⁴, showing emerging economies' need to build up infrastructure but also the potential in leapfrogging towards a competitive, low carbon economy.

Unlocking the investment potential of the private sector and individual consumers presents a major challenge. While most of this extra investment would be paid back over time through lower energy bills and increased productivity, markets tend to discount future benefits, and disregard long-term risks. A key question is, therefore, how policy can create the framework conditions for such investments to happen, including through new financing models.

In the implementation of the 20% energy efficiency target, the Commission will have to monitor the impact of new measures on the ETS in order to maintain the incentives in the ETS rewarding low carbon investments and preparing the ETS sectors for the innovations needed in the future. In this respect, appropriate measures need to be considered, including recalibrating the ETS by setting aside a corresponding number of allowances from the part to be auctioned during the period 2013 to 2020 should a corresponding political decision be taken. This would also ensure that the contribution to the energy efficiency target would be made in a cost efficient manner in both, the ETS and non-ETS sectors.

Additional public private financing mechanisms are key in order to overcome initial financing risks and cash flow barriers. Public finance through innovative financing instruments, such as revolving funds, preferential interest rates, guarantee schemes, risk-sharing facilities and blending mechanisms can mobilise and steer the required private finance, including for SMEs and consumers. In this way, limited public finance can leverage a multitude of private sector investments¹⁵. The European Investment Bank, the European Bank for Reconstruction and Development, as well as dedicated funding in the next Multi-Annual Financial Framework should play a role in providing additional financing for energy efficient and low carbon technologies.

Increasing domestic investments provide a major opportunity for increased productivity, added value and output from a wide range of EU manufacturing industries (e.g. automotive, power generation, industrial and grid equipment, energy-efficient building materials and the construction sector), which are key industries for the creation of future growth and jobs.

Beyond the reductions in greenhouse gas emissions, which are the key benefits of the shift to the low carbon economy, this transition will bring a number of other essential benefits.

Reducing Europe's energy bill and its dependency on fossil fuel imports

Taken over the whole 40-year period, it is estimated that energy efficiency and the switch to domestically produced low carbon energy sources will reduce the EU's average fuel costs by between €175 billion and €320 billion per year. The actual cost saving depends on the extent to which global action on climate change is undertaken. In a scenario of global climate action, less fossil fuel would need to be imported into the EU and the cost of what would still be imported would decline.

¹⁴ World Bank, Indicators.

¹⁵ If it constitutes State aid, public funding should be in line with State aid compatibility rules.

If the rest of the world does not take coordinated action, however, a major benefit of EU action would be to protect the economy against high fossil fuel prices. The analysis, as well as the IEA World Energy Outlook 2010, clearly demonstrates that fossil fuel prices are indeed projected to be significantly higher in case of limited global action. This is not only a long-term issue. Even following the recession in the Western world, oil prices are about twice as high as in 2005. The IEA estimated that the EU has seen its import bill rise by \$ 70 billion from 2009 to 2010, and that further rises in the foreseeable future are probable. As we experienced in the '70s and early '80s, oil price shocks can lead to inflation, increasing trade deficits, reduced competitiveness and rising unemployment.

In 2050, the EU's total primary energy consumption could be about 30% below 2005 levels. More domestic energy resources would be used, in particular renewables. Imports of oil and gas would decline by half compared to today, reducing the negative impacts of potential oil and gas price shocks significantly. Without action the oil and gas import bill could instead double compared to today, a difference of €400 billion or more per annum by 2050, the equivalent of 3% of today's GDP¹⁶.

New jobs

Investing early in the low carbon economy would stimulate a gradual structural change in the economy and can create in net terms new jobs both in the short- and the medium-term. Renewable energy has a strong track record in job creation. In just 5 years, the renewable industry increased its work force from 230 000 to 550 000. Also for the construction sector low carbon investment offers large short-term job opportunities. With some 15 million employees in the EU, it was particularly hard hit by the economic crisis. Its recovery could get a significant boost through a major effort to accelerate the renovation and building of energy efficient houses. The Energy Efficiency Plan confirms the large job creation potential from promoting investments in more efficient equipment.

In the longer-term, the creation and preservation of jobs will depend on the EU's ability to lead in terms of the development of new low carbon technologies through increased education, training, programmes to foster acceptability of new technologies, R&D and entrepreneurship, as well as favourable economic framework conditions for investments. In this context, the Commission has repeatedly emphasized the positive employment benefits if revenues from the auctioning of ETS allowances and CO₂ taxation are used to reduce labour costs, with the potential to increase total employment by up to 1.5 million jobs by 2020.

As industry takes advantage of the economic opportunities provided by the low carbon economy, the need to ensure a skilled work force, especially in the construction sectors, technical professions, engineering and research, becomes more pressing. This will require targeted vocational training of the existing work force towards "green-collar" job opportunities, addressing emerging skills bottlenecks and fostering these skills in education systems. The Commission is currently working on assessing the employment effects of greening the economy, for instance through the implementation of the Agenda for New Skills and Jobs.

Improving air quality and health

¹⁶ The level of reductions in the bill for fossil fuel imports depend on future fossil fuel price developments and diversification of supply sources.

Action to reduce GHG emissions would importantly complement existing and planned air quality measures resulting in significantly reduced air pollution. Electrification of transport, and the expansion of public transport, could strikingly improve air quality in Europe's cities. The combined effect of GHG reductions and air quality measures would bring about more than 65% lower levels of air pollution in 2030 compared to 2005. In 2030, annual costs of controlling traditional air pollutants could be more than €10 billion lower, and in 2050 close to €50 billion could be saved every year. These developments would also reduce mortality, with benefits estimated up to €17 billion per year in 2030, and up to €38 billion in 2050. Moreover, public health would be improved, with a reduction in health care costs and damage to ecosystems, crops, materials and buildings. These gains will be important also in the light of the comprehensive review of the EU Air Quality Policy, foreseen for 2013 at the latest, where the aim is to maximise co-benefits with climate policy and minimise negative trade-offs.

5. THE INTERNATIONAL DIMENSION

The EU with little more than 10% of global emissions will not be able to tackle climate change on its own. Progress internationally is the only way to solve the problem of climate change, and the EU must continue to engage its partners. By formulating and implementing ambitious domestic climate change policies for more than a decade, the EU has brought many other countries on board. The situation today is fundamentally different than at the end of 2008 when the EU unilaterally adopted its Climate and Energy Package. At COP15 in Copenhagen, world leaders agreed that global average temperature should not rise more than 2°C. Today, countries representing more than 80% of global emissions have pledged domestic targets under the Copenhagen Accord and the Cancun agreements. For some countries, delivering on these pledges will require stronger action than currently envisaged.

This concrete action, sometimes more ambitious than what countries would be ready to commit to internationally, is driven to a significant extent also by other domestic agendas: to accelerate innovation, increase energy security and competitiveness in key growth sectors and reduce air pollution. A number of Europe's key partners from around the world, such as China, Brazil and Korea, are addressing these issues, first through stimulus programmes, and now more and more through concrete action plans to promote the "low carbon economy". Standstill would mean losing ground in major manufacturing sectors for Europe.

In the coming years, implementing these pledges will be a key step in globalising climate change policies. The EU should use this opportunity to strengthen its cooperation with its international partners, including to work towards a gradual development of global carbon markets to support efforts of developed and developing countries to implement low-emission development strategies, and ensure that all climate financing contributes to "climate proof" development opportunities.

However, swift implementation of the pledges made since Copenhagen would only achieve part of the reductions needed. A recent report by UNEP estimated that their full implementation would reach 60% of the required emission reductions until 2020. If no firm global action is taken against climate change, temperatures might increase by more than 2°C already by 2050, and more than 4°C by 2100. In order to avoid this scenario, science indicates that by 2050 global greenhouse gas emissions need to be reduced by at least 50% compared to 1990. With the preparation of this Roadmap, the EU is taking a new initiative to stimulate

international negotiations in the run-up to Durban. In this way, the Roadmap is an integral part of a wider strategy to deliver on the objective to keep the global average temperature increase below 2°C compared to pre-industrial levels. When cooperating with its partners, the EU should take a comprehensive approach intensifying bilateral and multilateral engagements on the broad range of aspects across sectors that touch upon climate policy.

6. CONCLUSIONS

The Commission's detailed analysis of cost-effective ways of reducing greenhouse gas emissions by 2050 has produced a number of important findings.

In order to be in line with the 80 to 95% overall GHG reduction objective by 2050, the Roadmap indicates that a cost effective and gradual transition would require a 40% domestic reduction of greenhouse gas emissions compared to 1990 as a milestone for 2030, and 80% for 2050. Building on what has already been achieved, the EU needs to start working now on appropriate strategies to move in this direction, and all Member States should soon develop national low carbon Roadmaps if not already done. The Commission is prepared to provide some of the necessary tools and policies.

Second, the analysis also shows that with existing policies, the EU will achieve the goal of a 20% GHG reduction domestically by 2020. If the revised Energy Efficiency Plan would be fully and effectively implemented meeting the 20% energy efficiency target, this would enable the EU to outperform the current 20% emission reduction target and achieve 25% reductions. This Communication does not suggest to set new 2020 targets, nor does it affect the EU's offer in the international negotiations to take on a 30% reduction target for 2020, if the conditions are right. This discussion continues based on the Commission Communication from 26 May 2010¹⁷.

Third, as well as reducing the threat of dangerous climate change as part of ambitious global action, deep reductions in the EU's emissions have the potential to deliver benefits in the form of savings on fossil fuel imports and improvements in air quality and public health.

Fourth, the Roadmap gives ranges for emissions reductions for 2030 and 2050 for key sectors. To realise these milestones as cost-effectively as possible, and to maximise benefits for EU manufacturing industries, the implementation of the Strategic Energy Technology Plan is of crucial importance. Considering the important labour market implications, the New Skills and Jobs Agenda will need to support the transition process.

The Commission intends to use the Roadmap as a basis for developing sector specific policy initiatives and Roadmaps, such as the 2050 Energy Roadmap and the upcoming White Paper on Transport. The Commission will initiate the appropriate sectoral dialogues. The Commission will continue to ensure that the EU ETS remains a key instrument to drive low carbon investments in a cost-efficient manner. It will also remain attentive to the risk of carbon leakage in order to ensure a level-playing field for industry.

As part of the development of the next Multi-Annual Financial Framework, it will also examine how EU funding can support instruments and investments that are necessary to

¹⁷ COM(2010) 265.

promote the transition to a low carbon economy, taking into account the specificities of sectors, countries and regions.

