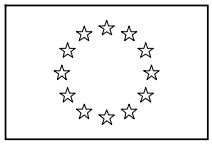

COMMISSION OF THE EUROPEAN COMMUNITIES

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Green Paper

Towards a European strategy for the security of energy supply

(Presented by the Commission)

EXECUTIVE SUMMARY

The European Union is consuming more and more energy and importing more and more energy products. Community production is insufficient for the Union's energy requirements. As a result, external dependence for energy is constantly increasing.

The dramatic rise in oil prices which could undermine the recovery of the European economy, caused by the fact that the price of crude oil has tripled since March 1999, once again reveals the European Union's **structural weaknesses** regarding energy supply, namely Europe's growing dependence on energy, the role of oil as the governing factor in the price of energy and the disappointing results of policies to control consumption. Without an active energy policy, the European Union will not be able to free itself from its increasing energy dependence.

If no measures are taken, in the next 20 to 30 years 70% of the Union's energy requirements, as opposed to the current 50%, will be covered by imported products. This dependence can be witnessed in all sectors of the economy. For example transport, the domestic sector and the electricity industry depend largely on oil and gas and are at the mercy of erratic variations in international prices. Enlargement will exacerbate these trends. In economic terms, the consequences of this dependence are heavy. It cost the Union some EUR 240 billion in 1999, or 6% of total imports. In geopolitical terms, 45% of oil imports come from the Middle East and 40% of natural gas from Russia. The European Union does not yet have all the means to change the international market.

The European Union's long-term strategy for energy supply security must be geared to ensuring, for the well-being of its citizens and the proper functioning of the economy, the uninterrupted physical availability of energy products on the market, at a price which is affordable for all consumers (private and industrial), while respecting environmental concerns and looking towards sustainable development, as enshrined in Articles 2 and 6 of the Treaty on European Union.

Security of supply does not seek to maximise energy self-sufficiency or to minimise dependence, but aims to reduce the risks linked to such dependence. Among the objectives to be pursued are those balancing between and diversifying of the various sources of supply (by product and by geographical region). .

The European Union now has to face **new challenges** characteristic of a period of profound transition for the European economy.

In the decade to come, **investments in energy,** both to replace existing resources and in order to meet increasing energy requirements, will oblige European economies to arbitrate among energy products which, given the inertia of energy systems, will condition the next 30 years.

The **energy options** exercised by the European Union are conditioned by the world context, by the enlargement perhaps 30 Member States with different energy structures, but above all by the new reference framework for the energy market, namely the liberalisation of the sector and environmental concerns.

Environmental concerns, which are nowadays shared by the majority of the public and which include damage caused by the energy supply system, whether such damage is of accidental origin (oil slicks, nuclear accidents, methane leaks) or connected to emissions of pollutants, have highlighted the weaknesses of fossil fuels and the problems of atomic energy. As for the struggle against climate changes, this is a major challenge. Climate change is a long-term battle for the international community. The commitments made in the Kyoto Protocol are only a first step. The European Union has reached its objective in 2000, but greenhouse gas emissions are on the rise in the Union as in the rest of the world. It is much more arduous to reverse this trend than it might have seemed three years ago. The return to sustained economic growth on both sides of the Atlantic and in Asia and the development of our energy consumption structure, mainly of electricity and for transport, which is a consequence of our lifestyle, are contributing to the increase in greenhouse gas emissions and of carbon dioxide in particular. This situation is a major stumbling block to any policy seeking to safeguard the environment.

What is more, the achievement of the **internal energy market** has given a new position and role to energy demand. New tensions are appearing and our societies will have to find valid compromises to ease them. For example, the fall in electricity prices goes against policies to curtail increasing demand and to combat climate change, while the competition introduced by the internal market is changing the conditions of competitiveness for the different sources of energy supply (coal, nuclear, natural gas, oil, renewables).

Nowadays the **Member States are interdependent** both as regards the issue of combating climate change and for the completion of the internal energy market. Any energy policy decision taken by one Member State will inevitably have an impact on the functioning of the market in the other Member States. Energy policy has assumed a new Community dimension without that fact being reflected in new Community powers. In this context, it is appropriate to analyse whether it is worthwhile conceiving a European energy policy from an angle other than that of the internal market, harmonisation, the environment or taxation.

The European Union must take better charge of its energy destiny. We are obliged to acknowledge that, despite the various crises besetting the European economy in the last thirty years, there has not been a real debate on the choice of energy sources and even less an energy policy regarding security of supply. Now, the twin pressures of environmental concerns and the new functioning of the European energy market make this debate inevitable. The oil price crisis prevailing since 1999 makes it urgent.

This debate should take into account that current energy demand is covered by 41% oil, 22% gas, 16% coal (hard coal, lignite and peat), 15% nuclear and 6% renewables. If nothing is done, the total energy picture in 2030 will continue to be dominated by fossil fuels: 38% oil, 29% gas, 19% solid fuels, 8% renewables and barely 6% nuclear.

The Green Paper sketches out the bare bones of a long-term energy strategy, according to which:

- **The Union must rebalance its supply policy by clear action in favour of a demand policy.** The margins for manoeuvre for any increase in Community supply

are weak in view of its requirements, while the scope for action to address demand appears more promising.

- With regard to demand, the Green Paper is calling for a real change in consumer behaviour. It highlights the value of **taxation measures** to steer demand towards better-controlled consumption which is more respectful of the environment. Taxation or parafiscal levies are advocated with a view to penalising the harmful environmental impact of energies. The transport and construction industries will have to apply an active energy savings policy and diversification in favour of non-polluting energy.

- With regard to supply, priority must be given to the fight against global warming. The development of new and renewable energies (including biofuels) is the key to change. Doubling their share in the energy supply quota from 6 to 12% and raising their part in electricity production from 14 to 22% is an objective to be attained between now and 2010. If current conditions apply, they will stagnate around 7% in ten years. Only financial measures (aids, tax deductions and financial support) would be able to buttress such an ambitious aim. One way which could be explored is that profitable energies such as oil, gas and nuclear could finance the development of renewable energies which, unlike traditional energy sources, have not benefited from substantial support.

The contribution of atomic energy in the medium term must, in its turn, be analysed. Among the issues which will certainly form part of the debate will be the decision by most Member States to relinquish this sector, the fight against global warming, security of supply and sustainable development. Whatever the conclusions of this reflection, research on waste management technologies and their implementation in the best possible safety conditions must be actively pursued.

As far as oil and gas are concerned, imports of which are increasing, a stronger mechanism ought to be provided to build up strategic stocks and to foresee new import routes.

Every form of technological progress will help to reinforce the impact of this outline energy strategy.

The Commission proposes to launch a debate during 2001 around the essential questions which shed light on the energy choices to be made. It is not a question of proposing a “key in the door” strategy for security of supply, but to hold a new and deep and debate on the principal questions which can be identified, notwithstanding possible additional ones.

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INTRODUCTION

This Green Paper is the response to an observable **fact**: Europe's growing future energy dependence.

Its aim is to initiate a debate on the security of energy supply, an issue that is still very much alive. The recent tripling in the price of crude oil on the international market has served as a grim reminder of the crucial role of energy in Europe's economy. Security of supply does not seek to maximise our autonomy in energy or to minimise our dependence, but to reduce the risks connected to the latter. Energy dependence is not in itself an easy problem to solve, however the concept of security of supply which appears in the Treaty on European Union (Article 100) calls for an exercise of reflection over the diversification of the various sources of supply (in products and by geographical areas).

The European Union is extremely **dependent** on its external **supplies**. It currently imports some 50% of its requirements, a figure that will rise to about 70% in 2030, with an even greater dependence on oil and gas, if current trends persist. It cost the Union some EUR 240 billion in 1999, or 6% of total imports and 1.2% of GDP. Security of supply in the energy field must be geared to ensuring, for the good of the general public and the smooth functioning of the economy, the uninterrupted physical availability on the market of energy products at prices for all consumers (both private and industrial), in the framework of the objective of sustainable development enshrined in the Amsterdam Treaty.

How much importance, then, should the European Union attach to the security of its supplies? This question is all the more pressing with enlargement imminent and relations with our partners (suppliers and transit countries) in the process of being redefined.

– Can we afford to ignore a dependence of more than 40% on oil imported from OPEC countries?

– Can we allow erratic increases in the price of oil and gas to disrupt our economies and those of the non-producer developing countries ?

