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COMMISSION STAFF WORKING DOCUMENT

Annex to the Green Paper

A European Strategy for Sustainable, Competitive and Secure Energy

What is at stake - Background document

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What is at stake - Background document on the Green Paper - A European Strategy for Sustainable, Competitive and Secure Energy

1. INTRODUCTION

The aim of the present document is to provide a quantitative description of the present EU energy supply and consumption situation, the global energy sector environment of which it is a part and of the likely – or possible – developments over the coming 20-25 years. The document supports the Commission's energy policy paper for discussion at the 2006 Spring Council and will hopefully provide useful guidance for the EU energy policy debate during 2006.

The main thrust of the document is the quantification, as far as possible, of the impact of future possible developments in the energy sector on four key parameters in energy policy formulation:

- Security of supply.
- Cost
- Competitiveness
- CO2 emissions.

The above four parameters have been chosen as the most important but certainly not the only ones relevant for a comprehensive analysis. Other parameters such as air pollution, waste, in particular nuclear waste, accidents especially in mines, etc. and trade issues such as barriers existing in supplying countries are not dealt with in this document.

The Commission is planning to develop a broader energy policy strategy during 2006 and the present analysis paper will, in parallel, be developed into a full impact assessment to come forward together with the broader strategy.

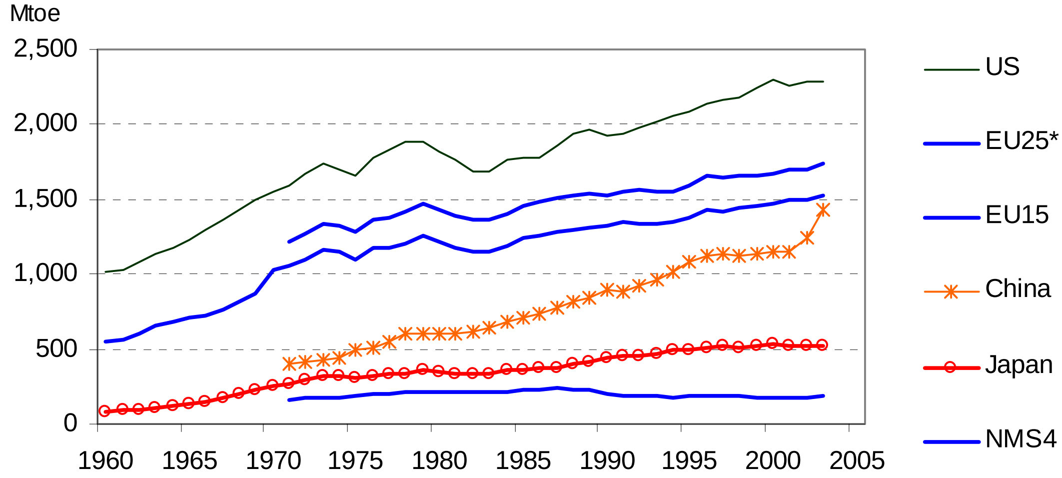
Whereas time has only allowed limited stakeholder involvement in the preparation of the present document, a full stakeholder involvement will be organised following the outcome of the Energy debate at the Spring Council.

2. GENERAL DESCRIPTION OF THE GLOBAL AND EU ENERGY SECTOR:

2.1. Global energy: past and future trends

World energy consumption has almost doubled since 1970. EU-25 primary energy consumption has risen steadily since the beginning of the 1970s, interrupted only by the two oil price shocks in 1973-74 and 1979-80. According to IEA statistics from 1971 to 2003 the increase was 41%, or an annual average rate of 1.1%. Primary energy consumption rose at a similar rate in the US, while it doubled in Japan (+2% per year) and increased almost fourfold in China (+4% per year), reflecting the pace of economic development. In China, it strongly accelerated since 2002 in relation with the high economic growth.

Figure 1: Total energy consumption



Source: IEA, own calculations
NMS4 = Czech Republic, Hungary, Poland, Slovakia

However, primary energy use per capita has generally increased only modestly since the oil shocks of the 1970s. This ratio shows large differences in the levels of the different regions, as energy use per capita in the US is twice as high as in the EU and Japan, and in China the ratio is 4 times lower again.

Energy demand continues to rise in virtually all regions of the world. The IEA World Energy Outlook[1] foresees total world energy consumption in 2030 to be almost 60% higher than it was in 2002. This growth is expected to be fossil fuel based (fossil fuels accounting for around 85% of the increase) with oil and gas taking the lion's share of around one third each of the increase. Nuclear would play a marginal role in the expansion of world energy supplies, while renewables including traditional biomass contribute more than 10% towards meeting higher world energy demand.

Energy demand growth is particularly high in China where a large population increases energy consumption from a rather low level resulting statistically in high percentage growth. The IEA projects energy consumption to double between 2002 and 2030. About half of this growth would come from solid fuels, 30% from oil and nearly 10% from natural gas, so that the fossil fuels contribution to higher Chinese energy supplies would be slightly less than 90%. The remainder of the rapidly increasing energy demand would be supplied by renewables and nuclear with nuclear accounting for 5% of the increase in energy to 2030.

In India, energy demand might rise by 90% up to 2030. Again, this growth is expected to be fossil fuel intensive (over 80% of the increase coming from fossil fuels: solids (nearly 40%), oil (30%) and natural gas (14%)). Renewables including traditional biomass are projected to

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1 The IEA World Energy Outlook 2004 follows are rather conservative approach as regards the effectiveness of recent energy and transport policies in the EU and probably also in other OECD countries. Moreover, the IEA modelling is based on an oil price in 2030 of around 33$/barrel in 2005 prices. Nevertheless, other world energy projections, such as the International Energy Outlook 2005 by the US Department of Energy have even higher growth rates for world energy demand as well as for energy demand in China and India.

provide as much additional energy as natural gas. Nuclear would account for 5% of additional demand.

The OECD countries show a less spectacular increase in relative terms. The IEA sees energy demand in these countries rise by 30% until 2030. The consumption increase would also be fossil fuel intensive (providing some 80% of the increase). However, the remainder would come from renewables, whereas the nuclear contribution would be negative (nuclear declining 6% to 2030).

The pattern of the increase in energy demand, however, looks very different if addressed in terms of per capita consumption, total national consumption increase or in terms of percentage increase. Tables 1 and 2 illustrate this. Oil consumption has been chosen as the example because it is the energy source of biggest relevance for the global energy supply. Numbers reflecting total energy consumption or CO_2 emission show a largely similar pattern.

Table 1: Oil consumption per capita

	2002	2030	2002-2030 difference	% change
	- barrels per capita per year -			
USA/Canada	22.8	23.8	1.0	4%
EU-25	10.4	11.6	1.1	11%
Japan/Korea	15.0	16.9	1.9	13%
China	1.4	3.2	1.8	128%
India	0.8	1.4	0.5	64%
Saudi Arabia	26.0	29.6	3.5	14%

The numbers put some general perceptions into perspective. The first observation is that the huge differences in per capita consumption are expected to remain virtually unchanged towards 2030. Saudi Arabia with already the highest per capita consumption is expected to see the biggest growth in terms of barrels per capita, whereas India is expecting the smallest. The difference between the US/Canada and China would be reduced from 21.4 barrels per capita per year in 2002 to 20.6 in 2030, -not much.

Table 2: Total oil consumption

	2002	2030	2002-2030 difference	% change
	- million barrels per day (mbpd) -			
USA/Canada	19.7	26.3	6.6	34%
EU-25	13.0	14.9	1.9	15%
Japan/Korea	7.1	7.9	0.8	11%
China	4.9	12.7	7.8	157%
India	2.4	5.3	3.0	124%
Saudi Arabia	1.6	3.2	1.6	98%

Looking at total oil consumption it is remarkable that US/Canada in 2030 still remain at more than double the Chinese consumption in spite of expected continued economic growth in China and its high population. It is also worth noting, that out of the additional 6.6 mbpd oil consumption in US/Canada between 2002 and 2030, 5.7 mbpd are due to population increase (88 mill. people) on the basis of the projected high per capita North American oil consumption in 2030.

By comparison a population increase in India of 383 million is responsible for an additional 1.4 mbpd (out of total 3.0) or an increase in China of 164 million is responsible for an additional 1.5 mbpd (out of 7.8). Against these numbers it is difficult to maintain that population growth in developing countries is a major challenge to the global energy (or oil) system. However, aiming at adopting the present unsustainable patterns of oil and energy use prevailing in industrialised countries means such a challenge. Policies for containing and eventually reducing fossil fuel consumption in industrialised countries seem to be a prerequisite for global moderation.

2.2. EU energy developments since 1990 and present situation

Energy developments since 1990

Energy consumption in EU-25 has been growing at a much lower pace than GDP, so that energy intensity[2] decreased by 1.4% p.a. in the 1990s. The 1990s were characterised by the restructuring of the economies of most of the new Member States and the ex-GDR, leading to an energy intensity decline of 3.6% pa in the new Member States compared with a decrease of 1.1% pa in EU-15.

[2] Energy intensity is the ratio between energy demand and GDP; a decline of this indicator means therefore an improvement, which reflects better energy efficiency as well as structural change towards more services and less energy intensive industries

CO_2 emissions[3] in EU-25 decreased by 3% between 1990 and 2000 with most of the decline taking place in the early 1990s. This reduction was caused by the developments in the new Member States where CO_2 emissions fell by 23%, while in the old Member States there was a slight increase of almost 2% above the 1990 level.

In the 1990s, the energy economy in the present EU Member States has changed significantly. This is particularly true in the new Member States during their transition from the centrally planned economy of the past. In addition to an often dramatic fall in GDP and a substantial decline of energy intensity by 3.6% pa, there was considerable fuel switching, in particular from solid fuels (from 54% in 1990 to 46% in 2000) towards less carbon intensive fuels. This fuel switching further added to the plummeting CO_2 emissions to levels far below these countries' emission targets for 2008-2012 agreed in Kyoto.

The old Member States (EU-15) have also seen substantial changes. Overall energy consumption grew by 10% between 1990 and 2000. Individual fuels have shown a different pattern: solid fuels[4] declined by 29%, natural gas soared by 52% and nuclear increased by 23%; renewables use went up 35% while oil consumption grew slightly below average (+8%).

Between 2000 and 2004 EU-25 overall energy consumption increased further by 1.4% pa [5]. Natural gas has been the strongest growing fuel (+2.8% pa), followed by renewables (+1.9%) and nuclear (+1.7% pa). Oil demand rose below average (+0.8%) and consumption of solid fuels started to increase again (+0.3% pa). Following these changes in the fuel structure, with robust growth for fossil fuels and only a small decline in energy intensity of less than half a percent per year, it is no surprise that ongoing economic growth leads to rising CO_2 emissions. Energy intensity has been rather flat due to sluggish economic growth that does not encourage capital turnover towards more energy efficient equipment. Renewables, in spite of impressive growth rates, especially for wind energy, have managed only a marginal increase in their combined share in overall consumption [6].

Present Situation

Total EU-25 energy consumption in 2004 amounted to an estimated 1745 million tonnes of oil equivalent (mtoe). Oil is the most important fuel accounting for 37% of total energy

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3 For the purpose of this document CO_2 emissions encompass all energy related emissions according to Eurostat energy balances including CO_2 from international air traffic, which concerns national flights, inter-EU flights and flights outside the EU; given rapidly increasing air traffic the inclusion of intra-EU and other international air transport leads to higher growth numbers for CO_2; emissions from bunkers (maritime transport) are excluded

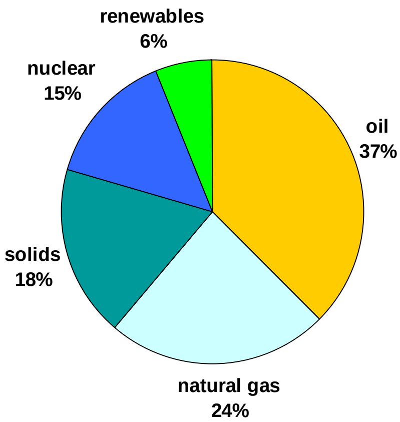
4 Solid fuels include coal, lignite and peat but they exclude wood

5 Based on preliminary energy statistics for 2004

6 It should be noted that Eurostat energy balance methodology, in conformity with the methodology of several other national and international energy balance providers, values the electricity derived from certain renewables, such as hydro and wind, according to the calorific value of the electricity produced without including losses in transformation. If contrary to energy balance conventions of Eurostat and others, one kWh of hydro and wind would be valued as much as one kWh from nuclear, the increase of the renewables contribution would have been two percentage points (up from 7% to 9%) instead of 1.4% under Eurostat conventions; the accounting principles of Eurostat value nuclear according to the heat nuclear generates (including the losses of roughly two thirds in power generation) and not to the electricity it produces; whereas for hydro and wind the valuation is based solely on the electricity produced.

consumption. Oil is predominantly used in transport[7](56% of oil consumption), as feedstock in e.g. petrochemical processes (15%), in the other final energy demand[8] sectors industry, services and households (joint share of 23%) and as an input for power generation including CHP and district heating (6%).

Figure 2: Total energy consumption by fuel 2004



The second most important fuel is natural gas (24% of total energy consumption). Natural gas is mainly used in power generation (29%), households (29%), industry (25%) and other final energy demand (13% - with only a minor role in transport).

Solid fuels come third with an 18% share in total energy consumption. They are mostly used for power generation (74%) and in heavy industries (e.g. steel industry).

Nuclear has been growing steadily to reach a share of nearly 15% in total energy consumption. However, investment in new nuclear plants slowed down substantially in recent years and closures of plants with safety concerns in some New Member States have been agreed and are now gradually taking place. In addition, three old Member States (Belgium, Germany and Sweden) have decided on a policy to phase out nuclear over time, but only a small number of plants has been actually closed so far.

Renewable energy sources (biomass, hydro, wind, solar, geothermal) have increased their contribution for several years reaching a share of 6%. Biomass is used for heating and power generation and recently also for producing transport fuels (biofuels). Hydro and wind contribute to electricity generation. While hydro is an established source, wind has seen impressive growth rates in recent years (4 fold increase in just 5 years from 1998 to 2003 with considerable growth thereafter: +57% from 2003 to 2005).

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7 The breakdown by sector in this section on the present situation is based on statistics for 2003 as 2003 is the latest year available with complete energy statistics from Eurostat. The breakdown is furthermore based on the energy that is delivered to either final consumers or power generation; it excludes therefore deliveries within the individual fuel sectors (e.g. consumption of refineries and refinery losses).