The Commission invites the other European institutions, Member States, candidate countries as well as potential candidates, and stakeholders to take this Roadmap into account in the further development of EU, national and regional policies for achieving the low carbon economy by 2050. Internationally, the Commission will present the 2050 Roadmap to its global partners in order to stimulate international negotiations working towards global action, and will foster cooperation with countries in the EU's neighbourhood on measures to promote a resilient low carbon economy.

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**COMMUNICATION FROM THE COMMISSION TO THE EUROPEAN
PARLIAMENT, THE COUNCIL, THE EUROPEAN ECONOMIC AND SOCIAL
COMMITTEE AND THE COMMITTEE OF THE REGIONS**

**Energy 2020
A strategy for competitive, sustainable and secure energy**

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**Energy 2020
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INTRODUCTION

The price of failure is too high.

Energy is the life blood of our society. The well-being of our people, industry and economy depends on safe, secure, sustainable and affordable energy. At the same time, energy related emissions account for almost 80% of the EU's total greenhouse gas emissions. The energy challenge is thus one of the greatest tests which Europe has to face. It will take decades to steer our energy systems onto a more secure and sustainable path. Yet the decisions to set us on the right path are needed urgently as failing to achieve a well-functioning European energy market will only increase the costs for consumers and put Europe's competitiveness at risk.

Over the next ten years, energy investments in the order of € 1 trillion are needed, both to diversify existing resources and replace equipment and to cater for challenging and changing energy requirements. Structural changes in energy supply, partly resulting from changes in indigenous production, oblige European economies to choose among energy products and infrastructures. These choices will be felt over the next 30 years and more. To enable these decisions to be taken urgently calls for an ambitious policy framework. Postponing these decisions will have immeasurable repercussions on society as regards both longer-term costs and security.

A common EU energy policy has evolved around the common objective to ensure the uninterrupted physical availability of energy products and services on the market, at a price which is affordable for all consumers (private and industrial), while contributing to the EU's wider social and climate goals. The central goals for energy policy (security of supply, competitiveness, and sustainability) are now laid down in the Lisbon Treaty¹. This spells out clearly what is expected from Europe in the energy area. While some progress has been made towards these goals, Europe's energy systems are adapting too slowly, while the scale of the challenges grows. Forthcoming enlargements of the EU will make this challenge even greater as the Union takes in countries with outdated infrastructure and less competitive energy economies.

The European Council adopted in 2007 ambitious energy and climate change objectives for 2020 – to reduce greenhouse gas emissions by 20%, rising to 30% if the conditions are right², to increase the share of renewable energy to 20% and to make a 20% improvement in energy efficiency. The European Parliament has continuously supported these goals. The European

¹ Article 194 of the Treaty on the functioning of the European Union (TFUE).

² The European Council specified: "provided that other developed countries commit themselves to comparable emission reductions and economically more advanced developing countries to contributing adequately according to their responsibilities and respective capabilities"

Council has also given a long term commitment to the decarbonisation path with a target for the EU and other industrialised countries of 80 to 95% cuts in emissions by 2050.

Nevertheless, the existing strategy is currently unlikely to achieve all the 2020 targets, and it is wholly inadequate to the longer term challenges. EU energy and climate goals have been incorporated into the Europe 2020 Strategy for smart, sustainable and inclusive growth³, adopted by the European Council in June 2010, and into its flagship initiative 'Resource efficient Europe'. The urgent task for the EU is to agree the tools which will make the necessary shift possible and thus ensure that Europe can emerge from recession on a more competitive, secure and sustainable path.

Despite the importance of energy policy aims, there are serious gaps in delivery.

The internal energy market is still fragmented and has not achieved its potential for transparency, accessibility and choice. Companies have grown beyond national borders, but their development is still hampered by a host of different national rules and practices. There are still many barriers to open and fair competition⁴. A recent study into consumer conditions in retail electricity markets indicates sub-optimal consumer choice⁵. Implementation of internal market legislation is disappointing, with over 40 infringement procedures underway on the second internal energy market package from 2003 alone.

The security of internal energy supplies is undermined by delays in investments and technological progress⁶. Currently, nearly 45% of European electricity generation is based on low-carbon energy sources, mainly nuclear and hydropower. Parts of the EU could lose more than a third of their generation capacity by 2020 because of the limited life-time of these installations. This means replacing and expanding existing capacities, finding secure non-fossil fuel alternatives, adapting networks to renewable energy sources and achieving a truly integrated internal energy market. At the same time Member States still need to phase out environmentally harmful subsidies.

The quality of National Energy Efficiency Action Plans, developed by Member States since 2008, is disappointing, leaving vast potential untapped. The move towards renewable energy use and greater energy efficiency in transport is happening too slowly. While we are broadly on track for the 20% target for renewable, we are a long way from achieving the objective set for energy efficiency.

At an international level, little heed is paid to warnings about tight oil supply in the future⁷. Despite serious gas supply crises that have acted as a wake-up call, exposing Europe's vulnerability, there is still no common approach towards partner, supplier or transit countries. The potential for further development of EU indigenous fossil fuel resources, including unconventional gas, exists and the role they will play must be assessed in all objectivity.

³ Communication from the Commission (doc. 7110/10 of 5 March 2010).

⁴ As evidenced by the Commission's Energy Sector Inquiry, Communication from the Commission of 1 January 2007 *Inquiry pursuant to Article 17 of Regulation (EC) No 1/2003 into the European gas and electricity sectors* - COM(2006) 851 - and the high number of investigations into anti-competitive behaviour in the sector (e.g. IP/10/494 of 4 May 2010).

⁵ Study of the functioning of retail electricity markets for consumers in the European Union, November 2010.

⁶ ENTSO-Electricity has estimated that the EU needs to build or renew 30000 km of network cables in the next ten years.

⁷ E.g. IEA World Energy Outlooks 2009 and 2010.

Member States' energy interdependence requires more European action.

The EU is the level at which energy policy should be developed. Decisions on energy policy taken by one Member State inevitably have an impact on other Member States. The optimum energy mix, including the swift development of renewables, needs a continental market at least. Energy is the market sector where the greatest economic efficiencies can be made on a pan-European scale. Fragmented markets not only undermine security of supply, they also limit the benefits which energy market competition can bring. The time has come for energy policy to become truly European.

The EU must remain an attractive market for companies at a time of increasing competition on energy resources worldwide. The new European energy strategy must support the integrated industrial approach just presented by the European Commission⁸, in particular since energy remains an important cost factor for industry⁹. The EU must also consolidate its competitiveness in energy technology markets. The share of renewable energy in the EU energy mix has risen steadily to some 10% of the gross final energy consumption in 2008. In 2009, 62% of newly installed electricity generation capacity in the EU was from renewable sources, mainly wind and solar. However, Europe's lead is challenged. The independent 2010 Renewable Energy Attractiveness Index¹⁰ now cites the US and China as the best investment opportunities for renewable energy. New stimulus is needed; more than ever is EU leadership called to address these challenges.

In international energy affairs, the EU could be much stronger and effective if it took charge of its common interest and ambition. Despite accounting for one fifth of the world's energy use, the EU continues to have less influence on international energy markets than its economic weight would suggest. Global energy markets are becoming tighter, with developing Asian countries and the Middle East accounting for most of the growth in global demand¹¹. As the world's largest energy importer, the EU is likely to be more vulnerable to supply risks as a result.

The inclusion of energy policy in the EU Treaty calls for a new outlook.

We must build on what we have achieved, and be bold in our ambition.

The EU cannot afford to fail in its energy ambitions. Therefore the Commission proposes a new energy strategy towards 2020. This will consolidate the measures which have been taken so far and step up activity in areas where new challenges are emerging. It is the result of extensive debates within the EU institutions and wide-ranging public consultations.

The focus here is not on a comparative analysis of different energy sources, rather the steps which are required to deliver Europe's medium term policy objectives. Various scenarios in terms of energy mix will be presented in the forthcoming energy roadmap 2050, which will describe ways of achieving Europe's long-term decarbonisation goal and their implications for energy policy decisions. This strategy sets out initial policy decisions which will be needed to meet our 2020 energy objectives as they currently stand. The 2050 low carbon

⁸ Communication on an "integrated industrial policy for the globalisation era" (COM 2010) 619

⁹ For example, it is estimated that electricity prices in Europe is 21% more expensive than in the United States or 197% more expensive than in China.

¹⁰ Issue 26, August 2010.

¹¹ International Energy Agency World Energy Outlook 2010.

economy and energy roadmaps will further inform and guide this programme of action and its implementation by offering a long term vision.

We urgently need far-reaching changes in energy production, use and supply.

First and foremost, the strategy underlines the need to rebalance energy actions in favour of a demand-driven policy, empowering consumers and decoupling economic growth from energy use. In particular, the transport and construction industries must pursue an active energy savings policy and diversify towards non-polluting energy sources. Beyond the Emissions Trading Scheme (ETS), the strategy should help create market conditions which stimulate higher energy savings and more low carbon investments, to exploit a wide range of centralised and distributed renewable energy as well as key technologies for energy storage and electro-mobility (notably electric vehicles and public transport).

Energy policy is a key contribution for achieving the objective of the new strategy for smart, sustainable and inclusive growth in support of a strong, diversified and competitive industrial base. In this context, Europe has to acknowledge that its industrial base is in need of all sectors across the entire value chain.

Public authorities have to lead by example. Each year, 16% of EU GDP, around €1,500 billion, is spent by public authorities. Public procurement rules should insist on efficiency conditions to increase energy savings and spread innovative solutions, notably in buildings and transport. The potential of market-based and other policy instruments, including taxation, to enhance energy efficiency should be fully exploited.

On the supply side, the priority must continue to be the development of secure and competitive sources of energy. In the field of electricity generation, investments should lead to nearly two thirds of the electricity coming from low carbon sources by the early 2020's, the current level being 45%. In this context, priority should be given to renewable energies. The strategy must provide a framework at EU level which, while respecting national differences, would not only allow Member States to outperform their respective targets, but also ensure that the renewable energy sources and technologies are economically competitive by 2020.

The contribution of nuclear energy, which currently generates around one third of EU electricity and two thirds of its carbon-free electricity, must be assessed openly and objectively. The full provisions of the Euratom Treaty must be applied rigorously, in particular in terms of safety. Given the renewed interest in this form of generation in Europe and worldwide, research must be pursued on radioactive waste management technologies and their safe implementation, as well as preparing the longer term future through development of next generation fission systems, for increased sustainability and cogeneration of heat and electricity, and nuclear fusion (ITER).