– Is it acceptable for oil and gas transport networks in their present form to be a source of instability in the supply chain?

Investments in energy, both to replace the obsolete infrastructures and to meet the growth in demand will be necessary in the next ten years in the new energy market context (opening up of the sector to competition and environmental concerns). The opportunity should be seized to promote a coherent energy policy at the Community level.

Faced with these constraints, the European Union still has too few resources and instruments at its disposal to meet these challenges. The present Green Paper describes these weaknesses and proposes a reflection about the different instruments which could be used. However, energy concerns have been a permanent feature since the very beginnings of European construction. Two of the three treaties establishing the European Communities are about energy: the European Coal and Steel Community (ECSC) Treaty and the Euratom Treaty. These two treaties were adopted primarily to ensure regular and equitable supplies of coal and nuclear energy in the Community. In the Treaty establishing the European Economic Community, however, the Member States chose not to lay the foundations of a common energy policy. Subsequent attempts to include a chapter on energy, during the negotiations on the Maastricht and Amsterdam Treaties, ended in failure. Energy receives no more than a mention in the preamble to the Amsterdam Treaty.

There has thus never been a real Community debate on the main lines of an energy policy. As a result, the energy problems which have inevitably cropped up since the Treaty of Rome was

adopted, more particularly after the first oil crises, have been approached either through the mechanism of the internal market, or from the angle of harmonisation, environmental policy or taxation.

Security of supply concerns are not, however, alien to the Treaty, as scope for action at the Community level to remedy supply problems has existed since the Treaty of Rome (e.g. Article 103). This is the Article on which the decision on oil stocks was based. However, since the Maastricht Treaty,[1] the implementation of such measures requires decisions to be taken unanimously rather than by qualified majority as previously (Article 100 of the Treaty on European Union).

Today, **Member States are interdependent**, both because of climate change issues and the creation of the internal energy market. Any energy policy decision taken by a Member State will inevitably have repercussions on the functioning of the market in other Member States. Energy policy has assumed a new, Community dimension. In this context, it is legitimate to question the wisdom of uncoordinated national decisions on energy policy. As Mr Prodi, the President of the European Commission, said in his address to the European Parliament on 3 October 2000 "You cannot on the one hand deplore the lack of effective and united European action and on the other be content with the weakness of the instruments available to the Community for carrying out such action. The recent petrol crisis is a perfect illustration".

The analysis in this Green Paper sets out to show, as objectively as possible, that the **European Union** has very **limited scope** to influence the energy supply side. It also sets out to show, without bias, that the major efforts required to promote renewables will in fact have a limited impact in the face of the growth in demand. Conventional energy sources will remain indispensable for a long time. **Efforts will have to focus on orienting the demand for energy in a way which respects the EU's Kyoto commitments and is mindful of security of supply**.

Apart from declarations of principle, what specific measures can be taken? This is the issue on which the Green Paper wishes to initiate a debate, starting in particular with the 12 questions at the end of the Paper which are reproduced below for the reader's convenience.

Three main points emerge from the Green Paper:

- The European Union will become increasingly dependent on external energy sources; enlargement will not change the situation; based on current forecasts, dependence will reach 70% in 2030.

- The European Union has very limited scope to influence energy supply conditions; it is essentially on the demand side that the EU can intervene, mainly by promoting energy saving in buildings and the transport sector.

- At present, the European Union is not in a position to respond to the challenge of climate change and to meet its commitments, notably under the Kyoto Protocol.

In these circumstances, the Commission would like the debate on the future strategy to be structured around the following principal questions:

[1] The new Article requires unanimity to "decide upon the measures appropriate to the economic situation, in particular if serious difficulties arise in the supply of certain products".

1. Can the European Union accept an increase in its dependence on external energy sources without compromising its security of supply and European competitiveness? For which sources of energy would it be appropriate, if this were the case, to foresee a framework policy for imports? In this context, is it appropriate to favour an economic approach: energy cost; or geopolitical approach: risk of disruption?

2. Does not Europe's increasingly integrated internal market, where decisions taken in one country have an impact on the others, call for a consistent and co-ordinated policy at Community level? What should such a policy consist of and where should competition rules fit in?

3. Are tax and state aid policies in the energy sector an obstacle to competitiveness in the European Union or not? Given the failure of attempts to harmonise indirect taxation, should not the whole issue of energy taxation be re-examined taking account of energy and environmental objectives?

4. In the framework of an ongoing dialogue with producer countries, what should supply and investment promotion agreements contain? Given the importance of a partnership with Russia in particular, how can stable quantities, prices and investments be guaranteed?

5. Should more reserves be stockpiled -as already done for oil - and should other energy sources be included, such as gas or coal? Should the Community take on a greater role in stock management and, if so, what should the objectives and modalities be? Does the risk of physical disruption to energy supplies justify more onerous measures for access to resources?

6. How can we ensure the development and better operation of energy transport networks in the European Union and neighbouring countries that enable the internal market to function properly and guarantee security of supply?

7. The development of some renewable energy sources calls for major efforts in terms of Research and Technological Development, investment aid and operational aid. Should co-financing of this aid include a contribution from sectors which received substantial initial development aid and which are now highly profitable (gas, oil, nuclear)?

8. Seeing that nuclear energy is one of the elements in the debate on tackling climate change and energy autonomy, how can the Community find a solution to the problem of nuclear waste, reinforcing nuclear safety and developing research into reactors of the future, in particular fusion technology?

9. Which policies should permit the European Union to fulfil its obligations within the Kyoto Protocol? What measures could be taken in order to exploit fully potential energy savings which would help to reduce both our external dependence and CO2 emissions?

10. Can an ambitious programme to promote biofuels and other substitute fuels, including hydrogen, geared to 20% of total fuel consumption by 2020, continue to be implemented via national initiatives, or are co-ordinated decisions required on taxation, distribution and prospects for agricultural production?

11. Should energy saving in buildings (40% of energy consumption), whether public or private, new or under renovation, be promoted through incentives such as tax breaks, or are regulatory measures required along the lines of those adopted for major industrial installations?

12. Energy saving in the transport sector (32% of energy consumption) depends on redressing the growing imbalance between road haulage and rail. Is this imbalance inevitable, or could corrective action be taken, however unpopular, notably to encourage lower use of cars in urban areas? How can the aims of opening up the sector to competition, investment in infrastructure to remove bottlenecks and intermodality be reconciled?

13. How can we develop more collaborative visions and integrate the long-term dimension into deliberations and actions undertaken by public authorities and other involved parties in order to evolve a sustainable system of energy supply. How are we to prepare the energy options for the future.

PART ONE: BASIC FACTS ABOUT ENERGY IN THE EUROPEAN UNION

The EU's energy choices are restricted by its limited capacity for self-sufficiency and by available technology.

I. THE IMPOSSIBILITY OF ENERGY SELF-SUFFICIENCY

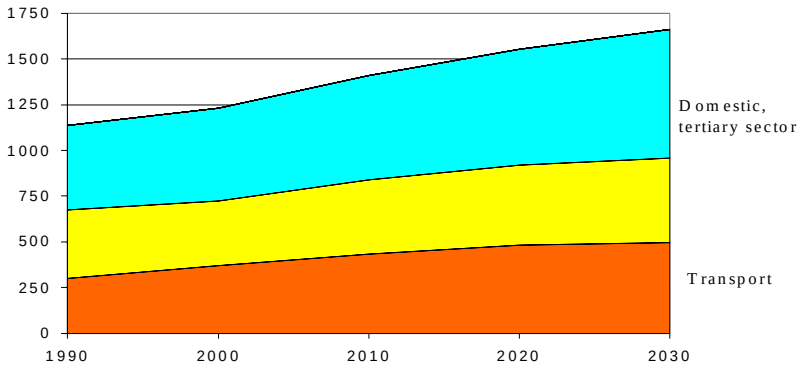
Since the first oil crisis, Europe's economy has grown faster than its energy consumption. Yet despite this achievement, the Union's energy needs are still increasing, and internal resources are inadequate to meet them. Whether or not the applicant countries are included in the calculation, the Europe of 15 is using far more energy than it can produce.[2]

A. An energy-intensive economy

The EU's demand for energy has been growing at a rate of between 1 and 2% a year since 1986. While industrial demand has been relatively stable, as a result of the transition to a service-oriented economy, the increased demand for electricity, transport and heat from households and the tertiary sector has more than made up for this decline.