8 Final energy demand is the energy consumed in transport, industry, services, agriculture and households; it includes electricity but excludes the fuel consumption for producing electricity as well as distribution and other losses; this holds for all energy products that come out of transformation processes (e.g. petrol from refineries).

Energy in its various forms is consumed in all parts of the economy. Most final energy is used for transport (30%), industry (28%) and in households (27%). Services and agriculture account for 11% and 4% respectively.

About half of our energy consumption is produced within the EU while the other half is imported so that EU energy import dependency stands currently close to 50%. Import dependency is particularly high for oil. Net oil imports account for 81% of oil consumption (including bunker fuels for maritime and air transport). More than half (54%) of gas consumption comes from outside the EU. Import dependency for solid fuels amounts to only 38 %, as lignite is exclusively produced within the EU and large quantities of coal are still mined in the EU. Nuclear and renewables are treated as indigenous fuels so that their import dependency is zero in Eurostat statistical conventions [9].

2.3. Trends to 2030 in the EU under current policies

Overview and assumptions

The following baseline projections to 2030 for the EU focus on the current EU of 25 Member States. They do not include Bulgaria and Rumania as the modelling for these countries has not yet been finalised. Further scenario work later this year will include these acceding Member States.

The baseline scenario [10] for EU-25 represents current trends and policies as implemented in the Member States up to the end of 2004. In particular, the baseline modelling assumes a continuation of policies on economic reform (Lisbon) and the completion of the internal energy market. The baseline scenario includes current policies on energy efficiency and renewables, without assuming that specific targets are necessarily met. For example, the renewables shares in electricity are modelling results (some 18% in 2010 for the EU) that show the effects of policies or their absence in the Member States. On transport, the baseline assumes that the targets agreed for 2008 with the car industry on the reduction of specific CO2 emissions for new cars are achieved without assuming a further strengthening of targets thereafter. The baseline assumes furthermore that decisions on nuclear phase-out in some old Member States will be implemented as decided and that certain nuclear plants with safety concerns in new Member States will be closed as agreed. Nevertheless, in Member States without a phase-out decision, the baseline scenario assumptions result in considerable investment in new nuclear capacity depending on the economics of power generation and the overall energy policy context in the individual countries.

The baseline does not take into account possible additional action in the Member States for living up to their Kyoto commitments, nor the possible development of climate change policy for the years after 2012. CO2 emissions are modelling results based on the development of the energy economy, which in turn reflects among other things policies implemented so far. For the purpose of the baseline a CO2 price of 5 €/t CO2 has been assumed up to 2030 for those

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[9] Nuclear fuels can be stocked covering the needs for a long period of time. However, uranium is imported into the EU and many Russian type reactors in the new Member States are using Russian fuel.

[10] The baseline scenario was derived with the PRIMES model operated by the National Technical University of Athens. The modelling comprises a detailed representation of production, imports, transformation and consumption for all energy products, demand sectors and Member States up to 2030 in line with Eurostat energy balances, which is one of the major data sources. The baseline was developed in 2005 in consultation with the group of Member States energy economists.

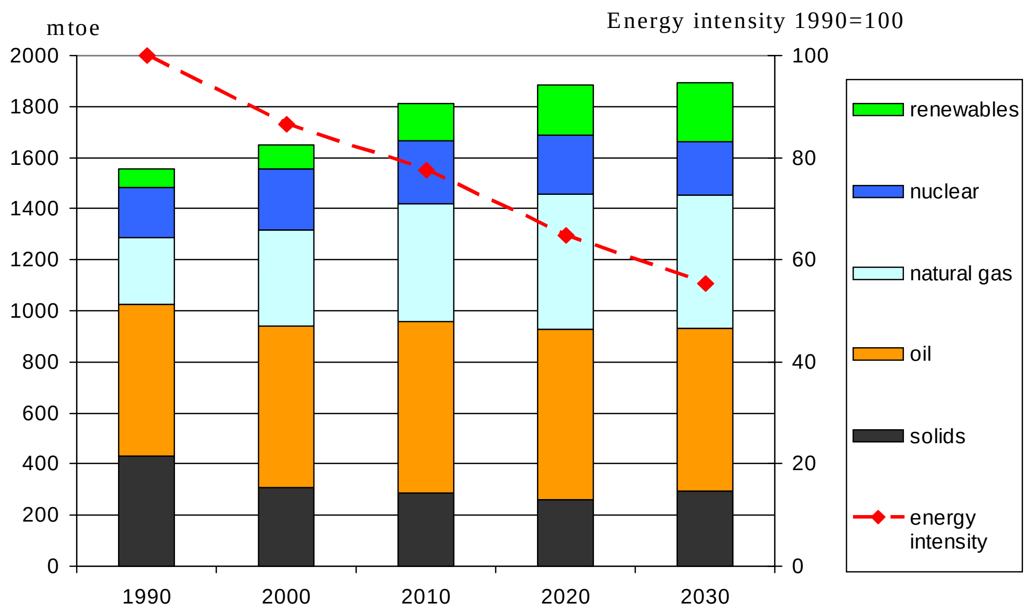
sectors covered by the EU Emission Trading Scheme (ETS) as a reflection of the medium-term price level of the emerging international carbon market (including Clean Development Mechanism) and the EU ETS being connected to it.

These baseline projections assume 2% pa economic growth until 2030 and oil import prices, reaching 58$/bbl for oil in 2030 (in 2005 $), up from 54 $/bbl for 2005. Gas prices are assumed to follow oil prices to reach 45$/barrel of oil equivalent in 2030, so that the gas – coal price difference widens over time.

Total EU-25 energy consumption in the baseline would continue to increase up to 2030. In 2030, total energy consumption is projected to be 15% higher than it was in 2000; the growth rates of energy become smaller over time with consumption virtually stabilising post 2020 reflecting stagnating population and consequently lower economic growth. The increase of energy consumption by 2030 is much lower than the growth of GDP (15% versus 79%) so that energy intensity improves by 1.5 % pa up to 2030.

The energy consumption increase is expected to be met by natural gas and renewables, which are the only energy sources that increase their market shares. Oil remains the most important fuel, despite slow growth over the next 10 to 15 years and an expected decline thereafter so that oil consumption in 2030 would not exceed the current level. Natural gas demand is expected to expand considerably by 140 mtoe from 2000 to 2030 after the substantial increase already seen in the 1990s. Solid fuels are projected to decrease somewhat by 2020 and to come back almost to the current level in 2030 following the nuclear phase-out in certain Member States combined with high oil and gas prices as well as the low CO2 cost assumed in the scenario.

Figure 3: Total energy consumption by fuel and energy intensity



Renewables increase more than all other fuels in relative terms (more than doubling their contribution from current levels by the year 2030). In absolute terms they increase by 135 mtoe from 2000 to 2030 contributing nearly as much as natural gas towards the increase of energy demand.

Following the political decisions on nuclear-phase out in certain old Member States and the closure of plants with safety concerns in some new Member States, nuclear is somewhat smaller in 2030 than it was in 2000 (minus 11 %).

Table 3: Share of energy sources in total energy consumptions (in %):

	1990	2000	2010	2020	2030
Solid fuels	27.8	18.5	15.8	13.8	15.5
Oil	38.3	38.4	36.9	35.5	33.8
Gas	16.7	22.8	25.5	28.1	27.3
Nuclear	12.7	14.4	13.7	12.1	11.1
Renewables	4.4	5.8	7.9	10.4	12.2

The renewables share is projected to rise from less than 6% in 2000 to 8% in 2010, to over 10% in 2020 and to 12% in 2030. Nevertheless, under baseline conditions the EU target on renewables for 2010 (12%) will not be achieved. The share of nuclear in total energy consumption remains close to 14% up to 2010, from where it decreases to 11% by 2030; in total the share of indigenous and carbon free energy sources (renewables and nuclear) rises from 20% in 2000 to 23% in 2030.

While energy consumption increases at a rather low pace through 2030, there is a steep decline in indigenous production, in particular of hydrocarbons, solid fuels and nuclear. Only renewables production is expected to increase. In 2030, current baseline projections have oil production declining by 73%, gas production would be 59% lower and solid fuel production is expected to sink by 41%. Nuclear generation might decrease by 11%, whereas the production of renewables should more than double between 2000 and 2030. All together, total indigenous energy production in 2030 would be 25% lower than it was in 2000.

Import dependency continues growing to reach two thirds in 2030, which is up some 15 percentage points from today’s level. Import dependency for oil continues to be highest, reaching 94% in 2030. Gas import dependency rises substantially from somewhat over 50% at present to 84% in 2030. Similarly, solid fuel supplies will be increasingly based on imports with import dependency reaching 59% in 2030.

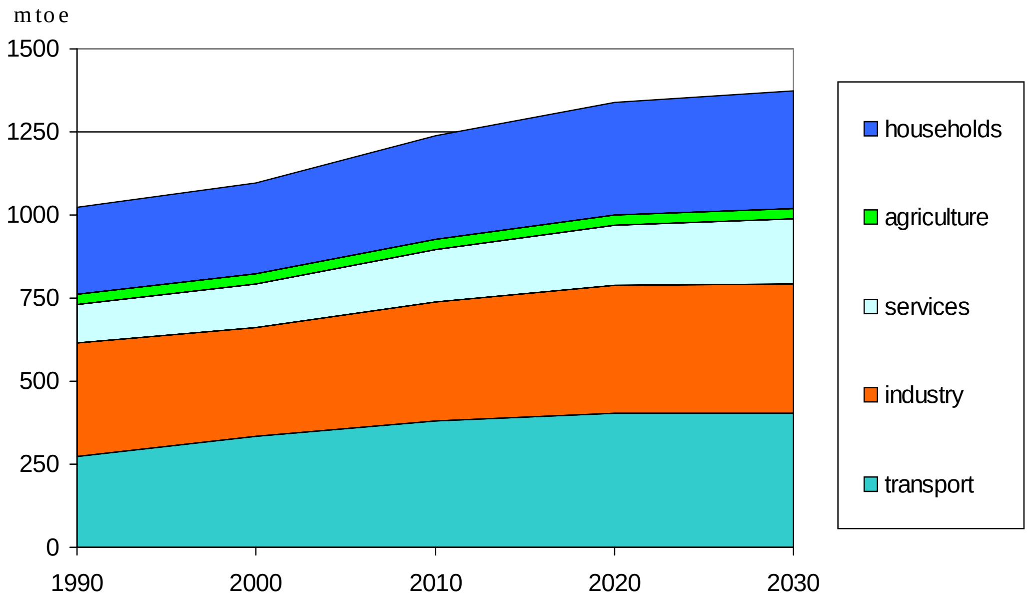
Energy related CO2 emissions (including international air transport) sank between 1990 and 2000, from where they have returned by now to broadly the 1990 level (base-year of the Kyoto protocol). However, over the projection period, CO2 emissions increase significantly, exceeding the 1990 level by 3% in 2010 and by 5% in 2030.

Final energy consumption

Final energy consumption increases by 25% from 2000 to 2030. Final energy demand rises most in the services sector due to the increasing share of services in modern economies.

Energy demand for services is projected to be 49% higher in 2030 than it was in 2000. This development is driven by increasing demand for electricity (e.g. office equipment).

Figure 4: Final energy consumption by sector



On the contrary, energy demand in agriculture increases least, growing nevertheless by 10% between 2000 and 2030.

Household energy demand is expected to rise by 29% between 2000 and 2030. The increasing number of households (+ 25% up to 2030) following demographic and lifestyle changes towards smaller household size is an important factor for this development. On the other hand, there are some saturation effects concerning heating energy demand. The increasing use of electric appliances and air conditioning entail rising electricity demand (+ 83%).

Transport energy demand in 2030 is projected to be 21% higher than in 2000. After having seen very high growth rates in the 1990s, the increase of energy use for transportation decelerates. This reflects the declining growth rates over time of both passenger and freight transport activity. In addition, there are important fuel efficiency improvements in particular in passenger transport (especially private cars following the agreement with the car industry on reducing specific CO2 emissions in new cars). Therefore, energy demand in transport grows less than transport activity (in passenger-km and tonne-km).

The projection period has some significant fuel switching in the transport sector as a result of the implementation of the biofuels Directive. Under baseline conditions the biofuels share in 2010 rises to almost 4% - however, falling short of the indicative target of 5.75%. The biofuels share continues increasing up to 2030 to reach 8%. No other alternative fuels are penetrating in this scenario reflecting current policies and the cost development in the modelling of "non-conventional" fuels relative to petrol and diesel.

Energy demand in industry is 19% higher in 2030 compared with 2000. This rather low growth reflects shifts in the industrial production structure towards less energy intensive branches focusing on higher value added. This shift in the production structure entails also much higher use of electricity in industry (+34%).

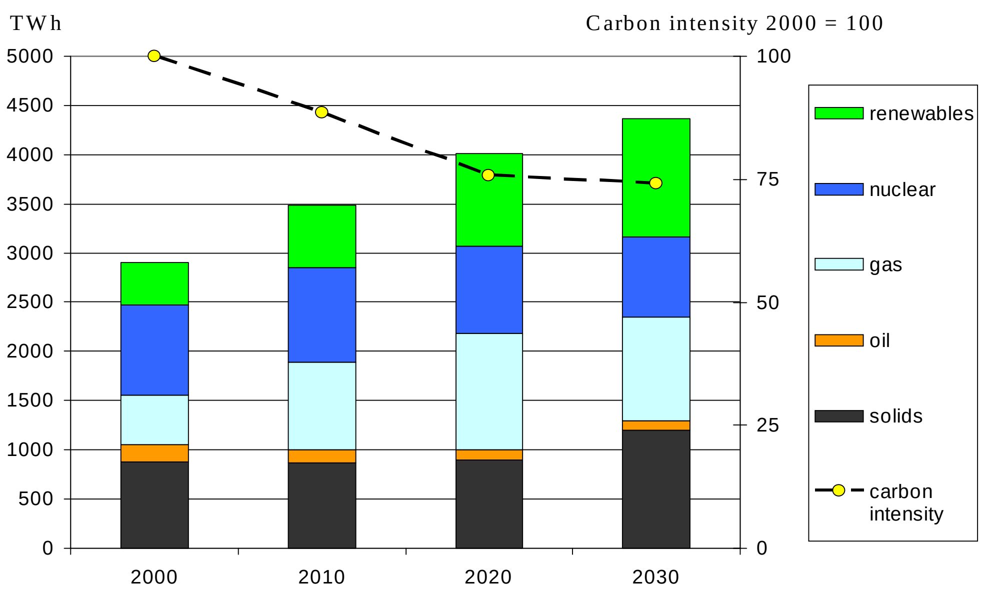
Overall, electricity is the fastest rising type of energy in final demand (+ 58% up to 2030). There is also strong growth of heat from CHP and district heating (+ 39%). Natural gas continues to make major inroads for heating purposes (+28%). Oil demand increases only moderately due to limited consumption growth in transportation and its replacement by gas and electricity in stationary uses. Solid fuels continue to decline strongly so that their use becomes more and more concentrated on some heavy industries. Renewables almost double their contribution – albeit from a rather small basis - in final demand encompassing both traditional uses, such as wood combustion, but also solar water heating and biofuels in transport. Higher deployment of biofuels is the major driving force for greater renewables penetration in final demand (as distinct from renewables use for power generation, where hydro and wind are established sources, with a great potential for further wind penetration).