For oil and gas, rising import requirements and increasing demand from emerging and developing countries call for stronger mechanisms to secure new, diversified and safe supply routes. As well as crude oil access, refining infrastructure is a crucial part of the supply chain. The EU is a strong geopolitical partner in energy markets and must have the ability to act accordingly.

The new energy strategy focuses on five priorities:

1. Achieving an energy efficient Europe;

2. Building a truly pan-European integrated energy market;
3. Empowering consumers and achieving the highest level of safety and security;
4. Extending Europe's leadership in energy technology and innovation;
5. Strengthening the external dimension of the EU energy market.

1. AN EFFICIENT USE OF ENERGY THAT TRANSLATES INTO 20% SAVINGS BY 2020

Europe cannot afford to waste energy. Energy efficiency is one of the central objectives for 2020 as well as a key factor in achieving our long-term energy and climate goals. The EU needs to develop a new energy efficiency strategy which will enable all Member States to further decouple their energy use from economic growth. This strategy will take into account the diversity between Member States in terms of energy needs. Energy efficiency is the most cost effective way to reduce emissions, improve energy security and competitiveness, make energy consumption more affordable for consumers as well as create employment, including in export industries. Above all, it provides tangible benefits to citizens: average energy savings for a household can amount to €1 000 per year¹².

It is necessary to address the paradox whereby demand for more energy-intensive or new products outstrips gains in energy efficiency. It is high time that we move from words to actions. Thus, energy efficiency needs to be mainstreamed into all relevant policy areas, including education and training, to change current behavioural patterns. Energy efficiency criteria must be imposed in all spheres, including the allocation of public funds.

Efforts should be concentrated on the whole energy chain, from energy production, via transmission and distribution, to final consumption. Effective compliance monitoring, adequate market surveillance, widespread usage of energy services and audits, as well as material efficiency and recycling are all musts.

We are a long way from achieving the 20% energy savings objective. The new strategy therefore calls for reinforced political commitment to achieving it through a clear definition of the objective to be reached and strong compliance monitoring. Member States and regional and local authorities are called to intensify their work to implement adequate policies and to make full use of the available tools, objectives and indicators, with comprehensive National Energy Efficiency Action Plans.

Special attention should be given to the sectors with the largest potential to make energy efficiency gains, namely the existing building stock and transport sector. Member States have agreed to legally binding climate targets for these and other non-ETS sectors but still need to implement appropriate measures¹³. The revision of the energy taxation directive could provide steering effects with the potential of long-term efficiency gains. Measures need to be developed to speed up significantly the rate of refurbishment using energy-efficient products and technologies. In the residential sector, the issue of divided incentives between owners and tenants needs to be addressed. Regarding the substantial stock of public buildings, the authorities need to exploit all available opportunities, including those offered by EU Regional

¹² COM(2008) 772.

¹³ Effort Sharing Decision No. 406/2009/EC.

Policy, to improve the energy efficiency and autonomy of the buildings. In the transport sector, significant potentials for example in multimodal solutions, efficient vehicles and efficient driving should be tapped.

The information and communication technologies have an important role to play in improving the efficiency of major emitting sectors. These technologies offer potential for a structural shift to less resource-intensive products and services, for energy savings in buildings and electricity networks as well as for more efficient and less energy consuming intelligent transport systems¹⁴.

The industry sector needs to incorporate energy-efficiency objectives and energy technology innovation into its business model. The ETS contributes significantly to do so for larger companies, but there is need for a wider use of other instruments, including energy audits and energy management systems in smaller companies and supporting mechanisms for SMEs. Efficiency benchmarking can give indication to companies where they stand in efficiency terms in comparison with their competitors. Efficiency, including in electricity use, must become a profitable business in itself, leading to a robust internal market for energy-saving techniques and practices and commercial opportunities internationally. A framework for wide resource efficiency would increase such savings.

The public sector needs to lead by example. Ambitious objectives ought to be set for public sector consumption. Public procurement should support energy efficient outcomes. Innovative integrated energy solutions at local level contributing towards transition to so-called ‘smart cities’ should be supported. Municipalities represent a major actor of the required change, thus their initiatives like the Covenant of Mayors should be further strengthened. Cities and urban areas, which consume up to 80% of the energy, are at the same time part of the problem and part of the solution to greater energy efficiency.

Resource-efficiency policies, including energy-efficiency investments, often have short-term, up-front costs before the medium- and longer-term benefits are felt. Tools are needed to encourage new investments in energy-efficient technologies and practices. EU financing can have a high leverage factor and innovative solutions must be developed. Innovative and carefully considered¹⁵ uses of taxation and pricing should also be explored as tools to encourage behavioural changes or to fund investments.

The Energy Efficiency Plan to be presented in early 2011 will be followed by concrete regulatory proposals in the course of that year. It will also address the issue of financing in terms of access to finance, the availability of innovative financing products, incentives to induce energy-efficiency investments as well as the role of EU funding, in particular the structural funds, further building on existing successful examples.

Priority 1: Achieving an energy-efficient Europe

Action 1: Tapping into the biggest energy-saving potential — buildings and transport

- The energy-efficiency renovation rate should be accelerated by investment incentives, wider use of energy service companies, innovative financial instruments with high leverage factors and financial engineering at European, national and local levels. In

¹⁴ Specific actions have been set out in the Digital Agenda for Europe, COM(2010)245.

¹⁵ Notably with regard to the possible cumulative effects of different market based measures

this context, division of investment incentives between owners and tenants and energy labelling of buildings (certificates used in the real estate market and public support policies) will be addressed in forthcoming proposals by the Commission.

- Public authorities need to lead by example. Energy criteria (regarding efficiency, renewables and smart networking) should be used in all public procurement of works, services or products. Programmes and technical assistance facilities are needed that build the capacities of energy services market participants to develop and structure finance for projects that target both public authorities and private actors. EU financial programmes will target energy savings projects and make energy efficiency a strong condition for allocating financial support.
- The forthcoming White Paper on future transport policy will present a menu of measures to improve transport sustainability and reduce oil dependence. This will include initiatives aimed at increasing the energy efficiency of the transport system, including support for clean urban mobility as well as multimodal transport solutions, intelligent traffic management and energy efficiency-standards for all vehicles, adequate economic signals and the promotion of sustainable behaviour. In this context, more efficient car-labelling systems should be explored.

Action 2: Reinforcing industrial competitiveness by making industry more efficient

- The Commission will seek to support European industries' competitiveness through energy efficiency by widening the Ecodesign requirements for energy and resource-intensive products complemented by system level requirements where relevant. The potential effect of voluntary agreements with energy and resource-intensive industry branches should be explored. More extensive energy labelling should be introduced to ensure more comprehensive comparison between products.
- Energy-management schemes (e.g. audits, plans, energy managers) should be implemented in industry and in the services sector. A particular emphasis on SMEs through dedicated support mechanisms should be established.

Action 3: Reinforcing efficiency in energy supply

- Energy efficiency, in the production as well as in the distribution, should become an essential criterion for the authorisation of generation capacities and efforts are needed to substantially increase the uptake of high efficiency cogeneration, district heating and cooling.
- Distribution and supply companies (retailers) should be required to secure documented energy savings among their customers, using means such as third party energy services, dedicated instruments such as 'white certificates', public benefit charges or equivalent and speeding up the introduction of innovative tools such as 'smart meters' which should be consumer-oriented and user-friendly so that they provide real benefits for consumers.

Action 4: Making the most of National Energy Efficiency Action Plans

- The National Energy Efficiency Action Plans provide comprehensive benchmarking on energy efficiency, including measurable objectives and indicators to monitor progress, taking into account the relative starting positions and national

circumstances. An annual review mechanism should feed into the Europe 2020 objective for energy efficiency.

2. ENSURING THE FREE MOVEMENT OF ENERGY

Europe's energy markets have been opened up to enable citizens to benefit from more reliable, competitive prices as well as more sustainable energy. This potential will not be fully realised unless robust efforts are made to create a more integrated, interconnected and competitive market.

Electricity and gas markets are not yet working as a single market. The market is still largely fragmented into national markets with numerous barriers to open and fair competition. Most energy markets remain national in scope and are highly concentrated, often with incumbent companies having a *de facto* monopoly position. Regulated energy prices further reduce competition in many Member States¹⁶. Given the remaining anti-competitive practice in the energy sector¹⁷, pro-active competition enforcement, not only by the Commission, but also by Member States, is needed. Improving competition in the energy markets will contribute to setting the right incentives for the investments required and reducing their cost to what is necessary.

By introducing a legislative framework designed to promote the achievement of the 20% target for renewable energy in 2020, Europe has just taken the first step in this area. It is necessary to ensure that the legislation is fully implemented and to pave the way for large scale use of renewable energy in the decades beyond 2020. The legal framework must be properly enforced to give investors the confidence to invest in new production, transport and storage options for renewable sources. The effects of the Renewable Energy Directive will be assessed as from 2011 with a view to strengthening or extending it where and when needed.

The further development of renewable energy will continue to rely for some time on support schemes. The Commission must play its part in ensuring that these are sustainable, consistent with technological progress and not hindering innovation or competition. It must however also ensure the required degree of convergence or harmonization between national schemes as the market for renewables is moving from a local to a cross-border supply. In this context, the necessary requirements for a pan-European trade in renewable energy should be defined on the basis of best practice. Greater use of balanced, cost-effective and predictable feed-in premiums, more technology-specific support and financing instruments should be mobilized in accordance with state aid rules when applicable. In particular, retroactive changes to support schemes should be avoided given the negative effect such changes have on investors' confidence.

As the Monti Report outlined, the new challenge to 2020 is to provide the backbone for electricity and gas to flow where it is needed. Without a proper infrastructure across Europe, comparable to the means of transport of other strategic sectors such as telecommunications or transport, the market will however never deliver on its promises. Further efforts need to be made to upgrade energy infrastructure particularly in Member States that joined as of 2004 as well as in less developed regions.

¹⁶ Report on progress in creating the internal gas and electricity market - COM(2010) 84.

¹⁷ After the Energy Sector Inquiry revealed manifold competition problems in the energy sector, which led to the adoption of nine major antitrust decisions, the Commission continues assessing the competitive landscape in European energy markets.