The long-term evolution of energy demand in the applicant countries will doubtless track that of the Union, even though these states are at present well behind in terms of energy conservation. Once the present crisis period is over, however, the medium term will inevitably see a rapid surge in energy demand, especially since their economies in the period leading up to 2010 will be growing much faster than those of the Member States (an annual rate of between 3 and 6%, as compared to 2-4% for the EU). This transition period could provide these countries with the opportunity of modernising their systems.

Europe-30: Final energy consumption (in Mtoe)



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1. Industry: life after oil

Investment in modernisation has enabled European industry to reduce its need for energy. A conscious effort has been made to reduce dependence on oil (which now represents only 16%

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2 This Green Paper examines the Union's energy needs in a 20-to-30-year time frame. Over this period it is possible the number of Member States may grow to around 30.

3 Mtoe = Million tonnes of oil equivalent

4 The figures used in the Green Paper are taken from the forecasts in Part 3 I.B below

of total industrial energy consumption) and diversify into natural gas and electricity. As a result, the sector saw its energy intensity[5] decline by 23% between 1985 and 1998.

The stability of consumption between 1985 and 1998[6] was due to the introduction of combined heat and power generation and greater technological efficiency, but Europe's transition to a service-oriented economy also played a key role. In the applicant countries, however, this trend is not yet clearly visible. As they recover from their severe recession, the industrial sectors of the CEEC countries will probably absorb 2% of annual growth in energy demand between now and 2020.

2. Held hostage by oil: households, services and the transport sector

a) Households, the tertiary sector and technological progress

In absolute terms, the biggest energy users are households and the tertiary sector. To date, their energy use has tended to grow at a moderate rate,[7] as a decrease in energy intensity was partly offset by a systematic rise in levels of material comfort. The result has been higher per capita consumption, in particular of electricity. Per capita consumption in the applicant countries remains lower, despite weaker energy saving efforts. This can be explained by delays in investment and economic development.

Excluding personal transport, 63% of household needs are supplied by oil and gas. Households are the biggest consumers of natural gas (1/3 of total gas consumption, supplying 40% of household demand) and account for approximately 18% of total oil use (1/4 of household demand).

b) Transport

Transport certainly represents the great unknown for the future of energy. With a market entirely dependent upon oil (98% of transport consumption, representing 67% of final oil demand), this sector has seen consumption rise steeply. Between 1985 and 1998 it rose from 203 Mtoe to 298 Mtoe, while the number of public and private vehicles in use rose from 132 million to 189 million, with a parallel explosion in air traffic. The sector's energy intensity increased by 10% between 1985 and 1998.[8] In the foreseeable future, this sector should continue to grow at a rate of 2% per annum over the coming decade. Within the European Union, passenger transport should increase by 19% by 2010, mainly due to a 16% rise in road use and a 90% increase in air traffic. At the same time, goods transport is expected to grow by 38%, driven by road (+50%) and seaborne (+34%). The efforts undertaken by the automotive industry under its agreements with the Commission to reduce CO_2 emissions from passenger cars will make and important contribution to preventing these trends from translating into a corresponding increase in fuel consumption. However, this progress will not be sufficient to reduce or even come close to stabilising the transport's sector's energy demand.

These growth factors will have an even greater impact in applicant countries. After enlargement, the Union will have to provide mobility for an additional 170 million people, while its territory will be extended by 1.86 million square kilometres. Given the gap in development with the European Union, there will be a lot of catching up to do. In one optimistic scenario, applicant countries could see their economies grow at an annual rate of 5-6% over the next decade - that is, twice as fast as the existing Member States. If that is the

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5 Energy intensity measures energy consumption in relation to GDP.

6 264-262 millions tonnes of oil equivalent (toe)

7 From 355 to 384 Mtoe between 1980 and 1998.

8 The most important factor underlying this rise was the increase, especially over the last few years, in intra-Community road transport between the Iberian peninsula and the rest of the Union, as well as with the Central and Eastern European Countries

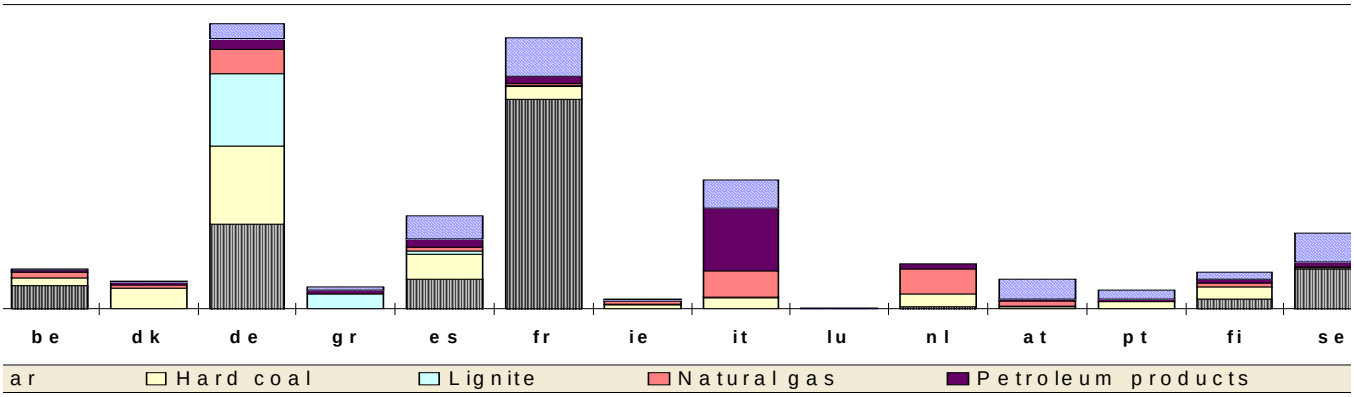
case, then transport demand will inevitably grow even faster than the economy. Most of this growth will have to be supplied by the road transport sector.

Growth in demand, combined with gaps in infrastructure and services, especially when it comes to international transport and the breakdown of traffic between the different transport sectors, will aggravate existing congestion problems (saturated cities, road networks, airports). This congestion not only comes at significant economic and environmental cost, it also impacts negatively on quality of life. In this way, external costs of pollution due to transport have been estimated at nearly 2% of GDP.

3. Energy diversification: electricity and heat

a) Electricity

GWH Electricity production by energy source and Member State



(scale – one space = 50GWH)

In recent years, demand for electricity has grown much more rapidly than for any other type of energy, and will continue to track GDP growth closely until 2020. In the applicant countries this demand should grow even faster, with electricity increasing by 3% annually[9] between now and 2020.

The EU's installed capacity should reach 800-900 GWe[10] in around 2020, compared to the present 600 GWe. Around 300 GWe of capacity will be installed over the next 20 years simply to replace power stations that have reached the end of their lives, in addition to the 200-300 GWe that will be necessary to meet increased demand.

In the absence of any major technological breakthrough, excess demand will have to be supplied from already available energy sources: natural gas, coal, oil, nuclear and renewable energy. At present, electricity is generated from the following sources: nuclear (35%), solid fuel (27%), natural gas (16%), hydro and other renewables (15%) and oil (8%). New capacity

9 European Energy outlook to 2020: figures based on the seven Central European countries, excluding Bulgaria, Slovakia and Romania.

10 Gwe : Giga watt electric

will be predominantly gas-generated, while the number of oil and solid-fuel power stations will continue to decline.

At the moment, it seems unlikely that nuclear energy will see renewed growth. In the long-term, its contribution is linked to the pursuit of policies to combat climate change, its competitive position vis-à-vis other energy sources, public acceptance and a possible solution to the problem of nuclear waste. Given the present political context (decision by certain Member States to relinquish this sector), it seems likely that the contribution of nuclear energy will change little from now until 2020. In the medium-term, possible disenchantment with nuclear could result in greater use of thermal power stations, barring new investments. However, this forecast could be changed with an enhanced contribution of renewable energy and action on the energy demand side.

The present electricity generation capacity of the applicant countries is difficult to assess. Modernisation/replacement of existing generation facilities seems certain to proceed at a rapid rate, since a large number of these plants are already obsolete.

- In theory, existing thermal power stations whose capacity is currently in surplus will require extensive modernisation. Some of the solid fuel stations may be replaced by gas-fired plants. However, were the price of gas on the international markets to rise and remain high, investments might be held back. In that case, solid-fuel and nuclear would continue to play a significant role. Indeed, in the reference scenario,[11] higher gas prices could lead to a 24% reduction in the growth rate for gas use.