Electricity generation

Following soaring electricity demand, power generation is expected to grow considerably given the limited potential for higher electricity imports from outside the EU. Electricity production is expected to increase by 51 % between 2000 and 2030. An increasing share of electricity will be produced in form of combined heat and power (up almost 10 percentage points to reach a 24 % CHP share in 2030).

The structure of power generation changes significantly in favour of renewables and natural gas while nuclear and solid fuels lose shares in the expanding electricity market. Electricity generation from natural gas is projected to more than double from 2000 up to 2030. Over the same period, renewables based power generation nearly triples.

Figure 5: electricity production by fuel and carbon intensity [11]



[11] Carbon intensity is an indicator for the fuel mix relating CO2 emissions to energy production (or consumption)

The renewables share in power generation rises to 18% in 2010 – which falls however short of the indicative target of the renewables electricity directive (21%) – indicating that the measures implemented in the Member States by the end of 2004 are not yet sufficient. In any case, the baseline shows a dynamic development in renewables penetration in electricity, as the renewables share (including waste) rises further to 23% in 2020 and 28% in 2030. Wind contributes the largest part to additional renewables power generation increasing its share from 1% in 2000 to 10% in 2030, by which time it is expected to produce even more electricity than hydro power. Wind energy in 2030 provides twenty times as much electricity as was available from this source in 2000. Hydro increases modestly in absolute terms as most sites for large scale generation have already been taken and as a result of environmental restrictions in some Member States. The share of hydro decreases, however, to 9% in 2030 given the strong increase in total power generation. Biomass and waste contribute 8% to power generation in 2030, up from only 2% in 2000.

Nuclear, the other major CO_2 free energy source for power generation, declines as a result of political decisions. The nuclear share falls from over 30% to only 19% in 2030 despite considerable investment in new nuclear plants in some Member States (largely replacing old nuclear plants). Overall, the share of indigenous and carbon free sources (renewables plus nuclear) remains flat at the current level of 45-46% throughout the projection period.

Solid fuels lose market shares in power generation in the medium term [12] and compensate these losses in later years towards 2030 in their function as replacement for nuclear and also as a result of the competitiveness losses of natural gas following increasing gas prices. Nevertheless, gas continues to gain market share due to its advantages as a clean, efficient and low carbon fuel. The role of oil diminishes further in power generation. Overall, the share of fossil fuels remains flat at broadly 55%.

As a result of these changes towards fuels with a low (gas) or zero carbon content (renewables and nuclear), CO_2 emissions from power generation (+10% by 2030) grow considerably slower than electricity production (+ 51%). Consequently, the carbon intensity of power generation declines considerably. However, in the long term post 2020 the decrease of carbon intensity comes to a halt on account of the nuclear phase-out becoming effective and the ensuing replacement of nuclear with coal, which is not sufficiently compensated by the further penetration of renewables. In addition, high oil and gas prices discourage further penetration of natural gas leaving much scope for solid fuels in the baseline that does not assume that CO_2 targets will be necessarily met.

Producing the power for meeting the strongly increasing electricity demand (rising by more than 50% up to 2030) requires substantial investment in new power plants. Over the next 25 years total investment for power plants in the baseline will be even slightly higher than today’s power generation capacity of almost 730 GW (gross), of which 60% will need replacement up to 2030. The shape of power generation and the overall energy system over the next 25 years can therefore develop in different ways, one of which, reflecting current trends and state of policy implementation, has been set out in the baseline described above.

12 If gas prices as of today prevail for the medium term, there would be more economic incentives for using more solid fuels instead of gas leading to a higher medium-term share of solids in power generation

2.4. Electricity and gas investment and Trans European Networks

Interconnections and other infrastructure

The development of a European single market for electricity and gas requires an energy network that can easily allow for exchanges between Member States. However electricity, and to a lesser extent, gas networks have usually been developed only with national requirements in mind. For electricity this has led to the situation that certain regions such as the Baltic countries, the Iberian peninsular, Great Britain and Ireland all remain rather isolated from their neighbours in terms of interconnection. Although some new interconnection projects have been realised over the past five years, there is still a large need for further investment to come closer to reach minimum interconnection levels between Member States of 10% as endorsed by the Barcelona European Council in 2002.

Realising a European wide grid instead of fragmented national networks implies that the problems concerning missing links, congested lines and the needs for further connections are solved satisfactorily. Moreover, enhanced diversification of sources and supply routes for gas as well as tackling congestion for electricity and setting up sufficient cross-border interconnection capacity will support energy policy objectives, such as security of supply, competitiveness and environmental protection through making cleaner and more cost-effective fuels widely available throughout the EU. Community support and funding for Trans-European Networks (TENs) is instrumental in this respect. In order to support the rapid implementation of the most important cross-border interconnection capacity, a number of projects have been declared to be of European interest. Electricity

Electricity is the fastest growing fuel over the next decades and new sources for electricity generation, such as wind energy, are expected to penetrate the system requiring large investment in power generation equipment and transmission lines. In addition, many components of the existing transmission grid need repair, replacement and upgrading because of aging. Moreover, measures to reduce congestion and to improve cross-border interconnections are a matter of priority for making the internal electricity market a reality. Investment for future electricity supplies concern mainly expenditure for power plants including expenditure for replacing power plants, but also to a significant degree investment in transmission lines.

Over the next 20 years, under the conditions prevailing in the baseline scenario, investment in power plants including expenditure for replacing power stations to be decommissioned amounts to around 625 bill. € [13]. About half of this expenditure is needed for the replacement of existing power plants that will be decommissioned up to 2025. The investment in additional generating capacity relates mostly to renewables, which account for an investment expenditure of around 215 bill. € or some 70% of the expenditure for increasing electricity generation capacity. Most of the renewables investment is for wind energy (around 115 bill. €) and biomass (around 70 bill. €). The investment in wind energy will help saving fuel costs especially for solid fuels and gas, which in the case of gas could become rather high. In any case, higher renewables use will contribute to reducing CO2 emissions, especially when such new investment displaces solid fuel based electricity generation.

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[13] It needs to be noted that the investment figure is not a forecast but it is a consequence of the developments under the 2005 baseline scenario following the assumptions made, notably on GDP growth, energy import prices and policy implementation as of the end of 2004.

Investment in the transmission grid is estimated at around 3 to 4 bill. € annually [14] so that over 20 years the total investment need for transmission is around 70 bill. €. The total investment amount depends on the penetration of off-shore wind parks, which require higher levels of expenditure for connection to the grid. With strong wind penetration as shown in the 2005 baseline and a stronger role for off-shore wind in the long term a total investment for transmission infrastructure of over 70 bill. € up to 2025 may be expected. Total electricity related investment over the next 20 years is therefore projected at around 700 bill. €.

Gas

The rapid increase in gas consumption, which will draw predominantly on gas imports, requires substantial investment in gas infrastructure (pipelines, LNG terminals and underground storage). Total investment needs in gas infrastructure over the next 20 years are estimated at around 100 bill. €, of which almost half would be for the transmission system of operators in the Member States. New interconnectors might require some 6 bill. €. Around 22 bill. € are foreseen for storage projects. With gas imports almost doubling there is a need for strong investment in gas pipelines and LNG projects of around 23 bill. €.

LNG terminals and underground storage play a major role for the security of supply in the gas networks. In order to ensure competitive gas prices at all times through higher import flexibility and more diversification as well as for working towards more world market integration, there is a need to strengthen investment in these gas facilities.

The volume of gas imports in the next ten years, according to the 2005 baseline scenario, is expected to increase by around 70%. To maintain a steady flow of gas supply from fields outside the EU and in order to have a reserve corresponding to 1 to 2 months consumption in the EU-25, an adequate number of storage facilities needs to be available. Some of these storage and LNG projects are among the priority projects of the TENs with an estimated cost up to 2013 of 2.5 bill. € for LNG terminals and 2 bill. € for underground storage.

Typical costs for the construction of a LNG terminal range between 200 and 500 mill. €. Priority projects for diversifying sources of supply and entry points and for connecting the LNG terminals to the transmission grid concern presently projects in Belgium, France, Spain, Portugal, Italy, Greece, Cyprus and Poland. Underground storage priority projects, with a typical cost ranging between 100 and 200 mill. € concern also a large number of Member States including Spain, Portugal, France, Italy, Greece and the Baltic countries.

Investment for network bound energy sources

In total, investment needs for grid related energy supplies in the EU (electricity and gas) amount to approximately 800 bill. € in the next 20 years. Many of these investment projects are highly profitable or at least bankable given clear demand trends. In addition to financing through operators including the use of bank loans, certain important projects benefit from EU support and loans (EU-funds, EIB). It is therefore important to use EU funding and support instruments, having an impact on energy infrastructure, in such a way that they support optimally the energy policy line developed in the Green paper process. This includes in

[14] Study for DG TREN by CESI, Ramboll, Mercados and Comillas: “TEN-ENERGY-Invest”, October 2005, estimating infrastructure requirements for electricity and gas on the basis of energy projections set out in “European Energy and Transport – Scenarios on key drivers” (baseline scenario).

particular ensuring that the appropriate investment signals exist to promote the necessary investment.

Investment numbers will depend on the way the EU energy economy will evolve. With better energy efficiency as called for in the Green Paper on energy efficiency of 2005, higher renewables penetration or more nuclear, the investment patterns will be very different. Energy efficiency will reduce investment needs for power generation, while the larger penetration of carbon free fuels implies a restructuring of the power generation park affecting also the way power stations due for decommissioning will be replaced. These issues will be addressed in the full impact assessment that is planned to be available by the end of 2006.

2.5. Challenges

The baseline developments clearly highlight important challenges ahead. High oil and in particular gas prices pose already today challenges in terms of costs and competitiveness as is further developed in chapters 3 to 5 of this document. This situation is unlikely to improve under baseline conditions, which include the absence of strong countervailing energy policies. Moreover, current greenhouse gas emissions are already too high as clearly recognised in the Kyoto process. In addition, recent years have seen several incidences in the world energy markets that have raised security of supply concerns.

In the trend projections, energy consumption continues to grow with supplies being increasingly met by imports, which come to a large extent from geopolitically unstable regions. With decreasing indigenous fossil fuel production and a limited combined contribution from renewables and nuclear, the EU dependency on imports grows to two thirds in 2030. The management of the increasing external dependence of the Union will require making optimal use of the EU's energy dialogues and would benefit strongly from the development of a Joint External Energy Policy, which is addressed in the first of the six priority areas of the Green Paper.

Energy demand growth is particularly strong for natural gas, which needs to be imported in increasing quantities over wider distances. Renewables also increase their contribution while the shares of solid fuels, oil and nuclear decline. Whereas the baseline scenario continues to offer a relative balanced distribution of fuels both in terms of total energy demand and electricity generation, there are issues concerning the achievement of agreed targets. This concerns reaching the 12% renewables share objective for 2010 as well as meeting Kyoto targets. The Green Paper, in another of its priority areas, sets out options for improving the sustainable energy mix in the Union.

Renewables, spanning a wide range of technologies with different cost characteristics, expand differently with biomass/waste and wind making the biggest additional contributions. The share of renewables will depend among other things on the cost developments of the different renewables technologies. However, the renewables target for 2010 will not be met unless there is a substantial increase in policy efforts in the Member States.

Nuclear, the other CO2 free energy source, is projected to decrease in the long term below the current level. As a consequence of these energy developments, CO_2 emissions rise significantly up to 2010 and continue growing thereafter, which is clearly incompatible with the EU's climate policy.

Rising energy demand in the baseline scenario with the above negative consequences clearly shows the need for better energy efficiency, which is another priority area for action in the Green Paper. Energy efficiency is further developed in the following chapters of the background document, especially in relation to transport fuel efficiency and modal shift as well as to electricity. Improved interconnections, innovation and investment are instrumental for bringing about the required change, which holds also for the completion of the Internal European electricity and gas markets. Innovation and internal market completion are further priority areas of the Green Paper.

The global energy system will also change considerably in the period up to 2030, with a growing share of the global energy consumption taking place in developing and emerging economies. The result will be increased competition for supply, and considerable investment needs for additional capacity throughout the world.

The issues related to energy security, cost, competitiveness and CO2 emissions are discussed further in the following chapters on oil, gas, electricity (including nuclear and solid fuels) and renewables. The issues surrounding these energy sources are particularly important for policy analyses given the high dependence from world markets, the specific characteristics of these markets and the fact that electricity is produced from all energy sources including nuclear, renewables, solid fuels as well as gas and to a minor extent oil.

3. OIL

3.1. General

EU 25 oil consumption amounts at present to close to 13 million barrels per day (mbpd) or 650 million tons of oil equivalent (mtoe) per year [15] [16] After a period of solid increase in consumption in the 1990es (1.5% per year between 1994 and 1998 reflecting high growth in private road transport in the new Member States), consumption has been almost constant (0.1% per year average) since 1998. With somewhat stronger economic growth (2.3% per year) in the future than in recent years an average 0.2% increase per year to 2020 is foreseen in the 2005 baseline scenario. This would be followed by a small decline thereafter reflecting stagnating EU population and low economic growth, so that EU oil consumption would come back to current levels in 2030. With the expected higher growth in global oil consumption, the EU share could fall from present 18% to around 13%.