Most important, Europe is still lacking the grid infrastructure which will enable renewables to develop and compete on an equal footing with traditional sources. Current projects of large-scale wind parks in the North and solar facilities in the South need corresponding power lines capable of transmitting this green power to the areas of high consumption. Today's grid will struggle to absorb the volumes of renewable power which the 2020 targets entail (33% of gross electricity generation).

Smart meters and power grids are the keys to full exploitation of the potential for renewable energy and energy savings as well as improvements in energy services. A clear policy and common standards on smart metering and smart grids¹⁸ are needed well before 2020 to ensure interoperability across the network.

Finally, the obligation of solidarity among Member States will be null and void without a sufficient internal infrastructure and interconnectors across external borders and maritime areas. As a major energy importer, the EU is directly affected by the evolution of networks in neighbouring countries. The construction of new interconnections at our borders should receive the same attention and policies as intra-EU projects. Such links are essential not only for our neighbours but to ensure the EU's stability and security of supply. There will be specific emphasis on the Southern corridor and the effective start of projects of European interest, in particular Nabucco and ITGI.

Investment of around €1 trillion will be needed by 2020 to replace obsolete capacity, modernise and adapt infrastructures and cater for increasing and changing demand for low carbon energy. While investment decisions lie mainly with market players (energy companies, system operators and consumers), public policy is decisive in creating a stable and transparent framework for investment decisions. The new tools created by the third Internal Energy Market Package, including an Agency for the Cooperation of Energy Regulators (ACER) and the new Networks of Transmission System Operators for Electricity and Gas (ENTSO-E and ENTSO-G) should be fully utilised in the coming years for the further integration of energy markets. Regional initiatives¹⁹ should serve as stepping stones towards a European market.

Infrastructure investments will continue to be financed mainly from tariffs paid by the users. However, given the scale of the investments, their nature and their strategic character, it cannot be assumed that all the necessary investments will be delivered by the market alone. The Commission will adopt a new strategy on energy infrastructure development to encourage adequate grid investments in electricity, gas, oil and other energy sectors. Provided the supply is stable, natural gas will continue to play a key role in the EU's energy mix in the coming years and gas can gain importance as the back-up fuel for variable electricity generation. This calls for diversified imports, both pipeline gas and Liquefied Natural Gas terminals, while domestic gas networks are required to be increasingly interconnected.

Beyond the financing issue, complex and lengthy administrative procedures can be a major bottleneck. Existing rules and procedures for projects of European interest (e.g. serving security of supply, solidarity or renewables integration purposes) will need to be improved and streamlined significantly, while respecting the principles of public acceptance and existing environmental legislation. Communities at local, regional and national levels will engage more constructively in facilitating projects of European interest if these also bring

¹⁸ The European Commission has set up a smart grid task force to discuss the implementation of smart grids at the European level: http://ec.europa.eu/energy/gas_electricity/smartgrids/taskforce_en.htm.

¹⁹ E.g. Baltic Energy Market, Mediterranean Ring.

concrete, shorter term benefits for them through, for example, privileged access to public funds.

Priority 2: Building a pan-European integrated energy market

Action 1: Timely and accurate implementation of the internal market legislation

- The Commission will continue to ensure correct and timely implementation of the existing internal energy market and a forceful competition policy. For further integration of the energy market, the regulatory framework needs to be consolidated (e.g. network codes), complemented by other actions such as market coupling, target model development²⁰ and a robust framework for traded markets through effective transparency and oversight. If these measures prove not to be sufficient or ACER's remit too narrow, further legislative measures will be envisaged.

Action 2: Establishing a blueprint of the European infrastructure for 2020-2030

- The Commission's forthcoming infrastructure communication will allow Europe to identify priority infrastructure to be deployed in order to have a functioning internal market, ensure integration of large-scale production of renewables and guarantee security of supply, in line with the vision for a sustainable European energy system by 2050. By 2015, no Member States should be isolated from the European internal market. Cross-border corridors will also be covered. The 10-year network development plans of ENTSO-E and ENTSO-G will be taken forward with the help of ACER, together with all other relevant stakeholders. This exercise will build on successful regional initiatives such as the one in the Baltic region and will also include an assessment of the necessary storage facilities and climate adaptation measures, including possible future needs for CO₂ transportation infrastructure in the EU.
- The Commission's proposal also aims at preparing the grid for the inevitable changes in demand which will ensue from energy and transport policies, such as electro mobility and an increase in decentralised as well as large scale renewable power generation.
- A set of policy tools will be proposed by the Commission next year to implement strategic infrastructure priorities in the next two decades. They will include a new method for defining the strategic infrastructures which will be essential for the European Union as a whole in terms of competitive energy provision, environmental sustainability and access to renewables as well as security of supply. These vital sections will be clearly identified in the overall mapping exercise and awarded a label of 'European interest' so that they can benefit from an improved permitting procedure and concentrated funding if necessary. Selectivity will be of the essence in this work. Network connections with third countries will be duly taken into account.
- ACER, ENTSO-E and ENTSO-G will be given a mandate to develop the blueprint of European electricity and gas grids on the horizon of 2020-2030. This should be

²⁰

An electricity target model has been developed in the context of Florence forum, in the so called Ad-Hoc Advisory Group. The guidelines and codes to implement this target model are being prepared. A target model for gas is being developed in the framework of the Madrid Forum.

followed by a longer-term vision on the basis of the energy 2050 roadmap to be presented in 2011.

Action 3: Streamlining permit procedures and market rules for infrastructure developments

- The Commission will propose to introduce a permitting scheme applying to projects of "European interest" to improve the current process through, for example, the nomination of a single authority at national level, while respecting safety and security standards and ensuring full compliance with the EU environmental legislation. The streamlined and improved procedures will provide for more transparency and ensure open and transparent debates at local, regional and national level to enhance public trust in and acceptance of the installations. In addition, ways of positively rewarding, through enhanced access to public fund regions and Member States that constructively engage and succeed in facilitating the timely construction of projects of European interest will be explored.
- To establish market coupling by 2014, ACER will, within the scope of its mandate, ensure the definition and implementation of all necessary technical (harmonisation, standardisation, etc.) and regulatory issues linked to the interconnection of networks across borders; access to renewables; and the integration of new technologies. A detailed programme of action will be presented accordingly to assist the Member States in the process of rolling out smart metering/smart grids (including the issue of display of information for consumers) and encouraging new energy services.

Action 4: Providing the right financing framework

- Acknowledging the fact that most of the infrastructure development is of a commercial nature, a methodology will be defined by the Commission to analyse the optimum balance between public and private financing (on the following principles to be applied across the Union: 'user pays', 'beneficiary pays' - in terms of cross-border cost-benefit allocation, and 'tax payer pays' - burden-sharing for commercially non-viable and 'EU-wide benefit' infrastructure). This will be defined in accordance with applicable state aid rules. For projects of 'European interest' which have no or poor commercial viability, innovative funding mechanisms will be proposed for maximum leverage of public support to improve the investment climate for the coverage of main risks or to speed up project implementation. The development of proper energy infrastructure is critical and urgent; it requires a broader view of new funding instruments (both public and private) as well as the mobilisation of additional resources under the next multi-annual financial framework.

3. SECURE, SAFE AND AFFORDABLE ENERGY FOR CITIZENS AND BUSINESSES

A well functioning, integrated internal market benefits consumers with wider choice and lower prices. Yet, many consumers do not perceive that they are better off as a result of market opening and competition among different suppliers. Individual consumers must be aware of, and exercise, their rights under EU legislation. They should be able to take advantage of the opportunities which market opening creates and feel confident that they have access to the energy services they need in the quality and emission profile they want. The opening of markets can deliver the best prices, choice, innovation and service for consumers

if it goes hand in hand with measures to guarantee trust, protect consumers and to support them to play the active role expected of them by liberalisation.

However citizens appear to be unaware of their rights under EU legislation, or reluctant to exercise them. Far greater efforts are needed to inform consumers about their rights and involve them in the internal market. Likewise, the potential for reducing energy bills through energy savings needs to be better articulated. The Citizens' (London) Forum and the Sustainable Energy (Bucharest) Forum were established with a view to improving the energy situation of household consumers and ways should be explored to make them more responsive to consumers' needs.

The competitive position of important sectors of the European economy also depends on the availability of secure energy at affordable prices. Energy, in particular electricity, constitutes a substantial part of the total production costs of key European industries, including large and small and medium enterprises.

The international market for oil supplies could become very tight before 2020, which means that it is important for EU consumers to step up their efforts to reduce oil demand. This is not happening at the moment. Consumers need to be made more aware of the necessity to reduce their consumption of fossil fuels and they need to know how they can reduce their bills at a time of rising prices. "User-friendly" smart grids, smart meters and billing can help in this respect. But consumers also need to become more pro-active. To help consumers participate in the market, measures should be put in place to raise awareness of opportunities, enhance price comparison, and facilitate the switching and improve complaint handling procedures.

Providing affordable but cost-reflective and reliable supplies to consumers is mainly the task of the internal market. A functioning internal market on the basis of sufficient transmission and storage infrastructure is the best guarantee for security of supply, as energy will follow market mechanisms and flow to where it is needed. However, safety nets are necessary, in the case of vulnerable consumers for example, or at the time of a supply crisis which market mechanisms cannot sufficiently address. The internal market is also hampered when Member States are not fully interlinked, such as in the Baltic States. The Gas Security Regulation is important in that it ensures that markets are fully prepared to cope in a crisis and that domestic consumers are protected. Furthering of interconnection amongst Member States as well as active competition enforcement by the Commission and Member States can contribute to a further diversification of supply sources particularly in those Member States which currently depend on only one or few supply sources.

Energy policy is also responsible for protecting European citizens from the risks of energy production and transport. The EU must continue to be a world leader in developing systems for safe nuclear power, the transport of radioactive substances, as well as the management of nuclear waste. International collaboration on nuclear safeguards plays a major role in ensuring nuclear security and establishing a solid and robust non-proliferation regime. In the oil and gas exploitation and conversion sector, the EU legislative framework should guarantee the highest level of safety and an unequivocal liability regime for oil and gas installations.