- The expansion of nuclear generating facilities will depend upon efforts by the states concerned to ensure that these facilities are safe. Nuclear power is already diminishing as a proportion of energy use in the applicant countries, and is forecast to decline from the present 15% to 8.1% by around 2020.[12]

b) Heating

Heating is the largest single user of final energy, accounting for about one third of total consumption. The market ranges from household heating (including hot water) to steam production for industrial uses. The energy balance for heat production is very different from that for electricity.

Unlike electricity, heat production is predominantly decentralised, whether it takes the form of individual heating systems, CHP[13] or dedicated heat stations with their associated heating networks. The latter are more common in the applicant countries than in the EU Member States.

B. Community resources are limited

Despite the considerable progress made in tapping conventional energy reserves in Europe, their levels remain low and they are expensive to extract. In the future, domestic fossil fuel resources are likely to decline quite sharply.

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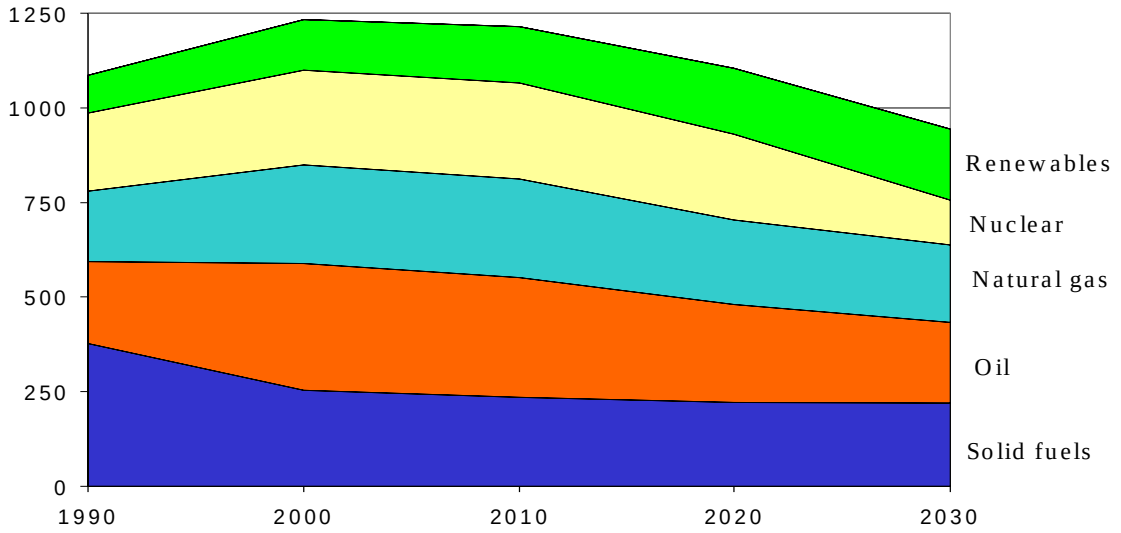
11 See Part 3, I.B.

12 This figure reflects both the growth of demand and planned closure/modernisation of nuclear plants.

13 Combined production of electricity and heat.

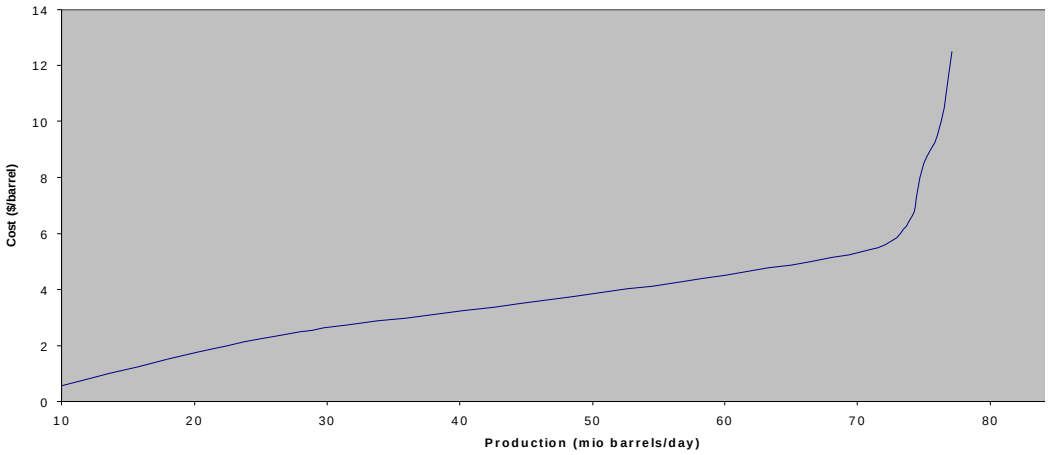
Europe-30: energy production by fuel: reference case (in mtoe)



1. Uncertainty about oil and gas production

a) **Oil reserves** are very unevenly distributed across the world, and the European Union in particular has very few. In the applicant countries, the situation is even worse. The Community has eight years of known reserves at current consumption rates (assuming no change in consumption patterns and/or related technologies). Thanks to the North Sea, whose reserves belong mainly to the United Kingdom, the Union produces some 158.3 Mtoe (1997), representing scarcely 4.4% of world output. Today, the cost of extracting one barrel of oil in Europe ranges between USD 7-11, compared to a range of USD 1-3 in the Middle East.

World oil production cost

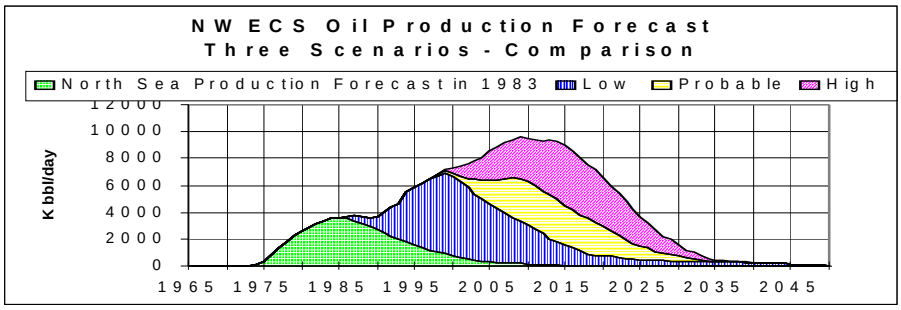


b) **Natural gas reserves** are more evenly distributed on the global level, but the European Union is once again unfortunate, with barely 2% of world reserves, or 20 years' consumption at present rates. 223.2 Mtoe were extracted in 1997, representing 12% of world production. Most of these reserves are located in the Netherlands (56%) and Great Britain (24%).

c) The **rate** at which Community resources **will be depleted** depends not only on the extent of known reserves, but also on the price of oil and gas on the world market, and on technological progress. The higher the price of oil, the more companies will invest in prospecting and production. If present oil and natural gas prices could be sustained (around USD 30 in 2000), then large reserves would be brought into production. Amid such uncertainties, however, one thing is clear: if production continues at its present rate, North Sea oil and gas deposits will be exhausted within 25 years. Enlargement will do nothing to increase internal supply[14]. Forecasts are usually exceeded notably as a result of technological innovation, as shown in the graph below.

If investment were to pick up, this might also help relieve the prevailing pessimistic outlook. New extraction technologies may mean that, in time, the recovery rate could rise from 20-40% of deposits to 60%.

North Sea production forecasts



- Under the High Scenario, the daily production is peaking at 9.5 Mibbl/d at 2010
- **Under the probable scenario production is kept at 6-7 Mibbl, but for much longer 2025**

2. Decline in mine production

a) Solid fuels

In absolute terms, the world has substantial reserves of solid fuel - 4-5 times as much as oil, or some 200 years' supply. 80% of Europe's fossil fuel reserves are solid fuels (including coal, lignite, peat and oil shale). However, this optimism has to be tempered by the fact the quality of solid fuels is variable and production costs are high.

The Community now produces 1.2 Mtoe of peat a year, 50 Mtoe of lignite and 60 Mtoe of coal (or some 5% of world production). After enlargement, the Union's coal production will more than double. However, while lignite and peat are profitable businesses, European coal is highly uncompetitive compared with imported coal.