Total EU oil production stands at 2.7 mbpd (135 mtoe) in 2004 (UK 70%, DK 15%), down from a peak of 3.4 mbpd (168 mtoe) in 1999, and a modest 20% of EU consumption. There is no sign of a change in the declining production trend, and with present production exceeding 10% annually of proven, economically recoverable reserves, production might well fall below 1 mbpd within the next 10-20 years, the precise time depending on future discoveries. Oil imports, already now the “staple food” of our consumption and even more so in the future, comes from a broad range of regions and countries. Net imports of crude oil, feedstocks and petroleum products contribute to EU consumption (plus bunkers) in the following way:

[15] Conversion from million barrels per day (mbpd) to million tonnes of oil equivalent (mtoe) is undertaken here at the standard rate of 50 mtoe per mbpd.

[16] This number excludes maritime bunkers of approximately 1 mbpd or 50 mtoe per year

– Russia 27%

– Middle East 19%

– Norway 16%

– North Africa 12%

– Other regions [17] 5%

It would be a mistake to pay too much attention to the geographical or national origin of today's oil imports. In reality, the EU depends, as any other major oil importer, on a global oil market where available resources are being distributed worldwide by a number of more or less globally operating oil companies which try to maximise their profits through a global distribution of crude oil and products in a way that minimises cost of transportation and maximises the value of crude oil against specific refinery capacities and market demands for products. The implication of this is that EU security of oil supply, whether seen as protection against disruption of supplies or against excessive prices, has to be measured against the global market. A hypothetical disruption of oil supplies from the Middle East (mainly supplying Asia), Russia (mainly supplying Europe) or Mexico or Venezuela (almost exclusively supplying US) will have – apart from a short adjustment period – virtually parallel impacts in the major consuming regions. There are no signs that this pattern will change significantly over the next 20 years.

3.2 Security of supply

With indigenous oil supply moving below 10% of consumption in maybe less than ten year's from now, the EU security of oil supply is fundamentally a question of the security of supply to be expected from the global oil market.

There is a widely held consensus (IEA, governments, oil companies) that a 3 -4% annual growth in the world economy is likely to translate into a 1.5-2% annual growth in oil consumption globally. In this scenario, global oil production would have to reach 120 mbpd against presently 85 mbpd within the next 20-25 years. There is, however, much less consensus, if any at all, as to whether actual developments are likely to match this scenario and particularly, if they are, at what price such a production level can be achieved.

It goes beyond the scope of this document to report in any detail on the ongoing discussion of whether global peak oil production is likely to occur within the next 20 years or not. Suffice it to say, that to the extent that officially recorded proven, economically recoverable reserves (1200 billion barrels) are reliable, there is enough oil to cover the expected consumption over the next 20-25 years. Beyond that, there is much less certainty of whether future oil discoveries and improvements in technology will provide an increase in the resource base necessary to provide both the necessary ± 900 billion barrels required over the next 25 years and the substantial quantity of oil necessary to exit decently from a global annual oil consumption of 120 mbpd.

[17] Other regions include suppliers to the EU such as West Africa, the Caspian region and South America as well as regions to which the EU exports more oil than it imports from them (e.g. North America buying in particular motor fuels from EU refineries); in addition indigenous oil production accounts at present for some 20% of consumption (plus bunkers)

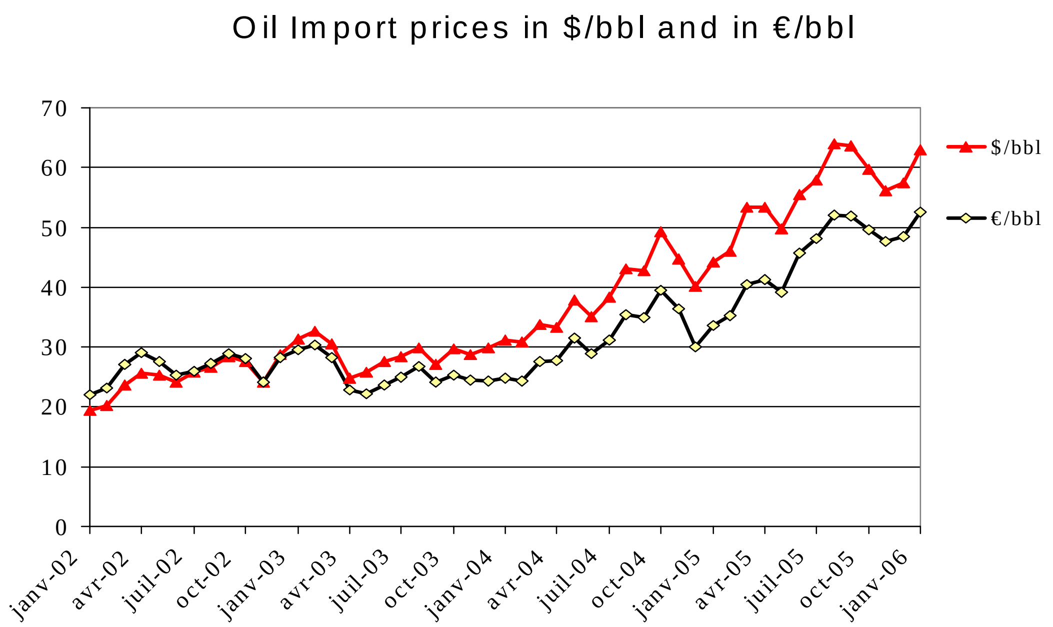
In the further assessment of the security of supply aspects of a 120 mbpd scenario it must be underlined that additional production capacity will be needed, not only to cover the higher consumption, but also to replace declining production in mature regions (North America, Europe, China, maybe Russia). Countries that have significant potential to increase production (presently producing less than 2% of their reserves annually) include: Venezuela, Kazakhstan, Iran, Iraq, Kuwait, United Arab Emirates, Saudi-Arabia, Libya. In addition deepwater oil production in Angola, Brazil, Nigeria and the Mexican Gulf is likely to provide up to 10 mbpd in the medium term but possibly less than that in a 25 years perspective.

Oil production in Russia deserves special attention. Since 1999 production has increased from about 6 to more than 9 mbpd, a trend that, if continued, would bring Russia to the level of present Saudi Arabia production. However, with a 12% share of global production on the basis of only 6% of global proven reserves, future discoveries and developments are crucial for further expanding production, or even for long term support of the present level of production.

All in all, potential for increased global oil production is there. Potential for secure global oil production is less sure. Long term implications of continued increase in oil consumption are far from reassuring and it remains an open question at which price oil will be made available to the global market under a “1.5-2% annual increase” scenario.

3.3. Cost

At present oil price levels (60$, 50€/barrel) the EU’s oil bill (for imported and domestically produced oil) stands at around 250 billion €/year or roughly 2.3% of GDP. This transfer of money from EU consumers to owners of oil resources, be it private oil companies or governments, has increased strongly in recent years due to soaring prices, which are illustrated in the following graph both in terms of dollar and euro[18].



[18] These calculations are meant to illustrate the order of magnitude of the costs involved.

In dollar terms, the oil price increased since early 2002 and particularly strongly in 2004 and 2005. In euro terms, oil prices were roughly flat in 2002 and 2003, but moved up in parallel to dollar prices since early 2004. In January 2006 oil in dollars was three times as expensive as only four years earlier, while the price in euro over the same period rose less thanks to the strengthening of the euro.

To answer the question of what is at stake in future oil prices, it would not be realistic to compare the present oil price level with the 20$/barrel or less prevailing between 1986 and 2002/03. It is widely recognised that this price level was too low to support the necessary investments in new production capacity outside OPEC. It was also well below the level where oil prices would have a detrimental effect on the global economy or on demand for oil. On the other hand, whereas the present price level of around 60 $/barrel does not seem to have much impact on short term global demand, and may not have much impact on medium term either, it is certainly well above the level required to justify investment in new production, whether in less accessible areas (deep water, arctic), in low grade oils such as the Canadian tar sands or in conversion of natural gas into diesel/jet fuel.

Without attempting to predict neither a "correct" nor a future oil price, it could be a useful illustration to assess the additional cost of a 20 $ or 20 €/barrel premium on the oil price in a tight market as compared to a more neutral market reflecting a reasonable level of spare capacity, while still respecting the need for the oil price to provide an incentive for exploration and development and to provide a reasonable remuneration to the owner of the resources.

With future oil imports likely to exceed 90% of consumption it is not unrealistic to consider the EU oil bill as money being paid out of the EU. A 20 € per barrel price differential (whether between 50 and 30, 60 and 40 or 70 and 50) represents an additional cost around 80 billion € annually. If gas prices will continue to be linked to oil prices, the total amount may go up well above 100 billion € annually or, probably accidentally, very close to the size of the present total EU budget.

Another example shows the order of magnitude which would be involved at the level of individuals. With an average annual oil consumption of 10 barrels per capita in the EU and assuming that half of the population is working, a 20 €/barrels price differential means that every person working will spend around 400 € out of his or her annual salary to pay for "more expensive oil" (for him/herself and the person supported on average), or the equivalent of around 3-4 working days per year, depending on the actual salary of the persons concerned.

However, for a person in a developing country with an annual oil consumption of only 1 barrel per capita, the additional price to be paid goes down to 40 € annually, but this would easily represent 8-10 days of work (at 4-5 €/day). This is another way of illustrating the hardship of the developing countries in coping with high oil prices, - in spite of their often very modest oil consumption on a per capita basis.

3.4. Competitiveness

The global character of the oil market (and relatively small price differences between different parts of the world) and the fact that oil is predominantly used as a transport fuel implies that oil prices have only marginal impact on competitiveness, apart from their possible impact on gas prices (see Chapter 4).

3.5. CO2 emissions

Neither the global trend in oil consumption (± 50% by 2025-30) nor the EU trend (foreseen in the 2005 baseline scenario at current levels by 2030) is anything close to what is required in order to meet the objective of long term stabilisation of greenhouse gas concentrations in the atmosphere without detrimental effects on the global climate (UNFCCC, 1992) nor the decision of the EU to continue reducing in greenhouse gas emissions beyond 2012 (end of first commitment period in the Kyoto Protocol, 1997). Without any signs that carbon sequestration (CO2 capture and underground storage) is likely to come down to the cost range which is already declared prohibitively high by several OECD countries, it will have to be assumed at this time, that every carbon atom burnt as fossil fuel will eventually be emitted to the atmosphere . And with global coal and gas consumption likely to follow a similar trend as oil the world appears to be on a remarkably unsustainable trend as climate change is concerned.

In order to, as a modest second step, stabilize global greenhouse gas emissions (the first step being for industrialised countries to stabilise their emissions) a reduction in emissions from industrialised countries will be necessary in order to allow developing countries their legitimate share of overall global emissions. The 2005 baseline scenario clearly demonstrates the risk of increasing CO_2 emissions over the coming decade, unless determined policy decisions will change the present trend. Although it might theoretically be possible to achieve such reductions through measures aiming predominantly at emissions from coal and natural gas, the higher scarcity of oil resources than that of coal and natural gas and the relatively high cost of oil offers both a moral and cost-effectiveness argument in favour of policies that will reduce oil demand, globally and at EU level.

3.6. The impact of possible policies to dampen the increase in oil demand

Some economists have questioned the need for policy action, arguing that the market would know how to respond to excessive prices as it did in the 1980es. This might well be an unjustified optimism.

First, part of the reason that the high oil prices in the 1980'ies collapsed was exactly a policy response, most notably the French decision to convert from oil to nuclear based generation. The introduction of the US "CAFE" fuel efficiency standard for passenger cars is another prominent example.

Secondly, a number of significant oil discoveries from the 60es and 70es (North Sea, Alaska, Mexico) went into production in the 1980es, thereby creating a significant overcapacity.

Thirdly, oil consumption outside the transport sector, such as in electricity, industry, domestic heating, offered a variety of commercially attractive substitution possibilities to an extent way beyond what is available today where oil is predominantly used in the transport sector and as a raw material in the petrochemical industry with limited substitution possibility. Consequently, it should not surprise anyone that so far there has been no discernable effect on demand following the price increase. (In fact demand today at above 60 $/barrel is higher than foreseen by the IEA in its 2004 World Energy Outlook on a price assumption of less than 30 $/barrel in dollars of 2000). Recent assessment from the IEA (Oil market report, December 2005) has, in spite of much higher prices, revised upwards expected global demand from 1.6 to between 1.8 and 2% annual growth up to 2010.

Whereas oil prices seem to have little short term impact on demand in the next few years, experiences during 2004 and 2005 demonstrate that demand can have a (surprisingly) large and prompt impact on prices. Any suggestion in 2003, that oil prices within a couple of years would move above 50$/barrel would have been met with fierce opposition.. The idea, that a normal, healthy, economic growth per se, could trigger a price increase like the one experienced was not even contemplated, except maybe by a few "exotics". This does not deny the additional impact of other events such as geopolitical instability or hurricanes on price behaviour in the market.

Against this backdrop it appears that if one believes that the present oil prices level is unnecessarily and/or increasingly high, policies aiming at reducing demand would be the appropriate response. There are still uses of oil outside the transport sector where demand can be reduced, such as gas oil used for heating which can in many cases be substituted with natural gas, biomass or waste heat from power production. These options should be pursued, but most of the potential is already exploited. Significant impact on oil demand will therefore necessarily have to address the transport sector. Modal shift, particular freight transport from road to rail or waterborne transport offers some potential. However, it appears to be a long and difficult process to make this potential materialise. The main potential lies in improved fuel efficiency and alternative fuels in the road (and partly air) sector.

First steps in this direction have been taken at EU level. The "ACEA-agreement" on reduced CO_2 emissions from passenger cars is de facto a fuel efficiency agreement. However the achievement of the 2008 target will require significant further efforts by the car industry and it is not clear yet what should be "post 2008" targets. The biofuels directive (2003) stipulates 5.75% substitution of motor fuels by 2010, another target still hanging in the balance. Compressed natural gas as a motor fuel was suggested by the Commission in 2001 and assessed in a "Stakeholder group report" 2003 with a market share potential of 10% or more by 2020.

A policy targeting fuel efficiency in the transport sector and alternative motor fuels offers a potential at the global level as well as at EU level. On the basis of experience and analysis at EU level, there is reason to believe that a progressive policy on fuel efficiency and alternative fuels specifically focusing on the transport sector at the global level could reduce transport oil demand by 20% compared to what would otherwise be the case. With transport energy consumption worldwide of some 60 mpbd in 2025 to 2030, this corresponds to an oil saving of 12 mbpd.

If assumed that half of the reduction would be due to fuel efficiency and the other half equally split between biofuels and natural gas, one could expect a net saving on the fuel bill corresponding to 10% from energy efficiency and 2.5% from natural gas (prices at roughly half of diesel/gasoline) leading to savings of over 150 bill. $ at an oil price of 60$/bbl Biofuels might add to the fuel cost, depending on oil prices and on where and how biofuel is produced. Whether the fuel expenditure saving would be sufficient to pay for the cost of all the measures depends on how it is achieved.