<u>Priority 3: Empowering consumers and achieving the highest level of safety and security</u>
Action 1: Making energy policy more consumer-friendly

- Active competition policy enforcement at European and national levels remains indispensable to foster competition and guarantee that consumers have access to energy at affordable prices.
- The Commission will propose measures to help consumers better participate in the energy market in line with the third energy package. These measures will include the development of guidance based on best practice in the area of switching suppliers, the further implementation and monitoring of the billing and complaint-handling recommendations, and the identification of best practices in alternative dispute resolution schemes. A price comparison tool based on a methodology to be developed by energy regulators and other competent bodies should be available to all consumers, and all suppliers should provide updated information on their tariffs and offers. Finally, further efforts should be aimed at moving focus from energy prices to energy costs by developing the market for energy services.
- The Commission will publish regular benchmark reports assessing the level of implementation of the regulatory provisions relating to consumers and the overall level of protection across the internal market. Particular emphasis will be given to vulnerable customers and to practices which enable consumers to reduce energy use.
- Efforts to improve the functioning of the retail market should be stepped up by regulatory authorities with the help of the London Citizens' and the Sustainability (Bucharest) Fora.

Action 2: Continuous improvement in safety and security

- The safety conditions of offshore oil and gas extraction are being reviewed by the Commission in the light of the Deepwater Horizon accident, with the aim of introducing stringent measures from prevention to response and liability issues which will guarantee the highest level of protection throughout the EU and the rest of the world.
- The legal framework for nuclear safety and security will be further enhanced through the mid-term review of the Nuclear Safety Directive, the implementation of the Nuclear Waste Directive, the redefinition of the basic safety standards for the protection of workers and the population and a proposal for a European approach on nuclear liability regimes. Greater harmonisation of plant design and certification at the international level should also be actively pursued. All these measures should allow the EU to keep its leadership in safe nuclear energy and contribute to responsible use of nuclear energy worldwide.
- The same security and safety considerations will also be upheld in the development and deployment of new energy technologies (hydrogen safety, safety of CO₂ transportation network, CO₂ storage, etc...).

4. MAKING A TECHNOLOGICAL SHIFT

Without a technological shift, the EU will fail on its 2050 ambitions to decarbonise the electricity and transport sectors. Given the time scale for the development and dissemination of energy technology, the urgency of bringing new high performance low-carbon technologies to the European markets is more acute than ever. The EU ETS is an important demand side

driver supporting the deployment of innovative low carbon technologies. However, new technologies will reach markets more quickly and more economically if they are developed through collaboration at the EU level.

Europe-wide planning and management is paramount for investment stability, business confidence and policy coherence. The Strategic Energy Technology (SET) Plan sets out a medium term strategy valid across all sectors. Yet development and demonstration projects for the main technologies (second generation biofuels, smart grids, smart cities and intelligent networks, Carbon Capture and Storage, electricity storage and electro-mobility, next generation nuclear, renewable heating and cooling) must be speeded up. Similarly, the crucial nature of innovation was highlighted in the Europe 2020 flagship on 'Innovation Union',²¹.

The resources required in the next two decades for the development of these technologies are very significant, especially when seen in the context of the current economic climate. Major projects, such as the ones over 140 GW of offshore wind power currently being planned by European utilities, developers and governments, mostly in the North Sea or the Desertec and Medring initiatives, affect several Member States. Europe-wide coordination and collaboration should include the pooling of different funding sources. All stakeholders will be expected to contribute. The Commission will seek to leverage the EU budget to raise further the overall level of funding.

The EU is facing fierce competition in international technology markets. Countries such as China, Japan, South Korea and the USA are pursuing an ambitious industrial strategy in solar, wind and nuclear markets. EU researchers and companies need to increase their efforts to remain at the forefront of the booming international market for energy technology and, where it is mutually beneficial, they should step up cooperation with third countries in specific technologies.

Priority 4: Extending Europe's leadership in energy technology and innovation

Action 1: Implementing the SET Plan without delay

- The Commission will reinforce the implementation of the SET Plan, in particular the Joint Programmes of the European Energy Research Alliance (EERA) and the six European Industrial Initiatives (wind; solar; bio energy; smart grids; nuclear fission; and CCS). Work will intensify with Member States to finance the activities of the Technology Roadmaps for 2010-2020 and to ensure the success of related large scale demonstration programmes such as under the New Entrants Reserve (NER300) programme²². Available Community funding²³ will be concentrated on the SET Plan initiatives.
- The Technology Roadmaps of the European Industrial Initiatives for 2010-2020 are being implemented from this year on and will be given additional support. They will be the cornerstone for the preparation of the next financial framework as regards a consolidated, regularly assessed, more efficient and focused energy research

²¹ SEC(2010)1161, 6 October 2010.

²² The revised ETS directive (2009/29/EC) foresees that 300 m ETS allowances from the New Entrants Reserve (NER) shall be available to support commercial-scale CCS and innovative RES demonstration projects in the territory of the Union.

²³ Funding available under the current Financial Perspectives.

programme. In this context, the Commission will promote the development of strategic energy research infrastructures in Europe as they strongly contribute to the shortening of the distance between research and technological development. It will also pursue other avenues with great potential, such as marine renewable energy and renewable heating and cooling.

Action 2: The Commission will be launching four new large-scale European projects

- 1. The Commission will take forward a major European initiative on smart grids to link the whole electricity grid system, from the off-shore wind farms in the North Sea, solar plants in the South and existing hydro-electric dams, to individual households, while making power networks more intelligent, efficient and reliable.
- 2. Re-establishing Europe's leadership on electricity storage (both large-scale and for vehicles). Ambitious projects will be developed in the fields of hydro capacity, compressed air storage, battery storage, and other innovative storage technologies such as hydrogen. These will prepare the electricity grid at all voltage levels for the massive uptake of small-scale decentralised and large-scale centralised renewable electricity.
- 3. Implementing large-scale sustainable biofuel production, including in the light of the ongoing review concerning the impact of indirect land use change. The €9 billion European Industrial Bioenergy Initiative²⁴ will be launched shortly to ensure quick market uptake of sustainable second-generation biofuels.
- 4. Providing cities, urban and rural areas with ways of making greater energy savings. The 'Smart Cities' innovation partnership to be launched early 2011 will bring together the best from the areas of renewable energies, energy efficiency, smart electricity grids, clean urban transport such as electro mobility, smart heating and cooling grids, combined with highly innovative intelligence and ICT tools. EU Regional Policy can play an important role in unlocking local potentials. Rural areas also have a significant potential in this respect and could make use of the EARDF that provides financial means to support such innovation projects.

Action 3: Ensuring long-term EU technological competitiveness

- In order to lay the foundations of our future competitiveness in the face of strong international competition, the Commission will propose a €1 billion-initiative²⁵ to support the frontier research needed to deliver science necessary for low-carbon energy breakthroughs.
- EU leadership must also be maintained in the global flagship research project ITER. The Commission will ensure effective governance (including cost containment) and industrial value creation from ITER and the European fusion programme.
- The Commission will develop an EU research programme for energy materials, allowing the EU energy sector to stay competitive despite dwindling rare earth resources.

²⁴ See footnote 23.

²⁵ See footnote 23.

5. STRONG INTERNATIONAL PARTNERSHIP, NOTABLY WITH OUR NEIGHBOURS

The European energy market is the world's largest regional market (over 500 million consumers) and largest energy importer. However, the same collaboration and common purpose that has led to the adoption of the EU's headline energy and climate targets is not yet evident in external energy policy. Several of the challenges facing the EU — climate change, access to oil and gas, technology development, energy efficiency — are common to most countries and rely on international collaboration. Member States have repeatedly called for the EU to speak with a common voice in third countries. In practice, national initiatives do not leverage the strength of the size of the EU market and could better express the EU interest.

International energy policy must pursue the common goals of security of supply, competitiveness and sustainability. While relations with producing and transit countries are important, relations with large energy-consuming nations and particularly emerging and developing countries are of growing significance. To lift people out of poverty will require access to energy since achieving the goal of eradicating extreme poverty by 2015 cannot be met unless substantial progress is made on improving access. In order to ensure that this does not harm other policy goals, sustainable development needs to be at the core of both energy and development policy, such as proposed in the Green Paper on Development Policy²⁶.

New patterns of supply and demand in global energy markets and increasing competition for energy resources make it essential for the EU to be able to throw its combined market weight effectively in relations with key third-country energy partners. Europe should be in a position to rely on significant additional energy supply sources and routes by 2020.

The need for international solutions obliges us to push our agenda for decarbonisation and energy efficiency with our main partners and in international negotiations and frameworks. The ETS is a driver of international carbon markets, and further action should build on ongoing action to further develop these markets. As a frontrunner in policy development, the EU has more scope to influence standard-setting environmental issues, and to promote respect for transparent and competitive markets.

The EU already has a series of complementary and targeted frameworks ranging from specific energy provisions in bilateral agreements with third countries (Free Trade Agreements, Partnership and Cooperation Agreements, Association Agreements, etc.) and Memoranda of Understanding on energy cooperation, through to multilateral Treaties such as the Energy Community Treaty²⁷ and participation in the Energy Charter Treaty. It is currently negotiating with several countries new agreements including important energy provisions.

The EU must now formalise the principle whereby Member States act in the benefit of the EU as a whole in bilateral energy relations with key partners and in global discussions. Building on the legal basis in the Lisbon Treaty, which clarifies and strengthens the external

²⁶ Non-OECD countries could account for all the projected growth in CO₂ emissions by 2030; however, ensuring universal access to modern energy services for all only mean a rise of 0.8% of CO₂ emissions, IEA World Energy Outlook 2009 and special early excerpt of the IEA WEO 2010 for the Millennium Development Goals Summit.

²⁷ The Energy Community Treaty is promoting market integration but also *acquis* transposition and implementation in the Western Balkans and is extending the EU internal energy market to South East Europe. This is not only a framework of cooperation but a legally binding instrument to prepare accession to the EU. Other parties are joining the Energy Community Treaty: Moldova is already a member; Ukraine and Turkey are in the process of joining.

dimension, the EU's external energy policy must ensure effective solidarity, responsibility and transparency among all Member States, reflecting the EU interest and ensuring the security of the EU's internal energy market. More effective coordination at EU and Member State level need to be put in place.

In the nuclear field, international cooperation has produced good results. This is particularly relevant since various neighbouring countries operate or, plan to operate nuclear power plants. The EU must now encourage partner States to make all existing international nuclear safety and security standards and procedures legally binding and effectively implemented worldwide. The EU is particularly well placed, as it is the first to have taken such action both in the field of safety and security and has specific cooperation instruments for this purpose.

As well as being vital for the EU's security of supply, the external dimension of EU energy policy must be consistent and mutually reinforcing with other external activities of the EU (development, trade, climate and biodiversity, enlargement, Common Foreign and Security Policy and others). There must be synergies between energy objectives and other policies and instruments including trade, bilateral agreements, and development cooperation instruments and vice-versa.