Difficult geological conditions and the rules governing social insurance in the European Union cause the average cost of producing European coal to be 3-4 times the international market price (US$ 150 per Tce compared to US$ 40 per Tce). Given this context, European coal cannot compete with that of the major coal exporting countries such as the United States, Australia, South Africa or Columbia. This gap has led producing countries either to cease all

[14] In 1999, Norway had 1.77 trillion cubic metres of proven gas reserves which at current production rates will last 23 years, proven oil reserves at around 11 bn barrels are over half Europe's reserves but at current production rates will last 10 years. However, there are substantial reserves of oil and gas to be exploited in the Barents Sea.

production as in Portugal, Belgium and France (in 2005) or to decide to restructure the industry so as to gradually reduce mining activity (Germany and Spain) or to make production competitive with that of imported coal (United Kingdom).

A few years hence, the highly uncompetitive European coal industry will be providing only a tiny proportion of the Union's energy needs, even after taking enlargement into account (Poland, Czech Republic, Romania). Although the applicant countries have substantial solid fuel reserves, they will not be able to stand up to international competition, and will have to reduce their mining activities in line with EU policy.

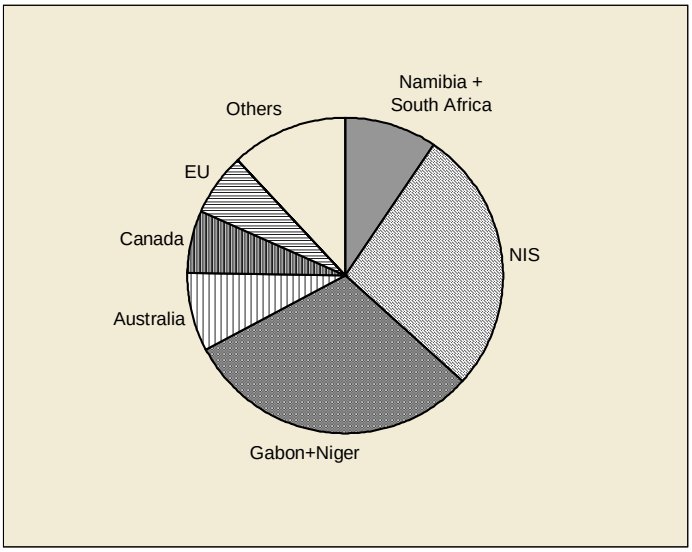
Difficult decisions will have to be taken regarding the future of the European coal industry on account of its lack of competitiveness. One path to explore could be that of maintaining access to certain reserves. To this end, it might be possible to envisage maintaining minimal capacity of coal production in realistic economic conditions, which would ensure the maintenance of the equipment and thus guarantee the continuity of good operation, while at the same time allowing European technology to keep its leading position in clean-coal mining and consumption.

b) Uranium

The world has two and half million tonnes of known uranium reserves (uranium being the only part of the nuclear fuel cycle in which the Union is not self-sufficient) at a market price lower than US$ 80 a kilo, representing 40 years' demand at present rates of consumption (the current market price is around US$ 20 a kilo). Further known resources come to about 850 000 tonnes (corresponding to 15 years' demand) at the same price and are mainly located in Australia, Kazakhstan, Uzbekistan and Canada.

The European Union, for its part, is home to barely 2% of the world's natural uranium reserves (i.e. 52 000 tonnes) at a price lower than US$ 80 a kilo but production will shut down around 2005 in France and Portugal. Europe's uranium mines have closed principally because the deposits have been exhausted and it is expensive to extract relative to the world price, and because world physical stocks of nuclear fuel are very high.

Origin of uranium imports used in the Union



More uranium could be made available, but only at a higher price. There are in fact non-conventional reserves which would be sufficient in the long term. But this would have little impact on the cost of electricity per kilowatt/hour, since it would concern only a very small part of total production.

The recyclable nature of the used fuel accounts for the promising outlook for reserves. Nuclear fuel differs from other primary energy sources in that fission products can be recycled, proportionately reducing import requirements. Once separated from their waste products (amounting to around 4%), both recovered uranium and plutonium can be used again to generate more electricity. Material obtained from the decommissioning of nuclear weapons can also be recycled as nuclear fuel.

3. Potential abundance of renewable energy

Renewable energy sources, such as firewood and hydro-electricity, have a modest role in the European economies. They represent more significant share in the applicant countries, and in some isolated regions, such as islands, are the only source of energy. Nevertheless, they have the potential to play a much larger role in both the economy and the energy balance.

Renewable energy technology, especially at the cutting edge, is still in its infancy. However, public support for research has led to significant progress over the last few years. Wind energy is now widely recognised as a viable option. Photovoltaic energy, meanwhile, though promising, is still far from economically competitive.

Resource levels for renewable energy are a problem only for energy forms which are not driven by the elements, such as biomass (including biofuel), wood and various kinds of biodegradable waste. Yet in theory, as their categorisation as 'renewable' indicates, there are not really any supply problems. Household waste is constantly growing and provides a significant energy opportunity, as do by-products from the timber and agri-foodstuffs industries. However, their use is not without environmental impact and can only develop thanks to advanced technology due to technological difficulties which still need to be overcome. The question of which type of waste can be incinerated will require attention.

Community resources in conventional primary energy cannot, at their current stage of development, form the basis for European energy self-sufficiency. Only technology-intensive renewable resources can help mitigate the present trend towards increasing energy dependence.

Conclusion : In 1998, the European Union consumed 1 436 million toe of energy from all sources taken together, of which 753 million toe were produced within the Community. Demand was covered by 16% coal, 41% oil, 22% gas, 15% nuclear and 6% renewables. The CEEC countries consumed 285 million toe and produced 164 million toe. **Unless consumption rates show a downward trend in the most rapidly growing sectors - transport and housing - Europe's energy dependence will reach more and more worrying levels.** The EU's physical energy stocks, though now at higher levels than when the first oil crisis broke, thanks to the implementation of policies for demand management and development of internal resources,[15] are bound to decrease. **In the long term, this depletion will be aggravated by the exhaustion of North Sea deposits and the scaling down of nuclear energy, even if to a greater or lesser degree in the case of the latter.** Even after enlargement and including Norway in the equation, the European Union's energy **dependence** will rise by 20 percentage points from current levels to reach some 70%.

C. Gulliver in chains, or energy supply in the European Union

The European Union is an important actor on the international market for energy products (second largest energy consumer in the world, and the largest energy importer[16]). As such, it is associated with demand on the world energy market, geo-political developments,

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15 North Sea oil, revival of nuclear energy programmes and renewable energy development..

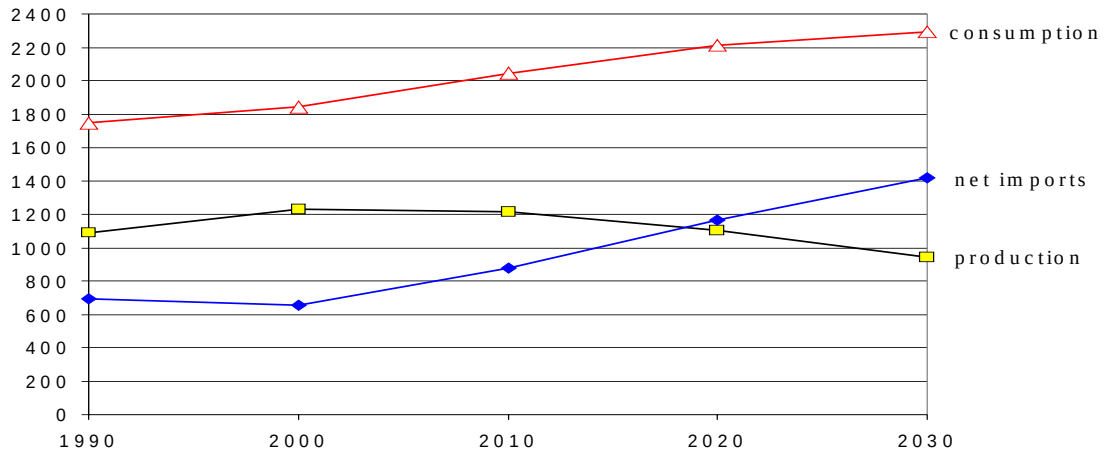
16 by comparison, the US imports 24% of its needs and Japan 80%

geographical location and the political stability of the countries through which the energy it imports must transit.