Transport appears to be the sector where oil reduction is most difficult to achieve. Assuming that a 20% oil saving would be realised worldwide on average for all the other sectors, global oil demand in 2025 - 2030 could be 95 mbpd instead of 120 mbpd.

More important, however, is the potential impact on oil prices of a lower global demand. If, as an illustration, one would expect that a 20% reduction achieved for the whole energy economy brings about a decrease of the oil price to for example 40 rather than 60 $/barrel the 20 $/barrel saved on the 95 mbpd actually consumed would amount to close to 2 billion $ daily or 700 billion $ annually. Corresponding EU numbers would be 200 million € daily or 70 billion € annually.

These numbers do not pretend to represent any higher level of truth as, for example, the reaction of oil producers to the decrease of consumption and prices will be important in determining final outcomes. Nevertheless, the above orders of magnitude illustrate that the economic impact on oil prices of a policy applied at the global level to reduce oil demand may well be more important than the value of the oil saved.

The CO_2 reduction impact of a combined fuel efficiency/alternative fuels policy would be around 13% (assuming 50% reduction from biofuels, 15% from natural gas) or 1.1 billion tons of CO_2 annually or close to 5% of 1990 (Kyoto reference year) global greenhouse gas emissions.

The importance of a global effort must be stressed. The positive impact on oil prices as well as on the global climate benefits all or at least all oil importing countries. Whereas the level of commitment to reduce greenhouse gas emissions is differentiated depending on individual countries per capita GDP and CO_2 emissions, everybody will benefit from the effect of the measures. The level of encouragement to pursue actions that has a cost for a specific country but benefits globally is obviously limited.

4. NATURAL GAS

4.1. General

Natural gas consumption has been growing steadily for decades within the EU, offering environmental as well as economic benefits. Present consumption stands at around 515 billion cubic metres (bcm) per year- roughly one quarter of total EU energy consumption- and is foreseen to grow further, both in absolute and relative terms, towards some 635 bcm by 2030 under the conditions laid down in the 2005 Baseline scenario. Intensified efforts on energy savings and improved energy efficiency as proposed by the Commission in its 2005 green paper offer potential to reduce, maybe prevent, this increase.

The present natural gas supply situation is relatively comfortable: 46% is covered by domestic production (UK, NL, DE, IT, DK), 25% is imported from Russia, 15% from Norway and the balance (14%) comes from North Africa, Nigeria and the Middle East (less than 1%); 6-8% is imported as LNG (Africa, ME).

EU production has been relatively stable over the last 10 years, but UK production has peaked and is in accelerating decline. Norwegian production has so far shown a strong increase.

Limited EU reserves make a 50% reduction in production a likely 20 years perspective. Against the 2005 baseline scenario consumption increase, a doubling of natural gas imports from presently 275 bcm annually to 535 bcm by 2030 is foreseen.

4.2. Security of supply

Until now natural gas has been produced, treated and consumed in 3 distinctly separated markets worldwide:

– North America and the Caribbean

– Europe incl. Russia and Central Asia, and Africa (North and West)

– Asia and Middle East.

In addition a smaller regional market exists in southern South America.

While regional gas markets are likely to remain in Europe and the US, they will be gradually transforming through the development of an Atlantic LNG market, where suppliers from Norway, (North) Africa, the Middle East and possibly Russia will exploit price differentials between Europe and the US. Similarly China may attract gas from Central Asia.

The perspectives for regional gas supply for the EU looks good for the coming 20-25 years. Over and above the huge Russian reserves, Norway, North Africa, Nigeria, Middle East and the Caspian Basin all hold large gas reserves in development or waiting to be commercialised. The proximity of the established EU market makes the EU a very attractive customer for these countries/regions.

The challenge is to ensure a continued high level of diversification of supply. Combined with an expansion of the interconnection between the different national or regional markets within the EU, supply diversification would be the most important security of supply measure.

A number of projects already decided or in an advanced stage of planning are likely to provide the necessary additional import capacity over the coming 5-10 year period:

– The Norway-UK pipeline, scheduled to open in 2006/7, capacity 20 bcm per year

– The Baltic pipeline, scheduled to start up in 2010, with an initial capacity 27.5 bcm/year

– A number of LNG terminals in Italy, Spain, the UK and possibly other Member States bringing the total 2010 capacity towards 140 bcm/yr

– The Nabucco project linking Caspian gas resources to the European market with a capacity of up to 31 bcm by 2020.

– A Trans-Caspian gas pipeline project is also getting more support as it would be a direct route to import gas from central Asia to the EU (and to Ukraine).

LNG terminals offer a particular contribution to security of supply, since they are normally not utilised 100% of the time. This offers additional flexibility in case of an emergency, but requires also a strengthening of interconnections within the EU.

4.3. Cost

The EU gas bill is significally less than the oil bill, partly because we use less gas, partly because gas is cheaper than oil. The higher share of indigenous gas production further reduces the import bill of gas relative to oil.

Taken at import prices (± 200 €/1000 cubic metres) the value of presented gas consumption is around 100 billion €/year (the actual cost may be somewhat less due to cheaper indigenous gas) and the import bill amounts to roughly 50 billion €/year. These numbers are close to a doubling of the level a couple of years ago.

To the extent gas prices will continue to be linked to oil prices, a 20€/barrel difference in oil prices will affect the overall EU gas bill by 30 billion € annually and the import bill by 15 billion € annually, the latter amount increasing with expected increased imports over time.

4.4. Competitiveness

Whereas the cost impact of gas prices is relatively modest, the potential impact on competitiveness is big. This has several reasons:

– Differences between gas prices in different countries or regions can be huge, ranging from almost zero to more than 300 €/1000 cubic meters. No "world market price" exists.

– Gas is used as a fuel in many energy intensive industries.

– Gas prices have a spill-over effect on electricity prices.

Very low gas prices in countries with excess "associated" gas from oil production or resources beyond local regional demand have made certain industries such as ammonia or methanol production uncompetitive in high gas price regions (Europe, North America, Japan). Present gas price levels in the EU put more industries (chemicals, glass etc.) under pressure. However the fact that gas prices in the US, Japan, and South Korea have also gone up limits the short term impact, but present gas prices may well be too high for new investments in gas intensive industries.

The spill-over effect on electricity prices can be particularly critical for consumer prices and thereby affect competitiveness of electricity intensive industries. An example will illustrate this:

Electricity produced from natural gas is normally the most expensive as far as marginal operational cost is concerned. Therefore, during periods with high electricity demand (above what can be covered by other energy sources than gas), electricity prices more or less reflect cost of production by gas. Increased gas prices as seen over the last year will add some 20€/MWh to generation cost. If that increase affects half of EU electricity the additional cost for consumers is around 30 billion € annually. This is much higher than the additional 15 billion € cost of the gas consumed in the electricity generation, implying a significant income transfer from electricity consumers to producers...

The conclusion is that gas prices are extremely important for industrial competitiveness. In this connexion, the link between oil prices and gas prices is unfortunate. At times of high and rising oil prices it is actually also unjustified since oil and gas are no longer competing energy sources to any significant extent.

The specific role of gas prices for decisions of the future energy mix in electricity generation is dealt with in Chapter 5.

4.5. CO2 emissions

The impact of greenhouse gas emissions of increased natural gas consumption is totally dependent on whether the increase represents a general increase in energy consumption or whether it reflects a substitution of other energy sources. Four cases are relevant:

– Substitution of solid fuels with natural gas is CO_2 friendly. On the energy equivalence basis natural gas emits 55% of the corresponding emission from solid fuels. Substituting solid fuels in electricity generation offers an additional reduction because of the higher efficiency in gas turbines, reducing CO_2 emissions to 35-40% of coal or lignite generated electricity on a kWh basis.

– Substituting oil as transport fuel with natural gas is CO_2 friendly albeit less than substituting coal. 15% reduction is achieved with technology available today, 25% if mass market will lead to taking full advantage of the special properties (high octane number) of natural gas.

– Substitution of nuclear power with natural gas, a likely option for countries that would phase out nuclear or abstain from replacing existing nuclear plants coming to their end of life, will lead to overall increase in CO_2 emissions, difficult to reconcile with the EU medium term greenhouse gas emission reduction objectives.

– Increasing natural gas consumption without cutting back on other energy sources is an equally climate unfriendly development, running against agreed EU policy and climate change.

Large scale use of natural gas offers the possibility of carbon sequestration. This is particularly relevant in the case of hydrogen production (for oil refining or in the chemical industry) where CO_2 is already separated (captured) in relatively pure form. Carbon sequestration from natural gas conversion is also a realistic option if a broader hydrogen economy will take off in the future. Undertaken at production sites, the CO2 can be re-injected into the depleting gas field while the hydrogen is transported to consumers.

However, in connection with commercial electricity generation carbon sequestration from natural gas is unlikely to be competitive with carbon sequestration from much cheaper coal. Possibilities for enhanced oil recovery from reinjecting the CO_2 into active oil fields can have a major impact on the economic feasibility. BP is for the time being considering a gas fired power plant with CO_2 injection in a North Sea oil field.

5. ELECTRICITY

5.1 General

EU electricity production has shown a steady increase since the early days of electricity production and stood at around 3200 TWh (billion kilowatt-hours) in 2005. With very little exchange with neighbours (net imports from Norway, Russia, etc accounting for only 1% of consumption) and no possibility to store electricity, production is virtually equal to consumption plus power plant own use as well as transmission and distribution losses (slightly above 10%).

The national mix of energy sources in electricity generation varies within wide ranges. Solid fuels, historically the main source of electricity, maintain a strong base in several Member States, old as well as new. Hydropower has a high or significant share of the Nordic, Alpine and Iberian Mountains. Nuclear power covers half or more of national consumption in several old and new Member States and contributes significantly in Germany, Spain and the United Kingdom. It has been denounced in some Member States, however with signs of wider public acceptance.

Natural Gas, originally mainly used in the Netherlands and later in the United Kingdom has made a strong showing as the fuel of choice for new power generation throughout the EU. Renewables other than hydro provide a modest contribution, but wind energy, presently slightly above 2% at EU level, has shown impressive increase in recent years and provides today more than 20% of consumption in Denmark. The combined result of power generation expansion over the last three decades, partly the result of government decisions, partly of private company decisions, is a well diversified electricity structure at EU level. However, insufficient interconnections between regional markets make the national or regional markets less diversified.

Annual growth rates in electricity consumption (and production) have moved downwards over a long period. From typically around 7% in the 1960's, the end of the nineties saw an annual increase of 2-3% and the present decade is expected to see around 2% annual growth.

The 2005 baseline scenario shows a continued growth in electricity consumption towards 2030, to roughly 50% above 2000 levels, in spite of further decline in the annual growth rate to 1% after 2020. The baseline scenario foresees a continuation of a healthy diversification at EU level with gas, solid fuels, nuclear and renewables all well above 20% each in the medium term (2015 to 2020), but nuclear falling to 19% by 2030, down from present 30%. With a fossil fuel share roughly constant at 55% through 2030 and some replacement of solid fuels by gas since 1990, CO2 emissions from power generation stay close to the 1990 level from 2010 to 2020, but increase thereafter as a result of the marked fall in nuclear, which, under baseline conditions, would be predominantly replaced by solid fuels.

5.2 Security of Supply

The security of supply for electricity depends on several factors. Over and above the importance of sufficient generation capacity, a sufficient transmission network and improved interconnection between the different countries and regions in Europe – all addressed in the Commission's 2005 Communication on the internal market – diversification of energy sources in electricity generation is the key parameter to determine security of supply. It goes without saying that the specific security of supply situation for the main energy sources is part of the equation. In electricity, this is particularly relevant for natural gas.

Whereas the baseline scenario offers an overall diversified electricity sector through 2030, it must be stressed that the scenario is not reflecting a likely, let alone acceptable, future development, which would be more in line with climate change requirements.

The high share of fossil fuel, particularly solid fuels, is the main problem, combined with a virtually constant (slightly above 45%) share of CO_2 free electricity (renewables and nuclear).

Any development consistent with present EU Climate policy will need either to force solid fuels consumption in electricity much down compared to the baseline scenario or to ensure broadly applied carbon sequestration in order to reduce emissions. A drastic reduction in solid fuels consumption could still be seen as compatible with a high level of security of supply if "replaced" by nuclear. However, if both solid fuels and nuclear, albeit for very different reasons, would decline significantly, the EU might see itself faced with an unacceptable over dependence on natural gas in the electricity sector, even if the share of renewables would grow more than reflected in the baseline scenario. A strong dependence on natural gas is particularly critical as long as natural gas is the only energy source for electricity for which there is an external security of supply concern.

A development with strong emphasis on energy efficiency has big benefits in a security of supply perspective. A 20% more efficient energy sector could well result in a 20% lower electricity demand or a 2020 demand at approximately present levels. Assuming, realistically, that renewables would continue to be promoted strongly, such a policy would affect predominantly fossil fuels and maybe nuclear capacity to the extent that unchanged electricity demand would lead to lower utilisation hours of existing nuclear plants and would impede the replacement of nuclear plants, due for closure, with new nuclear plants. Moreover, such an energy efficiency policy will most likely seek higher CHP penetration, which in turn will not be delivered from either nuclear, wind or hydro. With these considerations on nuclear in mind one can reasonably expect[19] that the share of renewables in lower electricity demand increases considerable, while the share of nuclear might remain close to the baseline level. Electricity generation from fossil fuels would fall substantially, but the EU could maintain a fairly diversified fuel mix in electricity generation with solid fuels and gas accounting for 20-25% each, nuclear contributing around 20% and renewables increasing their share to around 30%. Further analyses in 2006 will complete this first assessment of security of supply aspects.

5.3 Cost

This chapter deals with the genuine cost of electricity production, often very different from what consumers pay, even ignoring transmission and distribution costs.

The only relevant cost numbers to address are those which, as far as possible, reflect all cost elements, including external cost and costs of long term waste management and decommissioning.

At present, production cost for electricity is low in the EU. This largely reflects much lower capital cost on most of the production capacity (hydro, nuclear, solid fuels) than what would result from producing in plants built today. In particular, some existing plant may well be already fully amortised and not require any further payments in the form of a return on capital. This is, however, of little importance for what is at stake in the future.