Energy security is closely intertwined with EU's foreign and security priorities²⁸. Diversification of fuels, sources of supply and transit routes is essential for EU security as are good governance, respect for the rule of law and protection of EU and foreign investments in energy producing and transit countries. Moreover, EU policy will pay particular attention to safety and security of oil, natural gas pipelines and related production and transport infrastructure by combining energy policy and CFSP instruments.

In 2011 the Commission will present concrete proposals to reinforce the overall consistency and efficiency of our external energy policy, involving Member States, various external policies of the European Union and external support programmes.

Priority 5: Strengthening the external dimension of the EU energy market

Action 1: Integrating energy markets and regulatory frameworks with our neighbours

- The Energy Community Treaty should be implemented and extended to all those EU neighbours who are willing to adopt the EU market model. In this context, market integration and regulatory convergence should be pursued through comprehensive EU agreements based on the EU rules in the countries covered by the European Neighbourhood Policy and the Enlargement process, in particular in the Mediterranean region and with transit countries such as Ukraine and Turkey. Moreover, the Energy Community Treaty should be deepened by extending new *acquis* to the signatories to the Treaty. This approach would strengthen the participation of neighbouring countries in the internal market, while providing a level playing field and a safeguards against the risk of carbon leakage through the power sector.
- Mechanisms will be proposed by the Commission to align existing international agreements (notably in the gas sector) with the internal market rules and to strengthen cooperation between Member States for the conclusion of new ones.

²⁸ European Security Strategy adopted by the European Council in December 2003.

Proposals will also be made to set the required regulatory framework between the EU and third countries to develop strategic routes from new suppliers, notably around the Southern corridor and the Southern Mediterranean. Supply issues, including network development and possibly grouped supply arrangements as well as regulatory aspects, notably concerning the freedom of transit and investment security, would be covered.

- EU technical assistance will be mobilised for the effective implementation of the internal market *acquis* and the modernisation of the energy sector in neighbouring countries, while improving the coordination of support schemes provided by the EU, its Member States and the international community.

Action 2: Establishing privileged partnerships with key partners

- While pursuing diversification of import sources and routes, reinforced energy partnerships will be established by the EU with key suppliers and transit countries. They will aim at promoting key principles such as those contained in the Energy Charter Treaty (for example the freedom of transit, transparency, safety, investment opportunities as well as compliance with international law).

Action 3: Promoting the global role of the EU for a future of low-carbon energy

- Energy efficiency, clean technologies and safe and sustainable low-carbon energy should be integrated into EU and bilateral cooperation activities, particularly with major consumer and emerging economies and with global partnerships.
- The Commission will launch a major cooperation with Africa on energy initiatives in order to progressively provide sustainable energy to all citizens, in line with the Green Paper on Development Policy.

Action 4: Promoting legally binding nuclear-safety, security and non-proliferation standards worldwide

- The Commission will develop initiatives aiming at encouraging partner States to make international nuclear safety, security and non-proliferation standards and procedures legally binding and effectively implemented around the globe, in particular through reinforced cooperation with the International Atomic Energy Agency and the conclusion of Euratom agreements with key nuclear suppliers and user countries.

CONCLUSIONS

The EU is on the threshold of an unprecedented period for energy policy. Energy markets have been largely cushioned from the effects of global market turbulence in recent years as a result of liberalisation, ample supply and production capacities and adequate import possibilities. However, dramatic changes are afoot. Energy prices will be affected by the huge need for energy sector investments, as well as carbon pricing and higher international energy prices. Competitiveness, supply security and climate objectives will be undermined unless electricity grids are upgraded, obsolete plants are replaced by competitive and cleaner alternatives and energy is used more efficiently throughout the whole energy chain.

Member States and industry have recognised the scale of the challenges. Secure energy supplies, an efficient use of resources, affordable prices and innovative solutions are crucial to our long-term sustainable growth, job creation and quality of life. Member States have agreed that these challenges will be tackled most effectively by policies and action at EU level, by 'Europeanising' energy policy. This includes directing EU funding support towards public priorities that markets fail to meet and that bring the most European value.

The new EU energy strategy will require significant efforts in technical innovation and investment. It will foster a dynamic and competitive market and will lead to a major strengthening of institutional arrangements to monitor and guide these developments. It will improve the security and the sustainability of energy systems, grid management, and energy market regulation. It will include extensive efforts to inform and empower domestic and business consumers, to involve them in the switch to a sustainable energy future, for example by saving energy, reducing wastage and switching to low-carbon technologies and fuels. Investments in low-carbon energy production will be further encouraged by market-based instruments such as emissions trading and taxation. The new strategy will take the first steps to prepare the EU for the greater challenges which it may well have to face already by 2020. Above all, it will ensure better leadership and coordination at the European level, both for internal action and in relations with external partners.

The global energy system is entering a phase of rapid transition with potentially far-reaching implications that will unfold in the next decades. Europe has to act before the window of opportunity closes. Time is short. Thus, the Commission will present most of the proposals to achieve the 2020 goals in the coming 18 months. Discussion, adoption and implementation will be needed quickly. In this way, the EU will be better able to put in place the building blocks for the 2020 outcome – standards, rules, regulations, plans, projects, financial and human resources, technology markets, social expectations etc. – and prepare Europe's citizens for the challenges ahead.

Due to the long lead in times for energy system changes, taking action today does not guarantee that the structural changes needed for the low-carbon transition will be completed in the period to 2020, which this strategy covers. It is therefore necessary to look beyond the timescale of the present strategy to ensure that the EU is well prepared for the 2050 objective of a secure, competitive and low-carbon energy system. The Commission will therefore follow up this strategy with a complete roadmap for 2050 which will set the measures covered in this paper in a longer term and consider further and complementary steps.

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COMMISSION OF THE EUROPEAN COMMUNITIES

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**COMMUNICATION FROM THE COMMISSION TO THE EUROPEAN
PARLIAMENT, THE COUNCIL, THE EUROPEAN ECONOMIC AND SOCIAL
COMMITTEE AND THE COMMITTEE OF THE REGIONS**

**Offshore Wind Energy:
Action needed to deliver on the Energy Policy Objectives for 2020 and beyond**

**COMMUNICATION FROM THE COMMISSION TO THE EUROPEAN
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**Offshore Wind Energy:
Action needed to deliver on the Energy Policy Objectives for 2020 and beyond**

1. OFFSHORE WIND ENERGY — A SEA OF UNEXPLOITED OPPORTUNITIES

Wind energy will play an essential role in meeting the objectives of the new Energy Policy for Europe. Today electricity from wind provides a substantial share of total electricity production in only a handful of Member States, but its importance is increasing: more than 40% of all new electricity generation capacity added to the European grid in 2007 was wind, making it the fastest growing generation technology except for natural gas¹. The modelling scenario used for the Second Strategic Energy Review² suggests that wind will represent more than one third of all electricity production from renewable energy sources by 2020 and almost 40% by 2030, representing an accumulated investment of at least 200-300 billion Euros (or about a quarter of all power plant investments) by 2030.

The Commission's Communication of 2007 on An Energy Policy for Europe³ stated that it will be necessary to develop further the use of oceans and seas to promote the EU's energy goals, given their potential to support the generation of energy and to diversify energy transport routes and methods. **While land-based wind energy will remain dominant in the immediate future, installations at sea will become increasingly important.** Compared to onshore wind, offshore wind is more complex and costly⁴ to install and maintain but also has a number of key advantages. Winds are typically stronger and more stable at sea than on land, resulting in significantly higher production per unit installed. At sea, wind turbines can be bigger than on land because of the logistical difficulties of transporting very large turbine components from the place of manufacturing by road to installation sites on land. Wind farms at sea also have less potential to cause concern among neighbouring citizens and other stakeholders unless they interfere with competing maritime activities or impact negatively on important marine environmental interests. In fact, wind farms at sea may be advantageous to protect marine ecosystems and may generate synergies with other emerging uses of the sea such as offshore aquaculture, which can benefit from the substructures of wind farms.

The wind resources over Europe's seas represent a vast, indigenous source of clean, renewable energy. By generating electricity without fossil fuel and by creating jobs and growth in a sector in which European businesses are global leaders, **offshore wind can make a significant contribution to all three key objectives of the new Energy Policy:** reducing greenhouse gas emissions, ensuring security of supply and improving EU competitiveness.

¹ Source: "Pure Power" by European Wind Energy Association (EWEA).

² COM(2008) 738.

³ COM(2007)1.

⁴ See comparison of technology costs in SEC(2008) xxx.

In physical energy terms the wind resource could theoretically cover Europe's entire electricity demand. However, the variability of wind, together with other technical, political or economic challenges and constraints in practice determine the pace and extent to which the significant potential is harnessed. Today, the potential for offshore wind energy is largely untapped: even excluding potential deepwater deployments based on floating foundations, **the potential exploitable by 2020 is likely to be some 30-40 times the current installed capacity⁵, and in the 2030 time horizon it could be up to 150 GW⁶, or some 575 TWh.** A proactive policy is necessary to ensure that this opportunity is seized.

While this Communication addresses specifically the actions needed for a large deployment of offshore wind, many of the challenges and initiatives presented are also of relevance for other EU offshore renewable energy resources, such as tidal, wave, thermal and marine current energy. These offshore energy resources, although less developed than wind energy, are also emerging and will be able to contribute to the goals of Europe's Energy Policy.

In this context the scope for synergy between Europe's energy policy and the new EU integrated maritime policy⁷ is wide and is likely to increase in the future. The fundamentals of both policies are the same: both aim for an integration of economic development and environmental protection. If joined up, they will allow a better exploration of the geopolitical value of Europe's oceans and seas for energy security, competitiveness and sustainability⁸.

2. AN EMERGING MARKET FACED WITH MANY CHALLENGES

2.1. Improvements to the overall framework are on the way

Like other renewable energy technologies offshore wind needs clear, stable and favourable framework conditions if it is to develop its potential in competition with conventional energy sources. At EU level, the main regulatory instruments to provide that have so far been the general internal electricity market legislation⁹, the "Renewable Electricity Directive"¹⁰, the EU Emissions Trading Scheme¹¹ and the Community guidelines on state aid for environmental protection¹².

This existing framework is developed in the Commission's **"third internal energy market package"** of October 2007¹³ and in the **"energy and climate package"** presented in January 2008¹⁴. **The timely adoption and implementation of these two packages will form the EU's main contribution to promoting offshore wind** and renewable energy in general. The improvements proposed include binding targets, instruments to encourage stronger regional

⁵ Of the 56,5 GW installed in the EU at the end of 2007 only 1,1 GW was offshore (Source: EWEA).