1. External dependence

While world energy consumption has risen since the first oil crisis, the EU also succeeded in reducing its energy dependence over this period, from 60% in 1973 to 50% in 1999. Policies focusing on demand management (energy conservation), development of internal resources (North Sea oil) and diversification (revival of nuclear programmes,[17] research into renewable energies, etc.) have borne considerable fruit.

Europe-30: total energy: reference case (in million toe)



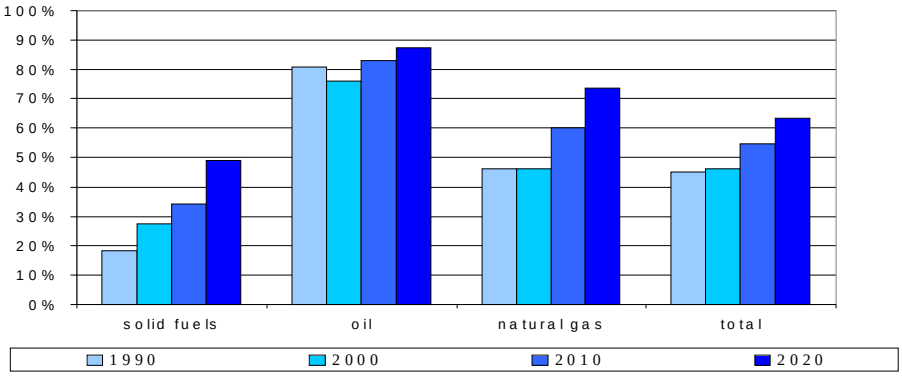
a) Increasing dependence for all forms of energy

As long-term growth begins to revive, the overall energy dependence of the EU is likely to rise once again, reaching 70% within 20 to 30 years. In the case of oil, dependence could reach 90%, for gas 70%, and for coal 100% dependence is feasible.

Enlargement will only serve to reinforce this trend. Natural gas imports to the applicant countries may rise from 60% to 90% of demand, and oil from 90% to 94%. Meanwhile, those countries which are currently net exporters of coal may have to import 12% of their needs by 2020, under the impact of drastic restructuring in this sector.

[17] Installed nuclear generating capacity has supported the policy of reducing external dependence. From 45 GWe in 1980, it has grown to 125 GWe today in the EU. This progress is the result of investment decisions made in the wake of the oil crises of 1973 and 1979. The aim was to replace oil-generated electricity with nuclear-generated, so as to reduce the reliance of pro-nuclear countries. The resulting savings can be estimated at 200 million toe for the year 2000, which is equivalent to a saving of €30-45 billion for the EU's trade balance.

EU 30 : Dependence according to energy product



b) Extent of dependence

Dependence will have different effects, according to the Member State concerned, and the structure of the international market for the type of energy in question.

- The impact of instability in energy supply in Member States will be in direct proportion to their reliance on external resources.[18] The impact will be greater where the supplier nations are themselves vulnerable to geopolitical instability.

- Price levels will also depend on the degree to which the imported commodity is traded internationally. Thus, 57% of oil consumed is traded internationally, as against only 20% of natural gas and 15% of coal.

- The markets for different energy products are structured very differently from one another, which also has an effect on prices.

For coal, one can talk of a competitive international market, for oil of a market dominated by a cartel[19], and for natural gas markets of a unique situation which might be described as regional oligopolies forming functional cartels in which prices are effectively determined by the oil market.

The most acute case of Community dependence is oil, where 76% of demand is met from external sources. In the long term, geographic diversification will not be as easily achieved as for natural gas, since the world's remaining oil reserves will increasingly be concentrated in the Middle East.[20] In the short term, there is little prospect of increasing supply in any significant way, as most oil-exporting countries have no spare production capacity. The sole exceptions to this rule are Saudi Arabia, Iraq and - to some extent - Russia.

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18 Since domestic prices are in any case related to international prices, the degree of external dependence will not influence prices to the same extent.

19 Some economists argue that OPEC cannot be described as a 'cartel', since its function is not to fix prices, but to eliminate competition between oil-producing countries - a project it has pursued with varying degrees of success.

20 Saudi Arabia, Iran, Iraq, UAE, Kuwait and Qatar.

At present, the EU is moderately dependent on imported natural gas, which supplies 40% of consumption. To try and offset the likely increase in this dependence (to 70%) over the next 20 to 30 years, the Union has several options. There are a number of nearby producer-nations which have limited resources (Russia, Norway and North Africa, especially Algeria and Libya). It should be noted, moreover, that despite various difficulties the USSR and subsequently Russia always fulfilled its supply obligations under its long-term contracts with the European Union. Further afield, vast amounts of natural gas have been discovered in regions where both production and transport costs are now at economically viable levels, in particular, Russia (Western Siberia), the Caspian region (including Iran), the Near East and Nigeria.

The Union currently imports more than 50% of the coal it uses. Although demand has been consistently decreasing in absolute terms, relative dependence on external sources will continue to rise for a number of years, to reach more than 70% in 2020. Some analysts even believe that the figure could reach 100%, given that Community coal production only survives thanks to huge public subsidies. The characteristics of the world coal market (geographical and geopolitical spread of supply and absence of price tensions) are reassuring in view of growing external dependence. In this respect one can speak of a stable economical and physical supply.

Europe depends on external supplies of uranium for 95% of its requirements. However, the European nuclear industry controls the whole fuel cycle. The problem of managing waste remains. The EURATOM Supply Agency is responsible for ensuring, primarily by authorising contracts, that there is a wide range of supply sources and for preventing any excessive dependence. Moreover, Europe's nuclear operators also have stocks of fuel representing a few years of operation for working plants (uranium is easy to store and the costs are low).

Adopting a policy of geopolitical diversification has not been able to free the Union from effective dependence on the Middle East (for oil) and Russia (for natural gas). Indeed, a number of Member States, and in particular the applicant countries, are entirely dependent on a single gas pipeline that links them to a single supplier country.

2. Trade in energy products: Europe constrained by its geographical location

Europe's increasing dependence on external energy resources, and the ever-greater distance at which those resources are located, are set to increase the burden of both transport costs and transit requirements. The challenges posed by the transit problem have also been significantly complicated by the emergence of the New Independent States (NIS) out of the ruins of the Soviet Union.

a) Trade in energy products

Growth in energy product transportation is a sensitive matter, because of the health and environmental risks it poses: oil slicks, leaks from gas and oil pipelines, transport of radioactive substances and traffic congestion in a number of transit zones, such as the Bosphorus.

Seaborne trade is vulnerable to such concerns. 90% of world trade in oil and coal, and one quarter of trade in natural gas (LNG), is carried by sea. Coal is the only energy product which has been removed from the International Maritime Organisation's (OMI) list of dangerous products. 800 million tonnes of oil and gas are transported through European waters every year, 70% of them off the Atlantic coast or through the North Sea and 30% through the Mediterranean.

The number of maritime accidents is directly linked to the age of the ships involved. Of the 77 oil tankers lost at sea between 1992 and 1999, 60 were more than 20 years old.

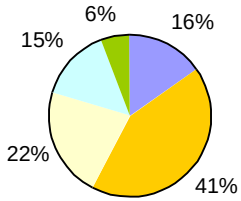
The wreck of the oil tanker ERIKA in December 1999 revealed a number of serious flaws in the way oil is currently shipped. The Commission responded by adopting a Communication on the safety of the seaborne oil trade, and proposed a number of measures for increasing technical controls. Plans were also made to exclude from European waters single hull oil tankers, which pose the greatest risk of pollution in case of accident. The ban will be enacted in two stages (2010 and 2015), according to the tonnage of the vessels concerned.

These measures will be followed up by new draft legislation prepared by the Commission to increase the supervision of ships carrying dangerous or polluting substances and to broaden the terms of responsibility for the principal parties involved in the seaborne oil trade (in particular, charter companies) in case of accidents leading to serious pollution.

In this context, the construction of new oil terminals which might create environmental problems for neighbouring countries needs to be carefully examined. A case in point is Russia's project to build a new oil terminal at Primorsk in the Gulf of Finland, where the environmental impact on states bordering the Baltic Sea should be addressed.