Electricity production on the basis of different energy sources has a very different cost profile. Hydro and wind have overwhelmingly capital cost but little daily operating cost (mainly maintenance). Nuclear and solid fuels have somewhat higher operating costs but still cheap fuel. Natural gas, at the other end of the spectrum, has relatively low capital cost, but – most likely in the future – considerable fuel cost. The high capital costs make nuclear and solid fuels unsuitable candidates for any production with an expected utilization of less than at least 50% of the time, in many cases more.

[19] Modelling evidence on combined policies for energy efficiency and renewables support these considerations; see chapter 4 of "European Energy and Transport – Scenarios on key drivers", September 2004

Another factor complicating any cost calculation is the fact that the "real" capital cost (based on the life expectancy of the plant) and the return on investment required by the stock market can be very different. An example demonstrates thus: Capital cost for nuclear electricity amounts to close to 50€/MWh if based on 6000 hours operation per year and 15% return on investment the benchmark rate of return applied in the power sector. This is unlikely to be competitive. However, if the cost is based on 8000 hours per year and 6.5% capital cost (reflecting present interest levels but not necessarily the uncertainty for power generators on electricity sales and the prices these fetch in a competitive market) and a 50-year lifetime, capital cost will be 16€/MWh, highly competitive.

Another important cost factor is the price of CO_2 emissions. If set at 20€/ton CO_2 it adds around 20€/MWh to solid fuels and lignite based electricity. This may be too much to justify investing in new solid fuels based capacity (depending on competing natural gas prices) but it is certainly a cost element that is manageable on existing solid fuels fired plants with today's difference between solid fuels and gas prices.

There are reasons to expect that production cost for electricity from new generation capacity is converging around 60€/MWh, a price level thus necessary to justify major investments under normal market conditions. Reducing electricity consumption by 20% towards 2020 would thus imply savings of electricity worth nearly 50 billion € in 2020. Clearly, investing in more energy efficient equipment for achieving such savings in the electricity bill will involve considerable costs itself leading to a lower net saving. While it goes beyond the scope and the possibilities of this document to attempt a quantification of the net effect, it is worth noting that many potential improvements in "electricity efficiency" would pay at much lower levels than 60€/MWh and reduced growth in electricity consumption would save investments in transmission lines and distribution systems. A quantification of these effects will be attempted in the impact assessment to be prepared for the energy policy strategy paper by the end of 2006.

5.4 Competitiveness

Electricity prices are an important factor in a limited number of – usually large – industrial sectors (chemical industry, metallurgical industry, pulp and paper). Depending on the contract structure, electricity prices in a liberalised market for such customers increasingly tend to reflect the cost of a marginal producer, i.e. production with the highest variable cost often based on the forward looking cost of new generation plant.

In addition, because of the very different variable cost between different production systems and because of different demand during the day and during the year, electricity prices show strong fluctuations with time. Newly liberalised markets are still at an early stage of deciding how to manage this new structure.

The consequences of this are that prices, on both a day-ahead or longer term basis, often exceed actual cost of most individual existing plant. However, long term price perspectives, based on marginal cost pricing, are crucial for decisions to build new generation capacity, whether to replace outdated capacity or to meet increasing demand.

For example, most of the "old" Member States and virtually all of the "new", have had over-capacity over the last decade. This kept electricity prices low relative to the cost of new generation. However, Italy for general lack of capacity, and Ireland and Spain due to rapid growth of demand, have often struggled with wholesale market electricity prices well above the EU average. This is now spreading to other Member States as demand has continued to increase, leading to the deterioration of the supply/demand position.

This is a clear, real life demonstration of the fact that the demand/supply balance combined with the production cost for the most expensive unit produced will usually set the overall price rather than the average production cost. Hydropower or nuclear power producers have not seen their cost rise, but their selling prices did increase.

This analysis suggests that two factors are of overriding importance for future EU electricity prices (apart from regulatory and physical requirements to generate a real open market):

– the market framework must provide sufficient capacity to avoid inflated and or over-volatile prices because of a tight supply situation

– reasonable gas prices are essential in order to prevent that excessive gas prices lead to generally high electricity prices reflecting the marginal cost of a minor part of overall electricity generation.

An energy efficiency policy that might keep electricity demand more or less flat over the next 15-25 years would greatly enhance the chances of moderate rather than excessive electricity prices. The higher the increase in demand, the more difficult it is likely to be to realise the appropriate investments. For example more expensive plant may have to be kept open and sub-optimal sites may have to be used for new investments. A lower level of consumption would enable inefficient production to be closed and restrict investment to the best and lowest cost sites. In addition, companies may be quicker to invest in replacement capacity which would simply maintain their market share as in new capacity covering expanded sales which may be seen as a riskier proposition, i.e., company psychology or strategy would make it a plausible assumption that incumbents would not like to see their production capacity shrink with the subsequent loss of market power as a consequence. More timely investment in this way would reduce price volatility.

If one assumes that the difference in electricity prices between a high demand growth scenario, and one based on a strict approach to energy efficiency would be of the order of €10/MWh, annual savings for electricity consumers (citizens, public authorities or industries) at 3000 TWh in 2020 would be 30 billion €.

Investment in production capacity, mainly renewables, could be in the order of 290 billion € rather than 430 billion € in the baseline. Part of this is reflected in the 30 billion € annually savings in 2020 as capital cost savings due to lower prices.

5.5 CO_2 emissions

As mentioned, the baseline scenario paints an alarming CO_2 scenario for the electricity sector. Even with the assumption of significantly improved efficiency of solid fuels based power generation and of fuel switching from solid fuels and oil to natural gas, CO_2 emissions will increase by 10% by 2030 over 2000.

This is virtually impossible to reconcile with a policy committed to continued reductions in CO_2 emissions after 2012 unless one has – presently unrealistic – expectations of strong reduction in transport and other sectors. Unfortunately the relevance of the scenario is confirmed by the slightly increasing trend in EU CO_2 emissions after 2000.

There are basically three options to redress this situation:

– Overall stronger efficiency improvements in electricity generation, distribution and consumption.

– Increasing the share of CO_2 free electricity (renewables and/or nuclear).

Reducing solid fuels consumption or reducing CO_2 emission from solid fuels consumption through carbon sequestration.

5.5.1. Efficiency Improvements

Efficiency improvements have already been argued as attractive from the point of view of security of supply, cost and competitiveness. They are particularly attractive from a CO_2 point of view. If it is assumed that the lower electricity demand will lead to a reduction in only fossil fuel based electricity, the relative CO_2 emission reduction will be even greater. 20% reduction in CO_2 emission relative to 2000 rather than 10% increase might well be the result.

5.5.2 CO2 free electricity

The baseline scenario mirrors very unambitious trends in nuclear energy and relatively unambitious developments on renewables. This reflects well the actual situation in the EU by the end of 2004 where there were more plans or decisions to phase out nuclear than to invest in additional or replacement capacity and where most Member States were (and still are) much behind the actual trend necessary to achieve their share of renewables in electricity generation as laid down in the 2001 directive.

The result is that while renewables show by far the strongest relative (and absolute) growth from 430 TWh in 2000 to 1200 TWh in 2030 (+770 TWh or 180%), the combined renewables and nuclear contribution only grows by 670 TWh or 50%, in line with overall growth. This scenario, if it comes true, implies that 100 TWh of renewable electricity or more than the present wind energy production in the EU would just compensate the decline in another CO_2 free electricity source.

This phenomenon may occur at national level much before 2030. It would take a much more ambitious renewables energy policy than presently in place in those Member States that have decided to phase out nuclear power or maybe not to replace retired plants just to maintain the present level of CO_2 free electricity.

The combination of a strong energy savings policy, increase in renewables as in the 2005 baseline scenario and unchanged nuclear production would allow electricity generation from fossil fuels to be reduced from presently 1700 TWh to ± 1300 TWh in 2020 to 2030. Because of the higher efficiency in future production CO_2 emissions might well be down by ± 30%.

5.5.3 Solid fuels reduction or carbon sequestration

Solid fuels consumption at a level as foreseen in the baseline scenario is obviously too high for a progressive climate policy. This problem can be addressed by replacing solid fuels with gas, or sequestering the CO_2 through capture and underground storage. Both will be encouraged by higher CO_2 prices in the emissions trading scheme.

At solid fuels prices of 50 €/ton, gas prices at 200 €/1000 cu.m (largely present prices) and a CO_2 sequestration cost of 30 €/ton CO_2, fuel cost per MWh is the following:

	Fuel	CO_2 sequestration	Total
Coal	17.5	30.0	47.5
Gas	40.0	12.0	52.0

Significant uncertainties prevail both concerning the potential for reducing sequestration cost and changing future natural gas prices. These aspects will be further developed in the course of 2006, including the relevance of investment cost of pre-combustion carbon capture (solid fuels gasification). The above-mentioned numbers do however illustrate that recent price increases of natural gas throws its competitiveness against climate friendly solid fuels combustion in doubt. This no less when the security of supply advantage of solid fuels over gas is taken into consideration. The case for addressing carbon sequestration in the energy policy agenda is obvious.

6. RENEWABLES

6.1 General

Possible impacts of higher share of renewables in the energy mix have already been addressed in chapter 3 and 5 as far as renewables as biofuels and renewables in electricity generation are concerned.

In general, renewables represent a diversified group of energy sources (hydro, wind, solar (thermal and photovoltaic), biomass, wave, tidal and geothermal) with very different benefits and impacts, depending on their origin, for which purpose they are used and on their stage of technological development.

6.2 Security of supply

As a main rule, renewable energy is considered as indigenous but import of biofuels and other biomass occurs. More important, however, is the security of supply situation for the energy source replaced. Using renewable energy to substitute oil products (biofuels or biomass for heating instead of oil) offers the highest security of supply value of renewables, whereas substitution of coal, abundantly available, is less valuable.

6.3 Cost

The cost of renewable energy ranges from the lowest (existing large hydropower) to the highest (e.g. photovoltaic) in the energy sector and depends in many cases on the state of technological development of the specific source. However, compared to the total turnover in the energy sector, or the cost implications of other policy developments, the potential cost of presently adopted renewable policies (overall, biofuels, electricity) is relatively low, up to around 15 bill. euro per year or 3% of the total energy bill. This cost estimate does not include the benefit of lower external cost (CO_2 emissions).

6.4 Competitiveness

The impact on competitiveness of renewables has so far been modest, primarily because the way they have been promoted in electricity generation (mainly through feed-in tariffs) has only had a small impact on electricity prices. The reduction in cost of wind generated electricity and increase in cost of other electricity sources (particularly gas) give reason to believe that future impact on competitiveness of renewable energy will remain at moderate level.

6.5 CO_2 emission

Renewable energy is normally considered a low environmental impact energy sources, including low CO_2 emissions for the entire fuel cycle and zero CO2 emissions in the phase of operation. In fact, this is a major reason for promoting them.

The most important potential deviation from this general rule is biomass, where – although the amount of carbon released to the atmosphere through biomass combustion corresponds to the amount of CO_2 taken from the atmosphere during the period of plant growth - the cultivation of the crops and subsequent conversion and use may entail significant greenhouse gas emissions and other negative environmental impact.These aspects will have to be an integrated component of policies to further develop the use of biomass/biofuels.

7. CONCLUSION

The present situation and future trends of the energy sector present several serious challenges to the European Union. Future security of supply, particular of oil and gas is uncertain, and indigenous production is declining rapidly.

High oil and gas prices weigh on the budget of consumers and companies and gas and electricity prices pose a potential threat to competitiveness of EU companies.

Greenhouse gas emission, particularly CO_2, are persistently stable or even slightly increasing at a time where Kyoto commitments and post 2012 climate policy would require clear decreases in emissions.

The document offers a number of examples that demonstrate how a combination of policies and market forces can reverse these trends, - as a preliminary contribution to the energy policy debate launched by the green paper.

ANNEX

EXTERNAL RELATIONS DIALOGUES AND INSTRUMENTS AT THE SERVICE OF ENERGY SECURITY

I. ENERGY COOPERATION WITH NEIGHBOURING COUNTRIES

The neighbouring countries are vital for the Eu's energy security either as current or future suppliers or as transit regions.

Turkey, Croatia, and the other Western Balkan countries are progressively integrating themselves into EU energy policies. Close cooperation and dialogue on energy take place in various fora and committees, including in the framework of the Energy Community Treaty. To address the urgent need for secure energy supplies as a fundamental basis for economic and social development and for promoting regional integration, the Commission has pioneered the creation of a single regulatory energy space in the region. Based on the extension of the relevant EU *acquis*, the **Treaty establishing an Energy Community** was signed on 25 October 2005 by all the Balkan countries and the European Community.

Turkey actively supported the Athens process leading up to the Energy Community Treaty, and remains invited to join it as soon as the Treaty's relation to Turkey's EU-accession timetable is clarified. The adhesion of Turkey to this treaty and the application of normal transit conditions, in particular for gas, are major topics in EU-Turkey energy relations.

Turkey is of strategic importance for the security of energy supplies to the EU, lying at the crossroads of various existing and future pipelines carrying both oil and gas from many core producer regions, namely Russia, the Caspian Sea, the Middle East and Northern Africa.

Through its Pre-accession instrument for Turkey, the EU has been providing active support for the reform of the Turkish energy market and the preparation of some of the pipeline projects though other funds.

Enhancing the energy partnership with the neighbouring countries is a strategic element of the **European Neighbourhood Policy** (ENP) and contributes to its objectives of peace, prosperity, security and stability in our neighbourhood, with the predictability of energy supplies being an important part of stability.

Seven ENP Action Plans are in force (with Israel, Jordan, Moldova, Morocco, the Palestinian Authority, Tunisia, Ukraine) and their implementation is underway. Preparation of Action Plans with Armenia, Azerbaijan, Georgia, Egypt and Lebanon has started. An ENP country report on Algeria is due in 2006. Belarus, Syria and Libya are other potential ENP partners.

The energy sections of the ENP Action Plans include, consequently, broad areas of cooperation: energy dialogues; convergence of energy policies and legal/regulatory frameworks (e.g. integration with the internal electricity and gas markets); possibilities for the participation in EU programmes and events; energy networks; energy efficiency and new/renewable energy sources; nuclear safety (Ukraine and, in the future, Armenia); and (sub) regional cooperation.

