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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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COMMUNICATION FROM THE COMMISSION

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 2030. How supply will keep up with this demand is unknown: the IEA in its 2006 World

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

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 €70 billion, an annual increase of €350 for every EU citizen.³ 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° - 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 final, 8.03.2006; 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 Art. 17 of Regulation 1/2003 on the gas and electricity markets (final report)", SEC (2006) 1724

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 final), 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; and
- 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 twenty five 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 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

¹⁷ Directive of the European Parliament and the Council 2004/67/EC of 26 April 2004 concerning measures to safeguard security of natural gas supply OJ L 127, 29.4.2004, p. 92–96

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° - 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 19th 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.

Key measures include:

¹⁸ Action Plan for Energy Efficiency: Realising the Potential COM(2006)545 of 19 October 2006

- 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:

- 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;

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 of 22 June 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

- 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 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

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

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 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

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

²³ See also communication from the Commission : Towards a European Strategic Energy Technology Plan , COM(2006) 847

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 5bn 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 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.

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.

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".

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 Illustrative Nuclear 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.

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

²⁷ Draft Nuclear Illustrative Nuclear 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 final

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 an 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 final of 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/tCO ₂) | GHG emissions (Kg CO ₂ eq/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 |
| Wind | On shore | 35 - 175 | 28 - 170 | 30 | | | 95-98% | nil | |
| | | 35 – 110 | 28 – 80 | | | | 95-98% | | |
| Wind | Off shore | 50 - 170 | 50 - 150 | 10 | | | 95-98% | nil | |
| | | 60 – 150 | 40 – 120 | | | | 95-98% | | |
| Hydro | Large | 25 - 95 | 25 - 90 | 20 | 95-98% | nil | | | |
| | 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