Gross internal consumption (in %) – 1998

EUR15



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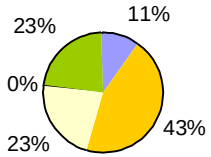

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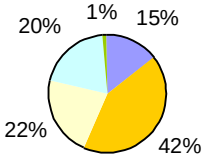

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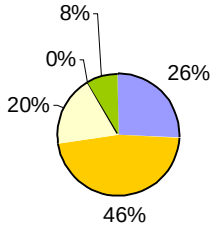

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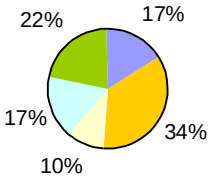

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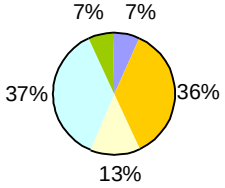

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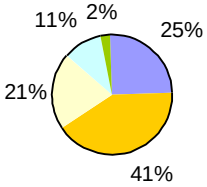

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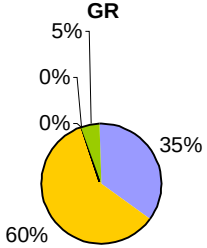

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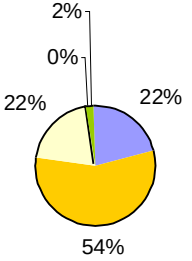

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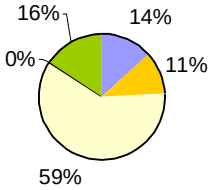

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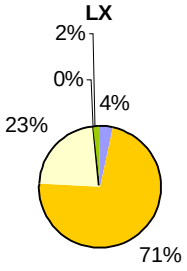

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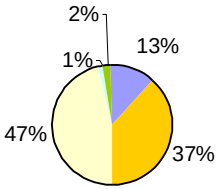

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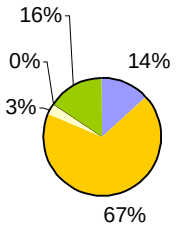

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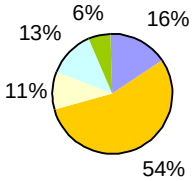

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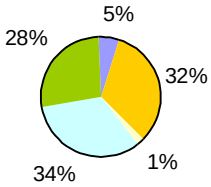

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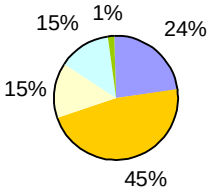
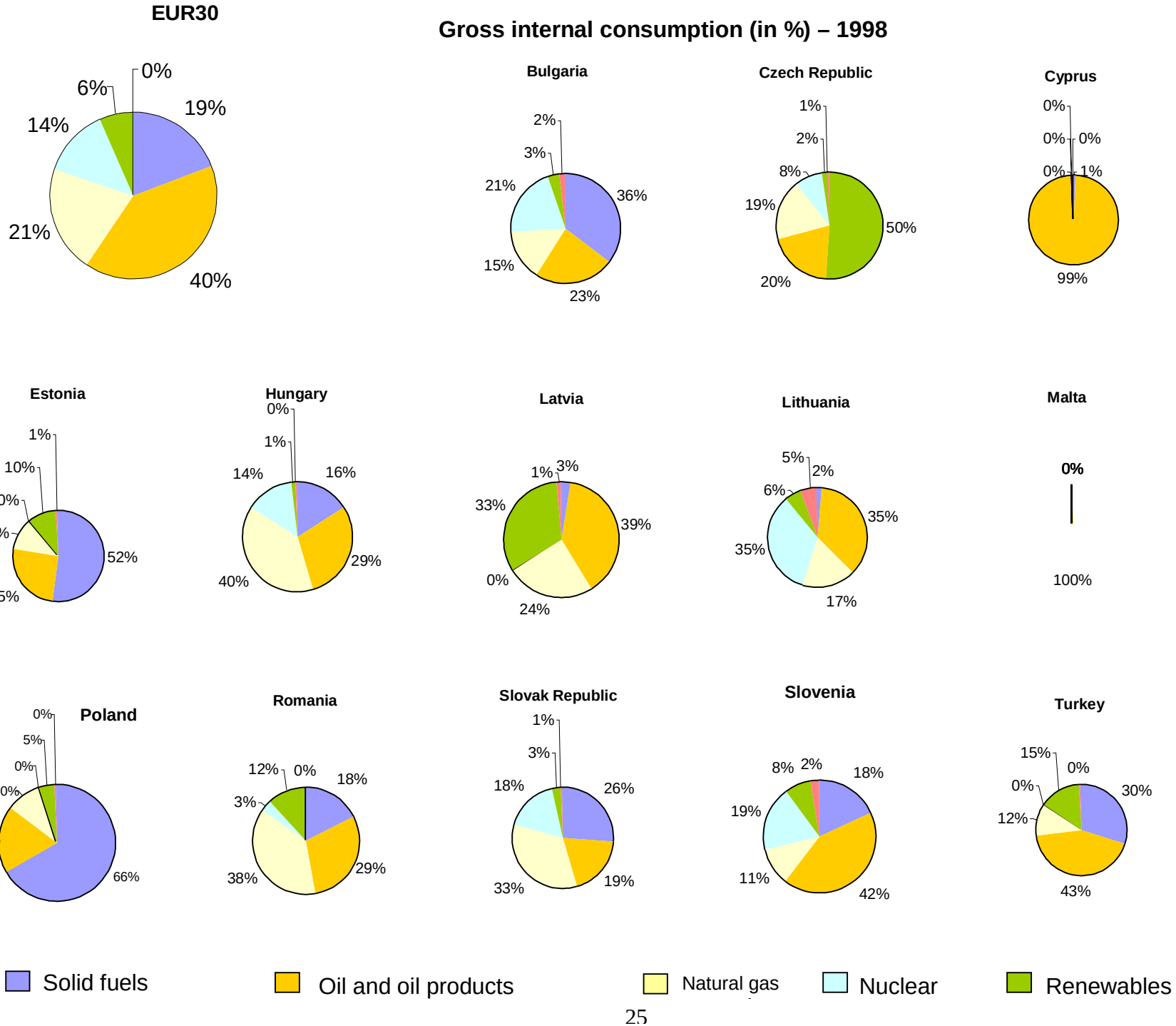


Gross internal consumption (in %) – 1998



b) Transit

It is essential for the Union to maintain satisfactory relations with transit countries if it is to have stable access to the energy products it needs. **This is especially true for gas, where the main risk lies in transit conditions and continuing diversification of transport routes, not in the status of world reserves.**

With regard to supplies originating in Russia, the Caspian Sea Basin, North Africa and the Middle East, two regions deserve special attention, Eastern and Northern Europe on the one hand and the Mediterranean Basin on the other.

- Russia plays an essential role, providing the Union with 42% of its natural gas needs. However, there is also considerable potential for oil and gas production in the countries of the Caspian Sea basin. As a producer, Russia is the world's leading natural gas exporter. It would also like to export more oil, and even electricity, to Europe, establishing new transport routes to this end. A range of transport routes will also be necessary if the resources of the Caspian Sea Basin are to be fully exploited. Particular attention should therefore be paid to transit states such as Turkey, the CEEC countries, Ukraine, the Baltic States and the Caucasian countries.

- North Africa is also an important producer region for Europe (Algeria, Libya).

In the light of their intention to join the Union, Europe should consider what support it could give to Turkey, Bulgaria and Romania, to develop transit facilities for Caspian basin gas and oil,[21] in addition to existing plans for transporting Russian supplies.[22] The natural gas interconnection project linking Greece and Turkey opens up the potential for European access to new sources of natural gas, providing an alternative to seaborne trade. It could also provide an export route for Middle Eastern production.

The northern, central and Mediterranean dimensions of energy policy assume primordial importance in this context.

3. The European Union – an actor on world markets

Because the European Union relies on imported energy, it is dependent on supply and demand conditions in the international energy markets. This dependence is to some extent re-balanced by the weight of EU exports to countries which themselves export energy products.

a) The Union is a major player in the international markets

The Union accounts for 14 to 15% of world energy consumption, though it is home to only 6% of the world's population. In particular it represents 19% of world oil consumption, 16% of natural gas, 10% of coal and 35% of uranium.

The EU imported 16% of the natural gas traded on the international markets in 1999 (450 billion m^3), and a quarter of the coal (150 out of 500 Mtce) and oil (9.7 out of 40.4 million barrels a day). Enlargement will increase the EU's share of these markets yet further, except for coal.

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21 The Caspian Sea Basin refers to the oil and gas reserves located in Southern Russia, the Caucasus, Central Asia and Iran.