II. BILATERAL ENERGY DIALOGUES

The **EU-Russia** Energy Dialogue launched at the EU-Russia Summit of October 2000 takes place on three levels: High level Interlocutors, Expert groups on infrastructure, investments, energy efficiency and trade comprising official and industry experts from the MS, Commission and Russia., and since October 2005, a Permanent Partnership Council on Energy with the EU Troika and the Russian Industry and Energy Minister. The objectives and a medium term agenda for cooperation under the energy dialogue have also been confirmed in the energy chapter of the road map for the Common Economic Space.

Norway as a member of the European Economic Area (EEA) applies most of the EU *acquis* including legislation on the internal energy market and related flanking policies (competition, environment, consumer protection, research and development programs etc.). Bilaterally, the EU-Norway Energy Dialogue principally aims at co-ordinating energy policies in a wider sense, including research and technological development in the energy sector and relations with other energy producing countries. Issues related to the possible exploration of the energy resources in the High North, i.e. the Barents Sea, are also discussed in the framework of the Dialogue. Norway is the world's third largest exporter of oil and gas after Saoudi Arabia and Russia.

Algeria is a key gas and oil supplier to the EU. The EU-Algeria Association Agreement foresees a reinforced cooperation in the energy and mining sectors. A strategic EU-Algeria energy dialogue is being developed.

The main tool for cooperation on energy security with **Ukraine**, a key gas (and oil) transit country for the EU, is the Memorandum of Understanding on energy cooperation agreed at the December 2005 Summit. Through the implementation of this MoU, Ukraine will progressively align with EU energy legislation and rules, and gradually integrate with the EU energy market, as foreseen in the ENP Action Plan for Ukraine. Ukraine is also an observer in the Energy Community Treaty involving the EU and the Balkans.

Moldova is particularly vulnerable, not only to unilateral actions from a party with monopoly status in the energy area, but also to steep and sudden increases in the pricing of energy. Moldova is also a transit country for Russian gas to Romania, Greece and Turkey, as well as the Balkan region. An agenda for cooperation in the field of energy with Moldova is set out in the ENP action plan.

Egypt is a rapidly expanding natural gas producer. Exports to the EU have started. Egypt's strategic energy role is furthermore marked by the Suez Canal and the Sumed (Suez-Mediterranean) pipeline, the Arab Natural Gas Pipeline and by construction of LNG export facilities as well as gas interconnections with Libya. The ENP Action Plans currently under negotiation foresees a significant chapter on energy cooperation.

Syria is emerging as a gas hub in the Mashrek due to the recent natural gas discoveries as well as the transit potential of the country for the supply of the Egyptian, Iraqi and Middle East gas to the EU. The EU has negotiated an Association Agreement with Syria and energy co-operation is one of the chapters covered by this agreement. However, this agreement has not been signed yet.

The EU has no formal relations with **Libya, a major gas producer**. The country has not yet joined the Barcelona Process. It is planned to explore the possibility of starting a dialogue with Libya on energy as soon as it is feasible.

Iran is the 4th largest oil exporter and has the 2nd largest gas reserves in the world for both oil and gas. Iran is also at the crossroads of a major transit route: half of the world's traded oil is shipped via the Straits of Hormuz. The negotiations of an EU-Iran Trade and Co-operation

Agreement, which started in 2002, comprise a section on energy. However, since the crisis erupted in August 2005, the EC has frozen the TCA talks and the energy dialogue with Iran is on hold.

Iraq is not only important for world oil supplies, but also as an important potential gas supplier to the EU. Provisions are included under the 2006 Assistance Programme for a Technical Assistance capacity programme. The 2004 Commission Communication on Iraq also proposed the establishment of a joint experts' working group on energy issues. However, to date, the Commission has not been successful in launching these actions due to the lack of a functioning administration on the Iraqi side. The recently proposed TCA mandate includes energy as one of the potential areas for cooperation.

China is a major, rapidly growing, consumer country. It is increasingly competing with the EU for the same global energy resources. Energy and energy related issues feature strongly in EU dialogue with China**.** Current mechanisms include the EU-China energy dialogue established in 1994, featuring annual working group meetings and EU-China Energy Conferences every second year.

Japan is the world's fourth largest oil consumer (after US, the EU and China), and imports practically all its oil, gas and coal energy resources. Japan has a strong record track record on energy conservation and – in addition to the cooperation in the field of nuclear energy- the EU has recently started to talk to Japan about energy security and energy efficiency. In this context, a regional seminar on energy efficiency was organised jointly by the Commission and the Japanese authorities in Tokyo in January 2006.

India's rapid economic growth in the recent decade has fuelled its demand for energy, and it is projected to continue to grow. Demand for electricity alone is expected to triple over the next 6 years. Furthermore, India imports about 70% of its oil. India is in the process of developing a global strategy in order to secure its future energy needs. In this context, the EU and India decided in 2004 to establish an EU-India Energy Panel to provide a forum for dialogue, co-ordination and co-operation.

USA is an EU energy strategic partner. Energy issues form part of the New Transatlantic Agenda and Action Plan of 1995. The 2003 Summit issued a declaration enhancing cooperation on hydrogen economy and EU and US initiated the cooperation under International Partnership for Hydrogen Economy. The Initiative to Enhance Transatlantic Economic Integration and Growth adopted at EU-US Summit on 20 June 2005 included a specific annex on 'Energy Security, Energy Efficiency, Renewables and Economic Development'. The Initiative is being implemented through a joint work programme, covering both supply side and demand side issues.

Canada was one of the first countries with which the EU signed an energy-related agreement, in the form of the Euratom-Canada agreement of 1959. However, there is no regular energy policy dialogue between the EU and Canada. The most recent expression of the EU-Canada political partnership, the March 2004 Partnership Agenda, specifically mentions energy efficiency and energy technology in the context of reducing greenhouse gas emission, although it is of sufficiently broad scope to accommodate quite easily a dialogue on energy policy should both sides so desire.

Venezuela, an OPEC founding member and major oil producer, is important to world energy markets because it holds proven oil reserves of about 78 billion barrels, is a key supplier to the important US market and is playing an increasingly ambitious role in the context of efforts to promote regional integration in the energy sector in Latin America. Energy relations between the EU and Venezuela are governed by an agreement signed in 1998, which provides for discussion and co-operation on specific subjects such as the dialogue between producers and consumers, the regulatory framework for energy, as well as on energy-related technology. It is hoped that a more dynamic and structured bilateral energy dialogue can be put in place in the future on the basis of this existing agreement.

III. REGIONAL ENERGY DIALOGUES

A number of regional energy dialogues and cooperation programmes are being conducted with the objective to promote the external energy security of supplies.

A new cooperation initiative aimed at the progressive integration of the **Black Sea and Caspian Sea** region energy markets with the EU energy market was launched in the framework of a Ministerial Conference in November 2004 in Baku involving the EU and the Governments of Azerbaijan, Armenia, Bulgaria, Georgia, Iran (observer), Kazakhstan, Kyrgyz Republic, Moldova, Russian Federation (observer), Romania, Tajikistan, Turkey, Ukraine and Uzbekistan and the Commission.

For the EU, the main objective of this initiative is to facilitate the transportation of the extensive Caspian oil and gas resources towards Europe, be it transiting through Russia or via other routes such as Iran and Turkey, as well as facilitating the progressive integration of the energy markets of this region into the EU market. Indeed, secure and safe export routes for Caspian oil and gas will be important for the EU's security of energy supply by increasing the geographical diversification of the EU's external energy supplies. Supplying the EU market at competitive international prices will also be crucial for facilitating the economic, social and political development of countries of the Caspian region.

The Energy Ministers of the **Baltic Sea region** countries and the Commission decided in October 1999 to establish the Baltic Sea Region Energy Co-operation (BASREC) with the aim of coordinating energy policies and actions around the Baltic Sea. At the BASREC Ministerial meeting in Reykjavik on 28 October 2005, it was, *inter alia*, decided to continue BASREC for the period 2006-2008.

A recently launched regional dialogue between the **EU and the Central Asian** countries will be brought to a political level through the holding of a Ministerial Conference in the second half of 2006, with one of the main items planned to be discussed being regional energy cooperation.

The European Union has been actively engaged with the **Southern Mediterranean Partner** countries, since the inception of the Barcelona Process, on an energy dialogue aimed at promoting regional energy integration, enhancing energy security and diversifying the sources and supply routes. The main instrument of cooperation has been the Euro-Med Energy Ministerial conferences, of which three have taken place since 1998. Sub-regional energy dialogues and cooperation initiatives covering the Maghreb, Mashrek and Israel and the Palestinian Authority have been established.

On 2 December 2003, in Rome, Algeria, Morocco, Tunisia and the European Commission (as « non-participant promoter ») signed a Protocol of Agreement for the progressive integration of the electricity markets of these three Maghreb countries (Algeria, Morocco and Tunisia) into the EU electricity internal market. The objective of the Commission, over the longer term, is the signature of a Euro-Maghreb Energy Community Treaty. It is also planned to include **Libya and Mauritania** into the Maghreb initiative, as well as to progressively develop the energy relations with the **Sub-Saharan** countries and the transit of the energy resources from this region into the EU.

The Commission is also pursuing the creation of a Euro-Mashrek harmonised and integrated energy market through the development of sub-regional energy markets in the **Mashrek region** and their progressive integration into the Balkan and EU energy market. A "Euro-Mashrek Gas Centre" in Damascus, financed by the EU and involving Egypt, Jordan, Lebanon, Syria and Iraq, will start its activities in 2006. The Commission is promoting enhanced energy co-operation between **Israel and the Palestinian Authority**.

A high-level EU-OPEC Dialogue has been launched in 2005. Its objectives are to co-operate towards achieving more stable international oil markets and prices, an attractive investment climate, improving market transparency, including by reducing speculation, improving market analysis and forecasting, a better technological and international cooperation.

An **EU-GCC cooperation** developed since 1989 has resulted in a wide range of activities covering industrial cooperation and exchange of expertise. A High level Euro-Gulf Energy Summit that took place in Kuwait in 2005 recommended the establishment of an EU-GCC Energy technology centre whose remit would include joint research and technology transfer, education and training.

The EU Energy Initiative (EUEI) was launched at the 2002 World Summit in Johannesburg as a framework for dialogue with developing countries. The main objective is to attract political attention and resources to the important role of energy in achieving the Millennium Development Goals, in particular poverty alleviation. The dialogue has been productive both at the country level, mainly via EU Member States, as the regional level, including with **AU/NEPAD** and the Forum of Energy Ministers of Africa (FEMA). The increased attention to energy in the EU development cooperation is reflected in the recent Communications of the Commission on policy coherence and on the new **EU Strategy for Africa**, as well as in the European Consensus on Development.

The **Africa-Europe Partnership on Infrastructure**, including energy, is an important element in the future energy cooperation with Africa. The partnership addresses AU/NEPAD priorities, including cross-border and regional cooperation and trade in energy, and can also address, from the EU perspective, the role of Africa as energy producer. Africa has significant energy resources and is already an important energy supplier also on the global market. Important energy consumers, including China, are increasingly active in the African energy markets.

As part of the implementation of the conclusion of **ASEM** 5 (the 5th ASEM Summit held in Hanoi in October 2004), energy issues are coming to the fore in the EU´s relations with Asia. The Commission, as a first step, is planning to organise, under the auspices of ASEM, an energy seminar in Tokyo together with the Japanese Ministry of Economy, Trade and Industry (METI) The Seminar will focus on energy efficiency in industry and in households and will involve all ASEA countries, as well as China, Korea and Japan. The intention is that the outcome of the seminar should feed into the next ASEM Summit scheduled for Helsinki in September 2006. It can be expected that **EU-Asia energy co-operation** will figure prominently on the agenda for the Summit scheduled to take place in Helsinki in September 2006.

Latin American energy exports have traditionally been directed at the North American market and the region is not a major supplier to the EU. Nevertheless, discussions on energy matters are an intrinsic and important element of relations between the EU and the Latin American countries, including in the context of relations with Mercosur, the Andean Community and Central America. The energy sector is also playing an increasingly important role in Latin America's own regional integration process. The forthcoming **EU-LAC** summit is expected to confirm the commitment of both regions to the promotion of energy efficiency and the increased use of renewable energy sources.

IV. MULTILATERAL FRAMEWORK

Several dialogues and cooperation on energy security are also taking place in the framework of various international/multilateral institutions.

Created in 1974 after the oil crisis, **the International Energy Agency**'s major role is the security of oil supply through oil stockholding. The IEA's activities include the exchange of information on energy policies including the rational use of energy, the environment, energy technologies and advice to non member countries. The IEA in particular plays a key role in the field of oil stocks and oil crisis measures. The IEA energy forecasts are widely used as a reference.

Unlike many other international bodies, the **G8** does not have a fixed structure or a permanent administration. It is up to the country that has the Presidency (rotating annually) to set the agenda and organize the annual G8 Summit. The 2005 G8 presidency was held by the United Kingdom, which identified two main priorities for that year: climate change and Africa. With respect to the first of these, a ¨Plan of Action on Climate Change, Clean Energy and Sustainable Development" was adopted by the Gleneagles G8 Summit on 6-8 July 2005. Russia is holding the G8 Presidency in 2006. It has three main priorities for its Presidency: energy security, education and infectious diseases. As regards the issue of energy security, Russia suggests focusing on identification of possible means aiming at improving predictability and transparency of hydrocarbon markets, development of alternative energy sources and new technologies aiming to ensure long-term energy security.

The **United Nations** offers several fora for discussing, monitoring and information sharing on Energy Security. For instance, the 2006/2007 work programme of the UN Commission on Sustainable Development includes energy as one of the major thematic issues. The IAEA (International Atomic Energy Agency) is a good example of a UN system agency that provides a forum for discussion and information sharing on nuclear energy. For the European Union, the UNECE (UN Economic Commission for Europe) provides a particularly interesting platform for regular exchange of information, discussion and monitoring of developments.

Energy issues are discussed also in the **OSCE** framework, with focus on security. This forum should be made use of, in particular because Russia and many other NIS countries have pushed for increased emphasis of the OSCE on economic issues, including energy.

Finally, the **Energy Charter Treaty** is a legal instrument on non-discriminatory and market based conditions for trade, transit and investment in energy products. 51 countries have ratified the Treaty that is largely based on same elements and principles as WTO rules and the EU legislation. Russia has not ratified the Treaty, due to a pending Transit Protocol, that is subject to ongoing negotiations between the EU and Russia.

The **International Energy Forum** is a grouping of energy ministers of countries from around the world – both consumers and producers. The main objective of the Forum is to provide a framework for a high-level energy dialogue between key energy producers and consumers. The next meeting of the Energy Forum is scheduled to take place in Qatar in April 2006. The organisation has a small permanent secretariat based at Riyadh, Saudi Arabia. No formal decisions are taken by the Forum.