⁶ The modelling work performed for the Second Strategic Energy Review suggest some 31 GW by 2020. EWEA's "low", "medium" and "high" estimates published in March, are 20, 35 or 40 GW by 2020, and 40, 120 or 150 GW by 2030, respectively. The European Environment Agency is expected to publish an independent resource estimate in late 2008.

⁷ COM(2007) 575, 10.10.2007

⁸ See Commission Staff Working Document entitled "Energy policy and maritime policy: ensuring a better fit", SEC (2007)1283, 10.10.2007.

⁹ OJ L 176, 15.7.2003.

¹⁰ OJ L 283 27.10.2001.

¹¹ OJ L 275, 25.10.2003, p. 32

¹² OJ C 82, 1.4.2008, p. 1.

¹³ http://ec.europa.eu/energy/electricity/package_2007/index_en.htm

¹⁴ http://ec.europa.eu/energy/climate_actions/index_en.htm

cooperation between energy regulators and between system operators, and more robust requirements on Member States to streamline their planning and authorisation procedures, provide grid access and reduce administrative barriers.

However, **certain barriers affect offshore wind projects specifically or to a particular degree**. Following a public stakeholder consultation conducted earlier in 2008¹⁵, the Commission has identified four key areas which require special attention.

2.2. A sector facing particular industrial and technological challenges

Compared to onshore wind energy, offshore wind is still relatively expensive and technologically undeveloped. Some early projects were essentially offshore applications of moderately adapted onshore technologies and experienced unexpected technical problems, for example with the reliability of turbine components such as gear boxes and transformers. This has made investors more cautious, **has made it harder to finance projects** and entails higher costs because of the risk premiums required by investors. Equally, the experience to date shows the importance of bringing down the costs of installation, operation and maintenance which are much higher in the rougher and less accessible sea environment than on land.

The current structure of the industry complicates this situation further. Today very few turbine manufacturers have long and large-scale experience with machines deployed in offshore applications — this reduces the level of competition and innovation and further increases the cost differential to onshore wind. Moreover, there are **bottlenecks at various points in the supply chain** — the limited availability of turbine components, affordable installation vessels, suitable harbour facilities and similar equipment and infrastructures as well as of skilled personnel with the necessary mix of qualifications is a key barrier.

Existing foundation technologies are limited to relatively shallow waters (typically less than 30 metres of depth). Large-scale introduction of offshore wind would be greatly facilitated by technologies enabling deployment in deep waters, but cost-effective solutions still have to be demonstrated in real applications.

At present **offshore wind competes on the one hand with onshore wind for the existing turbine production capacity and on the other with the oil and gas exploration industry for the existing offshore equipment and expertise**. In this "double-squeeze" the pioneers are struggling to work up from a niche market to a full scale industry because investors are wary of making substantial investments in R&D and in the required increases in supply chain capacity as long as the technology is still climbing up the learning curve.

2.3. Lack of integrated strategic planning and cross-border coordination

In contrast to spatial planning on land, **Member States generally have limited experience with, and sometimes inadequate governance structures and rules for, integrated spatial planning in the marine environment**. The lack of processes looking simultaneously at the spatial distribution of the wind resources, at constraints imposed by other marine activities or interests, and at electricity grid aspects tends to increase uncertainty and the risk of delays in or failure of projects at sea. This applies equally to other renewable ocean resources such as tidal and wave energy.

¹⁵ A summary of the consultation feedback is available at http://ec.europa.eu/energy/res/consultation/offshore_wind_energy_en.htm

Moreover, the **absence of points of access to the electricity grids at sea leads to uncertainties about the ability to, or costs of, connecting to the grid** and creates additional risks for offshore projects.

On a more positive note, offshore projects can represent an opportunity for creating lines that both connect new generation capacity and establish or increase transmission capacity between different regions in the internal electricity market. However, such **potential synergies between offshore projects and cross-border inter-connectors are currently not being exploited**¹⁶. One reason for this is the additional complexities that cross-border cooperation entails because of the need to deal with different planning and regulatory regimes. However, without cross-border coordination, grid investments risk being sub-optimal in that they will be viewed from an individual project perspective rather than from a system perspective. Offshore projects that depend on new cross-border connectors are thus more vulnerable to uncertainties arising from differences in regulatory regimes such as support schemes and rules on grid investment cost recovery.

The need for better cross-border cooperation is not only limited to network planning and development, but also relates to system operation and management. Increasing offshore wind penetration may have consequences which need to be reflected in power congestion management strategies and generation/demand balancing plans, and in improved mechanisms for cross-border trade and balancing power markets.

2.4. Lack of knowledge and information sharing hampers a smooth application of EU environmental legislation

Offshore electricity production is relatively new or even non-existent in most Member States, and the experience in applying EU environmental legislation such as the "Birds"¹⁷, "Habitats"¹⁸ and "Environmental Impact Assessment"¹⁹ Directives in respect of such projects is still comparatively scarce. In practice this means that developers of offshore projects face additional uncertainties that can lead to extra delays and costs.

One factor which needlessly frustrates offshore projects is the **delays in Member States' designation of protected areas under the Habitats and Birds Directives in the marine environment**. Failure to identify such areas increases uncertainty about the potential suitability of any given site for wind farms. Without the necessary data on marine ecosystems and information about where sensitive or protected habitats and species occur, impact assessments and consenting procedures may be longer and subject to more disputes.

Another factor relates to awareness about up-to-date knowledge about the impacts of wind farms on natural habitats and species. Such information needs to be generated and shared more systematically to facilitate environmental impact assessments. Although a substantial and rapidly developing body of scientific literature exists, much of it is recent and unknown to many local, regional and national authorities and stakeholders. **In this situation, developers risk being subject to excessive and expensive environmental assessment and monitoring**

¹⁶ The nature of these possible synergies are well illustrated in a recent report by consultants 3E: see [http://www.greenpeace.org/eu-unit/press-centre/reports/A-North-Sea-electricity-grid-\(r\)evolution](http://www.greenpeace.org/eu-unit/press-centre/reports/A-North-Sea-electricity-grid-(r)evolution).

¹⁷ OJ L 103, 25.4.1979.

¹⁸ OJ L 206, 22.7.1992.

¹⁹ OJ L 175, 5.7.1985.

requirements which might have been avoided if state-of-the-art knowledge had been taken into account.

2.5. Dealing with bottlenecks and power balancing in the onshore electricity grids

For a number of reasons, **electricity generation from offshore projects will tend to be less geographically dispersed** than onshore wind and many other RES technologies.

Firstly, the need to establish dedicated grid connections to points far out at sea makes economies of scale particularly important if offshore projects are to be competitive (especially in the case of regulatory regimes where connection costs are paid by the developer rather than through system tariffs). This alone means that offshore projects will tend to be bigger than onshore projects.

Secondly, all offshore energy is produced in areas with no demand (apart from perhaps some consumption on oil and gas platforms), so all the production feed-in points are concentrated on the coastline.

In a scenario with large-scale development of offshore wind power, **this will challenge the capacity of the existing system to balance generation and demand and to transmit the power to the consumption centres**, many of which are inland. In some Member States, especially in Germany, bottlenecks already exist or are expected in the event of significant wind capacity expansion in the North Sea, and the need for further interconnection capacity has been demonstrated e.g. by the German Dena I study²⁰.

3. THE WAY FORWARD

3.1. Investing in the future competitiveness of the EU wind energy industry

Bringing offshore wind out of the shadow cast by its nearest competitors for investments — onshore wind and offshore oil and gas exploration — will require dedicated efforts to develop technology and supply chain infrastructures over the decades to come. The **Strategic Energy Technology Plan (SET-Plan)**²¹, presented in 2007 and endorsed by the European Council in March 2008, constitutes together with the **Seventh Framework Programme for research, technological development and demonstration (FP7)**²² and the **Intelligent Energy Programme (IEE)**²³ the overall EU framework within which these challenges should be addressed. In addition, the Union's Cohesion Policy Funds will support investments of over 787 M€ in wind energy, including possibilities for offshore projects, for the period 2007-2013. As the Cohesion Policy Funds also can support investments for sustainable energy, including wind energy, under other headings like Research and Development (total allocation of €63,6 bn), the actual support to the wind energy area from the Cohesion Policy is expected to be much higher.

The SET-Plan identified doubled output of the largest wind turbines, with offshore wind as the lead application, as a key challenge for meeting the 2020 targets, and proposed a

²⁰ www.offshore-wind.de/page/index.php?id=2605&L=1

²¹ COM(2007) 723, 22.11.2007.

²² OJ L 412, 30.12.2006, p. 1.

²³ OJ L 310, 9.11.2006, p. 15.

European Industrial Initiative on Wind Energy. The aim is to foster market deployment and bring down the cost of wind energy, but given that onshore wind is already among the most competitive technologies the Commission believes that **offshore wind should be a key priority of the initiative**. While it may be tempting for industry to concentrate on reaping the benefits of the currently booming onshore market, investing in offshore will be critical to maintaining the EU's global technology leadership and will prepare the ground for new export markets. There will also be important positive spill-over effects on other related markets, a good example being modern High Voltage Direct Current (HVDC) cable technology where European industry has a unique potential²⁴.

For these reasons, **the Commission has given more emphasis to offshore wind under FP7 starting with the 2009 energy work programme**. The Strategic Research Agenda²⁵ of the Technology Platform for Wind Energy (TP Wind)²⁶ published in July 2008 includes proposals for priority research areas for offshore wind which are a welcome input to prioritising and coordinating future EU and national research efforts. In this context, Member States are also encouraged to make further use of the opportunity offered by Cohesion Policy Funds in the area of research and development.

As demonstrated in the Strategic Research Agenda **there are questions about the adequacy of current levels of support for research into wind energy, including offshore, given the new ambitious direction of Europe's energy policy**, and the Commission will consider this issue further in the context of the Communication on financing low carbon technologies announced in the SET-plan. In the same context, **options for combining public, industry and other private resources within the industrial initiative will be considered** to ensure sufficient focus on offshore aspects.