V. ONGOING FUNDED EXTERNAL ENERGY RELATED PROGRAMMES

EU GRANT ASSISTANCE

For **Eastern Europe and Central Asia**, funding takes place under National and Regional Tacis programmes. The primary objective sought is to secure oil and gas supplies from the NIS. This is achieved under the **INOGATE** programme which aims to promote the regional integration of the pipeline systems and to facilitate oil and gas transport within the NIS and towards the EU markets, in addition to encouraging private investment and IFIs' support. Between 1996 and 2006, INOGATE has earmarked 56 Mio€ of which 40% has gone to support urgent interventions for maintaining the continuity of supplies and improving the transparency of cross border gas trade in the NIS.

For the **Mediterranean region**, funds are allocated through the MEDA regional budget and under the bilateral assistance. Among other operations, in the framework of a pre-neighbourhood programme, 14 M € support: (i) integration of the Maghreb electricity market; (ii) creation of a Euro-Mashreq gas market, involving Egypt, Jordan, Lebanon and Syria; and (iii) establishment of a Joint Energy Office aimed to enhance energy cooperation between Israel and the Palestinian Authority, particularly in the fields of electricity, gas, renewable energy and energy efficiency.

Under bilateral assistance, the harmonization of legislation and the adoption of the EU *acquis*, where appropriate, are sought in the framework of the programmes for the implementation of the association agreements, which also cover the energy sector.

As far as the **new European Neighbourhood Instrument** is concerned, the Regional Strategy Paper for 2007-2013 and the Regional Indicative Programme for 2007-2009 underline the need to further encourage energy market integration, through energy dialogue, trade liberalisation, infrastructure development and networking, and the further strengthening of the sub-regional energy markets previously established.

A similar emphasis on energy and identical priorities for cooperation are highlighted in the strategy paper for central Asia 2007-2013 and the Central Asia Indicative Programme 2007-2010.

As concerns the **Balkans**, The EU has been financing both urgent reconstruction and, increasingly, market reform projects, mainly through the **CARDS** programme (now also

Phare) and the **European Agency for Reconstruction** (mainly Serbia, Montenegro and Kosovo). From **2007, IPA** will be the main tool of EU assistance.

The **ACP-EU Energy Facility** (total amount: 220 M€) was adopted 2005 and its call for proposals are currently under preparation. The facility will provide co-financing of energy services delivery in rural areas, support to capacity building, management and governance and facilitate large scale investment in cross-border connections.

The **Africa-Europe Partnership on Infrastructure**, that is included in the EU Strategy for Africa adopted in December 2005, will facilitate interconnectivity at a continental and regional level in order to promote regional integration and economic growth. The Partnership programmes will be a mix of physical infrastructure investment and support to facilitation and the regulatory frameworks that are essential for efficient operation and service delivery also in the energy sector. It is expected to become operational during 2006.

An EU-**China** Energy Environment Programme worth € 42 million (EC contribution € 20 million) was officially launched in 2004.

The EU-**India** Action Plan foresees a number of concrete areas of co-operation in the field of energy, and funding is expected to be provided under the so called Action **Plan Support Facility** (8 Mio€) and NIP, as Energy has been singled out as one of the focal sectors for economic co-operation in the Action Plan.

Finally, the Commission is preparing a € 24 m project for 8 **Latin America** countries, aiming at improving electricity supply in small isolated rural communities through the provision of alternative energy kits (solar panels and windmills).

EU LOAN ASSISTANCE

The European Investment Bank covers two major areas: electricity (generation, transmission and distribution) which account for 59% of the loans and gas (extraction, transport and distribution) for the remainder. 3.2 billion € were allotted to the energy sector during the 1995-2004 period. Some of the most sizeable interventions concern Morocco: rural electrification (30 M €); extension of the electricity networks (135 M €), connection of the electricity grid with Spain (80 M €), interconnection of gas distribution with Spain (350 M €). Algeria is likely to be one of the most important recipients for the future: construction and operation of a gas pipeline with Spain (300 M €); gas production in the central-eastern part, supplemented by a liquefaction plant in Arzew (800 M €); combined gas-solar power plant in Hassi R'Mel (50 M €); gas pipeline with Italy (however still at the pre-identification stage).

Projects currently considered also include a participation (170 M €) in the funding of a methanol plant in Egypt which will value a part of the large natural gas reserves of the country.

The most recent loan (45 M €), decided in late 2005, is targeted at the rehabilitation and upgrading of the electricity transmission and distribution network in the Palestinian Territories.

The Council is considering an extension of the mandate of the European Investment Bank for the period 2007-20013 to enable loans of up to € 400 mio in **Central Asia**, € 10.0 billion for the **Mediterranean,** and € 5.0 billion in **Eastern ENPI countries** for selected projects closely linked to the EC cooperation priorities with these countries, particularly for transport and energy infrastructure. Loan subsidies and twinning projects are particularly relevant in this context.

The Commission is working closely with the **European Bank for Reconstruction and Development**, in which the EU and its member states are major shareholders. The EBRD policy for energy sector covers energy conversion, transportation, distribution and consumption. It includes power generation, transmission and distribution, heat generation and distribution, gas distribution and utilisation of power, heat and gas consumers and energy utilities. The oil and gas production and transport are covered by separate natural resources policy.

The EBRD is active in Central and Eastern Europe and in the ex-Soviet Union countries. The Bank has so far invested more than €1,800 million in the power and energy sector, which represents 16% of its total investment portfolio. These investments are spread across 46 projects with a total value of € 4.67 billion. Generation projects account for 65% of the total, while transmission and distribution represent 28% and 7%, respectively.

The EIB and EBRD are considering to be engaged in significant joint financing of projects. The Commission is co-operating closely with the EIB and EBRD to identify areas for common action, in particular in the area of infrastructure and energy development and networks. A tri-partite Memorandum of Understanding is in preparation to be signed in 2006 and it will provide the institutional frame to develop this joint cooperation in countries covered by ENPI and Central Asia in line with EU strategic priorities, including energy. Technical assistance support for the development of joint EBRD/EIB operations will be considered under the Strategies/Indicative Programmes for ENPI Regional Cooperation and for Central Asia in the period 2007-2013, currently being developed by the Commission, to be funded under the new EC assistance instruments.

VI. MULTIPLE SOURCES, MULTIPLE PIPELINE ROUTES

The EU is surrounded by the most important gas resources in the world in particular resources located in Russia, Iran, Norway, Algeria, Libya, Nigeria, the Caspian Basin and central Asia, the Middle East. The proximity of the established EU market makes the EU a very attractive customer for these countries/regions.

The challenge is to ensure a continued high level of diversification of supply. Maintenance and upgrading of the existing gas network as well as supply diversification would be the most important security of supply measure.

As concerns the existing network, the upgrading of the transit pipeline systems for the Russian gas supplies to the EU through Ukraine, Belarus and Moldova as well as through Tunisia and Morocco for the Algerian gas remain essential.

A number of new **gas** projects already decided or in an advanced stage of planning are likely to provide a very significant additional import capacity over the coming 5-10 year period:

– The Norway-UK pipeline, scheduled to open in 2006/7, capacity 20 bcm per year

– The Yamal II project through Belarus or the alternative through the Baltic States (Amber)

- The Baltic pipeline, scheduled to start up in 2010, with an initial capacity 27.5 bcm/year

- The Nabucco pipeline which will cross Turkey, Bulgaria, Romania, Hungary and Austria and make it possible to transport gas from the Caspian region, Iran and the Middle East to the European market with a capacity of up to 31 bcm by 2020.

- The future Trans-Caspian gas pipeline which will offer direct access of gas from central Asia via Southern Caucasus or Iran and Turkey the EU, to the Western Balkans and other partner countries linked to the European Neighbourhood Policy, provided political conditions permit.

- The off shore pipeline projects linking directly Algeria to Spain (Medgaz) and Algeria to Italy (GALSI)

- The expansion of transit capacity in the Southern Caucasus to cater for additional Caspian natural gas transportation

- The trans-Mashrek gas pipeline that will bring Egyptian, Syrian, Iraqi gas to Turkey and to the EU through the future Nabucco pipeline.

- The pipeline's extension to Italy of the Turkey – Greece interconnection that would enhance the supplies from Southern and Eastern sources to the EU and the Balkans.

- The gas network interconnection between North Africa and Middle East to sub Sahara (e.g. Nigeria) and Gulf producers (e.g. Qatar)

LNG terminals offer a particular contribution to security of supply, since they are normally not utilised 100% of the time. This offers additional flexibility in case of an emergency, but requires also a strengthening of interconnections within the EU. Are considered important:

- A number of LNG terminals in Italy, Spain, the UK and possibly other Member States bringing the total 2010 capacity towards 140 bcm/yr;

- Sub regional diversification schemes for East Northern EU based on land reversible pipeline interconnections, joint gas underground storages and specific LNG terminals in the Baltic States and Poland as well as in the Black Sea coast of Ukraine.

As regards **oil**, major international oil pipeline projects concentrating on the Caspian and central oil supplies to the EU are essential. A certain number of projects are being developed:

- the extension of the Odessa-Brody pipeline to Poland and its branches to Latvia, Germany, Slovakia and Czech Republic,

- the pipeline linking Bratislava to Schwechat

- the Bourgas – Alexandropoulis pipeline

- the Constantza – Trieste pipeline,

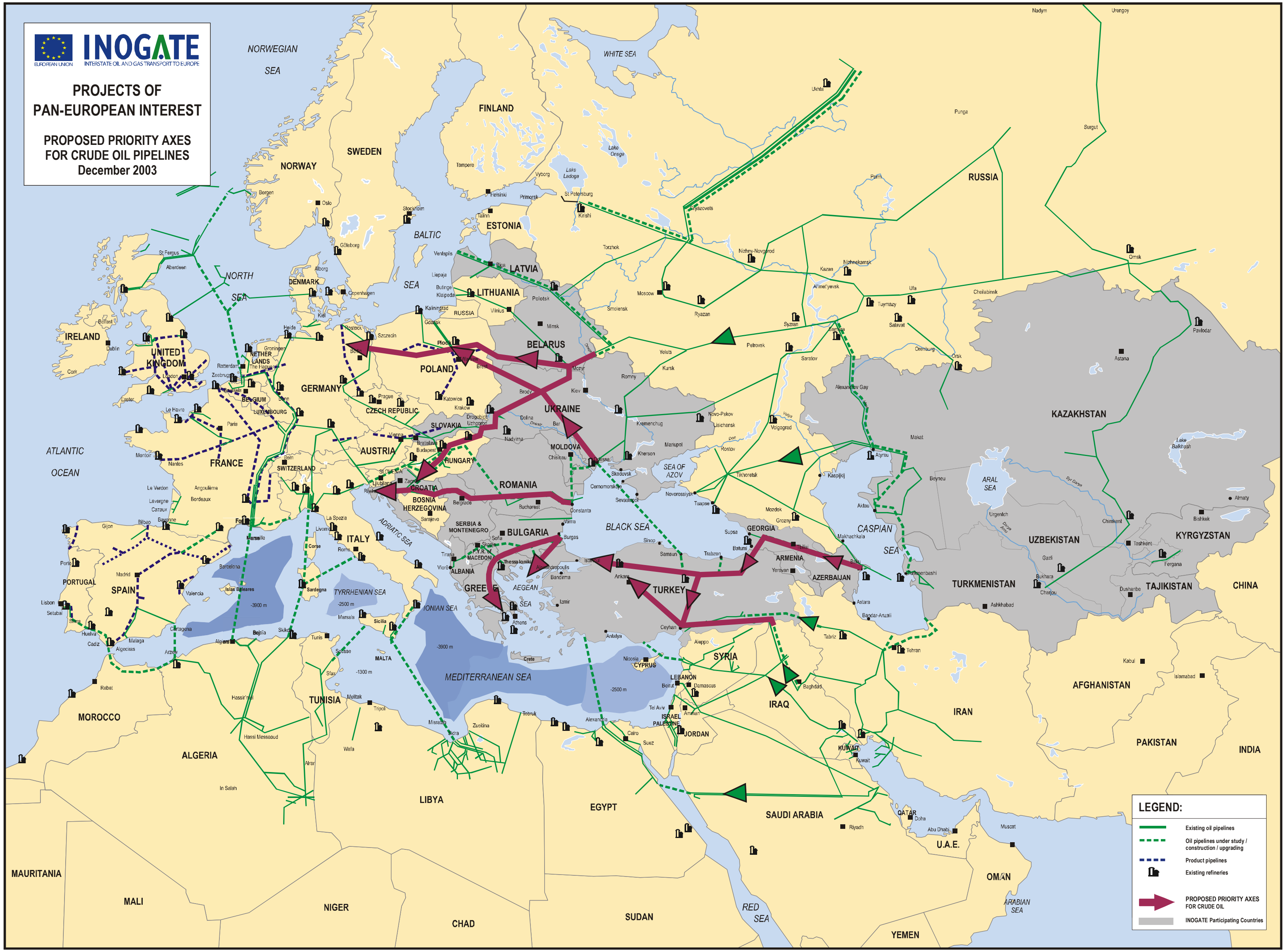
- the integration of the Adria (Central Europe) and Drujba (Eastern Europe) oil pipeline systems ,
- the future oil Trans-Caspian oil pipeline provided political conditions permit
- the expansion of transit capacity in the Southern Caucasus to cater for additional Caspian oil transportation.

VII. AN EU EXTERNAL CRISIS MONITORING MECHANISM FOR ENERGY

If the functioning of the EU energy internal market is monitored by appropriate community mechanisms and bodies, the external dimension of the EU security of energy supplies is, for the time being, neither coherently identified nor under any EU control. It is therefore essential to envisage a **multi-level coordination and permanent monitoring instrument** aimed at enhancing the EU's reaction and response capabilities in the event of an external energy crisis, and covering all current and potential energy producing regions. The recent bilateral gas dispute between the Russian Federation and Ukraine that impacted the EU gas supplies and for which the EU could not intervene technically is an example which argue in favour of such mechanisms and instruments. In support of the crisis monitoring mechanism, one could establish a network between existing and future technical energy regional technical centres financed by the EC dealing, inter alia, with the external security of supplies.

VIII. MAJOR INTERNATIONAL PIPELINE MAPS

This map is for communication purposes only.
The information contained in this map does not necessarily reflect the policy of the European Union.



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