In terms of skilled workers, installation vessels and other specialised resources, offshore wind at present competes unevenly with oil and gas production. However, with time **the common ground between offshore renewables and the oil and gas industry can be turned into an asset if the opportunities are seized in coastal areas to achieve a managed, gradual transition to new energies**. Many regions in Europe are already realising the potential for future jobs, growth and economic regeneration that lies in redeploying existing skills and resources from fisheries, shipbuilding and harbours in decline and other potentially relevant industry sectors. While high oil prices are likely to stimulate continued investments in European oil and gas production for some time to come, production has peaked and it is time to start planning the transition and harnessing the necessary new skills. EU programmes such as Intelligent Energy Europe and programmes under the Cohesion Policy are already being used to fund projects taking a proactive approach in the adjustment to renewables and supporting the development of offshore wind²⁷.

3.2. Adopting a more strategic, coordinated approach to offshore developments

As explained above, a more strategic and coordinated approach will be important for exploiting Europe's wind resources in a cost-effective way, and a range of planning instruments and forums at EU or regional level may play a role in this respect.

²⁴ See for example the "Electra initiative": http://ec.europa.eu/enterprise/electr_equipment/electra.htm

²⁵ www.windplatform.eu/92.0.html

²⁶ www.windplatform.eu

²⁷ Examples include www.power-cluster.net, www.offshore-power.net and www.windskill.eu.

From a **renewable energy source perspective**, the Commission has proposed that the new Directive on energy from renewable sources should contain an obligation for Member States to prepare National Action Plans²⁸. This will be an opportunity for Member States to set out a consistent framework for the contribution of different renewable energy sources and technologies. It would appear appropriate for Member States with offshore renewable energy resources to spell out the expected contribution to their 2020 target in this context.

From a **marine environmental perspective**, the implementation of the recently adopted **Marine Strategy Framework Directive**²⁹ will be an opportunity for Member States to consider offshore wind farms in their overall assessment of the pressure and impacts on the marine environment, and whether these are likely to affect the attainment of the "good environmental status" objectives of that Directive. In this context, the **regional sea conventions** (OSPAR, HELCOM, MAP, BSC etc.) may also contribute to better coordination and much work has already been done e.g. in relation to environmental assessments³⁰.

From an **electricity grid perspective**, the regional cooperation within the new **European Network of Transmission System Operators (ENTSO)** proposed under the "third package"³¹ and their related grid development and investment plans will be important new tools for coordination, and European Transmission System Operators support the idea of dedicated regional offshore wind energy grid plans. The **new Agency for the Cooperation of Energy Regulators** and the existing regional initiatives will also play an important role in coordinating regulatory matters, to ensure that improved markets mechanisms (including for balancing power and cross-border trade) and more coordinated, flexible and favourable conditions encouraging investment in transnational offshore grids are put in place. Moreover, the **European coordinators** appointed under the TEN-E guidelines³² (including the coordinator for offshore wind in Northern Europe) have specifically been tasked with promoting the European dimension of certain projects by facilitating cross-border dialogue and with helping to coordinate national procedures for consulting stakeholders.

The challenge is to ensure that the various processes are linked up and at the same time to exploit their specific advantages, resources and expertise. As explained in the Commission's Communication on an Integrated Maritime Policy for the EU³³ **the long-term vision for the management of the seas must be to move towards genuinely integrated maritime spatial planning**, and the Commission will present a roadmap to this end before the end of 2008. Such an approach could provide a framework for balancing and arbitrating between different sectoral interests and set stable conditions for investments. **To make timely progress towards this end, practical steps and experience from processes driven forward by actual, sectoral needs of high political priority will be necessary.**

In this perspective the current German-Swedish-Danish work to explore the possibility of a joint connection solution for the three offshore wind farms all located at Krieger's Flak in the Baltic Sea, which is strongly supported by the European coordinator, will yield valuable experience of how to share the potential socio-economic benefits of a common solution combining new wind farms and interconnections. The **Commission will support and**

²⁸ COM(2008) 19, 23.1.2008.

²⁹ OJ L 164, 25.6.2008, p. 19.

³⁰ See www.ospar.org and www.environmentalexchange.info

³¹ COM(2007) 528.

³² OJ L 262, 22.9.2006.

³³ COM(2007) 575, 10.10.2007.

complement the efforts of the European coordinator to bring together the various processes, authorities and stakeholders, to develop 'best practice' through specific cases, and to stimulate the emergence of similar cooperation efforts elsewhere, beginning with the North Sea. It will notably ensure close interaction with EU funded projects of specific relevance such as NORSEWiND³⁴ and WINDSPEED³⁵.

3.3. Maximising the environmental benefits of offshore wind

The environmental benefits of wind energy as a clean source of electricity with no emissions of greenhouse gases or local air pollution and the benefits in terms of security of supply are widely recognised, and the overwhelming majority of Europeans have a very positive attitude to wind energy³⁶. The avoidance of water consumption compared to thermal electricity production and the positive, global and long-term contribution to preserving biodiversity in terms of climate change mitigation are less well known but also significant.

Locally, however, individual projects are sometimes the cause of concern because of visual landscape changes, noise or effects on local biodiversity and habitats. If located far from the coast only the latter is potentially a problem for offshore wind farms, and experience to date shows that it rarely actually is: **monitoring programmes at existing offshore wind farms have shown that it is quite possible to construct even large farms without significant impacts on local biodiversity and habitats.**

Nevertheless, farms that are not properly situated may affect sensitive species and habitats. Such **potential problems should be identified at an early stage through strategic assessments**, and if necessary addressed through appropriate mitigation measures to avoid or minimise any significant adverse effects.

The Commission considers that the **existing EU legislation on nature and environmental assessments is an adequate framework which is flexible enough to deal with these aspects**. It recognises, however, that further guidance on its application in the specific context of wind farms in or near protected or sensitive nature areas might help create further certainty for developers, authorities and other stakeholders. Therefore, the **Commission services will step-up work to develop guidance on nature and wind farms with the aim of finalising it in 2009 at the latest**. Options for providing, maintaining and disseminating state-of-the-art overviews of scientific findings about environmental impacts of wind power will be considered in this context. In addition, the Commission will continue work to establish a European Marine Observation and Data network (EMODNET) to facilitate access to data that can underpin environmental impact assessments

As stressed above, striking the right balance between the different interests involved in siting offshore wind farms is facilitated by strategic planning. The **designation of marine Natura 2000 sites under the Habitats and Birds Directives is therefore important for creating certainty for developers**. These designations are long overdue, and a guide has already been

³⁴ NORSEWiND is a new project funded by FP7 designed to provide a wind resource map covering the Baltic, Irish and North Sea areas using a combination of traditional meteorological masts, ground based remote sensing instruments and satellite acquired data.

³⁵ Supported by the Intelligent Energy Europe programme WINDSPEED aims to develop a roadmap for deployment of offshore wind energy in the Central and Southern North Sea taking all spatial marine interactions into account.

³⁶ Special Eurobarometer, January 2007. http://ec.europa.eu/public_opinion/archives/ebs/ebs_262_en.pdf

prepared by the Commission to assist Member States in identifying and selecting marine sites. The ball is clearly in the Member States' court and the **Commission will take all necessary measures to ensure that sites are designated** in a timely and appropriate manner.

3.4. Integrating large-scale offshore wind in the grid of the future

The large-scale development of offshore wind energy may make bottlenecks in the existing electricity grid more likely if the grid is not adapted to the changes in the generation infrastructure. This problem is already being explored by the European coordinator for offshore wind in Northern Europe, and it is also subject to detailed technical investigations in projects such as TradeWind³⁷ and the European Wind Integration Study (EWIS³⁸).

Before the exact extent and nature of the problem has been better quantified, it is not possible to provide a final answer on how to address it. Any response is likely to involve new transmission capacity and input from modern "smart grid" technologies involving intelligent demand management, energy storage (possibly through greater electrification of the transport sector) and, more generally, systems integration.

The Green Paper on European Energy Networks adopted in parallel to this communication, further work by the European coordinator and the closer cooperation between Energy Regulators and Transmission System Operators as discussed in section 3.2 will, however, provide the appropriate, wider context for this whole debate.

4. CONCLUSIONS

Offshore wind energy is an indigenous resource for electricity production with a vast potential that remains largely untapped. Offshore wind can and must make a substantial contribution to meeting the EU's energy policy objectives through a very significant increase — in the order of 30-40 times by 2020 and 100 times by 2030 — in installed capacity compared to today.

However, developing the necessary technology and industrial supply chain capacity and getting projects through the planning and consenting processes takes time. To make the required investments in time for 2020, the industry urgently needs more certainty and stable, favourable framework conditions. The binding 20% target for renewable energy and the energy and climate package will be key to achieving this, but Member States with offshore wind resources will need to use this framework and the proposed national action plans to spell out clearly their ambitions for offshore wind and take the necessary action.

For its part, the Commission will apply to the full all relevant existing or recently launched EU initiatives as outlined above, and will take further steps if necessary. It will in particular:

- seek to **facilitate regional cooperation on offshore energy site-and grid planning** between Member States, energy regulators, transmission system operators (TSOs) and other relevant stakeholders, **using instruments such as those established by the "third package" and the coordination platform set up by the European coordinator** for offshore wind connections in the Baltic and North Sea areas;

³⁷ www.trade-wind.eu

³⁸ www.wind-integration.eu

- **encourage the Members States to implement maritime spatial planning** based on the principles of the forthcoming Commission roadmap on maritime spatial planning to regulate the competing and growing uses of the seas via transparent decision making processes and to achieve optimal site selection.
- encourage TSOs and energy regulators to step-up cooperation to urgently put in place **more favourable regulatory conditions for investments in transnational offshore grids**, for cross-border trade and for the development of efficient balancing power markets;
- **emphasise offshore related research** under the Seventh Framework Programme for research, technological development and demonstration (FP7) and, in the context of the European Industrial Initiative on Wind Energy and the Communication on financing low carbon technologies announced in the SET-plan, **review the possibilities for stepping up support to accelerate the development and market deployment of offshore wind and other marine renewables in the light of the EU's new energy policy objectives** ;
- emphasise in future calls under the **Intelligent Energy-Europe programme** actions to tackle the main non-technological barriers to the use of offshore wind energy;
- finalise the specific **guidance on the application of the EU nature conservation legislation in the context of wind farms** and **take all necessary measures to ensure that Member States designate marine protected areas** under the Birds and Habitats Directives in a timely way, so as to improve planning certainty for project developers and contribute to the EU's biodiversity objectives;
- **consider the large-scale integration of offshore wind in the electricity grids as one of the key issues for the follow-up of the Green Paper on European Energy Networks**, taking into account ongoing studies and work by the European TSOs.