22 A transit agreement was signed by the Applicant Countries and most of the Mediterranean states as part of the Umbrella Agreement under the INOGATE programme.

In 1997, the EU spent €120 billion on energy imports, representing 6% of the total value of all imports. Oil alone accounted for 75% of this sum. In 1997, the Union's oil bill was €94 billion, almost half of which (45%) was paid to Middle Eastern suppliers (more than €40 billion). In 1999, this bill reached €240 billion. Changes in the €/$ rate since January 2000 added a heavy burden to this bill.

b) The EU has no influence over international prices

In the long term, it is the energy choices made by the developing countries - and in particular China, India[23] and Latin America, whose populations and energy demands will see the strongest growth - which will have the most decisive and lasting influence on the international energy markets.

According to demographic experts, by 2020 the world's population will have grown to 8 billion - 2 billion more than in the year 2000. World energy demand according to current trends, could rise sharply, and the developing nations will account for 90% of that increase. Demand is forecast to rise by some 65% over 20 years, from 9.3 billion Toe in 2000 to 15.4 billion Toe in 2020. This trend may have a substantial impact on international fossil fuel prices. However, this trend could be reduced by international efforts to promote renewable energy and energy efficiency, for example in the fight against climate change.

To give an example, the number of cars in use world-wide is forecast to double by the year 2020. Most of this growth will come from the developing countries. In the OECD states, there are already around 6 cars for every 10 citizens, whereas in most of the rest of the world, the ratio is 2 cars for every 10 persons. Even if the shortfall in supply could be partly made up, the pressure on oil prices in the relatively short term is likely to be considerable.

That is one reason why agreements with developing countries have to take the aspect of security of energy supply into account.[24]

Beyond overall market trends, instability in energy prices for products traded on the international markets (oil, natural gas, coal and uranium) may result from a number of other disruptive factors: deliberate actions by exporting countries (such as OPEC), geopolitical disputes or the effects of exchange rates. Sudden price shifts and the profound crises they can cause are connected to intense price volatility, recurring conflicts over prices, the ability of our economies to absorb price changes, and their capacity to bring pressure to bear on both the market in question and those for substitute energy products.

While the EU economies are now better able to deal with price volatility, they are still unable to control all the relevant geopolitical and speculative factors, and have little power to determine the future direction of world markets.

- On the geopolitical level, recent problems with the Middle East peace process, the embargo against Iraq and uncertainty over the situations in Iran and Libya have all influenced the actions of OPEC, without it being possible to say what exactly their effect has been.

- On the financial level, the impact of speculative capital flows generated by the growing number of transactions in the futures markets can cause sudden price movements and is also

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23 China and India combined consume some 1.115 billion Toe a year (respectively, 844 million toe and 271 million toe).

24 Communication on co-operation as regards energy with Asia (COM/96/308).

highly worrying. In such a context, as the Commission has already pointed out, strategic reserves may be able to play an anti-speculative role.[25]

Unfortunately, the EU lacks the means of negotiate and exert pressure. The Union suffers from having no competence and no community cohesion in energy matters.

Apart from the powers established by the ECSC and EURATOM treaties, there is no explicit mandate for a European energy policy. As a result, over the last 40 years, Europe has failed to develop a consistent common energy policy (within both the EU and the International Energy Agency), as the OPEC countries have today, and as other producer groups may in the future.

The lack of a real energy policy reduces the EU's bargaining power. In the face of powerful oil-exporting companies, European importers without co-ordination on a market where prices are largely fixed. The development of the single market should help to curb the influence of exporting countries, as liberalisation and increased trading encourage competition between exporting companies, particularly where natural gas is concerned.

As long as the EU fails to develop means to reduce the influence of the international markets, this situation will remain the Achilles' heel of the European economy and its ability to influence dialogue at world level will remain limited. As a result, the Union will be unable to pull its weight in international political debate. As the current President of the European Union remarked at the European Council meeting in Biarritz, the recent increase in oil prices has alerted Member States to the need for a co-ordinated response in times of crisis.

c) An inadequate strategy for prevention

Energy security and - insofar as it might be possible - self-sufficiency have always lain at the heart of the Member States' energy policies. This goal was embodied in the ECSC and EURATOM treaties, and was intended to provide the cornerstone of European harmony as conceived by the Union's founding fathers.

Following the first oil crisis, the Member States and the European Union sought to minimise their quantitative reliance on external energy sources. The result was a raft of measures intended to support domestic production that would otherwise be uncompetitive, a deliberate policy of stockpiling, and programmes to promote energy efficiency and technological development. However, these measures did not go far enough to reverse the underlying trend.

<u>The coal industry</u>

The truth of this statement is particularly obvious if we consider the coal mining industry. Social and regional considerations argued for mitigating the effects of an inevitable decline, rather than examining how the sector might make a positive contribution to energy security in the context of a well-ordered and efficient international market. Of course, whatever credibility such a contribution might once have had has since been largely eroded by the rise in European production costs.

<u>Responding to oil crises</u>

World physical supply of oil can be disrupted at any moment by events in producer regions and transit zones, especially political instability and/or war. Emergency reserves and crisis measures, such as those set up by the International Energy Agency (IEA) and by Community

[25] Communication from the Commission of 11.10.2000, The European Union's oil supply

legislation, provide a partial response to this threat. Existing measures should not only be maintained, but might be strengthened further.

The key decisions regarding strategic reserves were taken in 1974 through the Agreement concerning an International Energy Programme, the act founding the International Energy Agency (IEA). This move came in the wake of the oil embargo imposed on a number of industrialised nations by OPEC as a consequence of the political climate in late 1973.

One of the IEA Member States' principal commitments is to maintain reserves of oil and/or petroleum products at a level equivalent to 90 days of *net imports*, for use in case supply should be cut. Most Member States actually maintain their strategic reserves at a somewhat higher level.

The Union has issued three Directives which, together with measures taken by the IEA, govern the organisation of Member States' national reserves :

- Two directives[26] impose an obligation on Member States to maintain stocks equal to 90 days' *consumption* for each of three main categories of petroleum-based energy products. When reserves fall below this level, the Commission must organise consultation with the Member States.[27]

- Under another directive[28] Member States must be ready to act, i.e. they must establish contingency plans, together with appropriate bodies and mandates, in particular for releasing reserves onto the market, limiting consumption, ensuring supply to priority customers and regulating prices. The same Directive stipulates that should a crisis break out, the Commission must organise consultation with the Member States to ensure their actions are co-ordinated through an Oil Supply Group. The Commission must also ensure that the different national systems do not give rise to distortions of competition or obstacles to intra-Community trade.

These mechanisms are in no way intended to deal with circumstances such as the present rise in the price of oil. As a result, Community legislation on strategic reserves can have only a limited impact on concerns about energy supply.

The impact of the United States' decision to release 30 million barrels from its crude oil reserves in September 2000 only serves to illustrate the fact that the mechanisms which exist at the international level to deal with crises are severely limited - especially since such crises often have more to do with market economics than with physical disruption of supply. No one denies the importance of co-ordination between those countries which are net consumers of oil. However, the experience of negotiations within the IEA demonstrates that effective co-ordination and co-operation are extremely difficult to achieve in practice. During the Gulf War, as again today, it has been left to the US Strategic Petroleum Reserve (SPR)[29] to spearhead pro-active intervention in the oil markets.

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26 *Directive 68/414/EEC, amended by Directive 98/93/EC.*

27 It should be noted that presently several Member States have more than 90 days of stocks. This excess can therefore be 'released' without triggering Community consultation.

28 Directive 73/238/EEC.

29 The United States established the Strategic Petroleum Reserve in 1975, after joining the IEA, and two years after the first oil crisis. American law lays down that there should be a strategic reserve equal to 1 billion barrels of oil, for use in case of war or other serious conflict leading to the physical disruption of supply. Presently, there are 571 million barrels in the SPR, representing an investment of USD 20 billion at today's prices. The SPR is located in the Gulf of Mexico (Louisiana and Texas), a region

The Community's own mechanisms are quite inadequate in view of tensions on the market for energy products. For instance, there is no centralised decision-making mechanism through which oil could be released onto the market. If oil prices were to rise to unreasonable levels, the EU would find it had little power to act. In order to reduce the risk of a crisis as a result of their dependence on external energy, a number of Member States have set up independent inventories or strategic reserves for certain energy products. Thus the Netherlands has implemented a policy of responsible use of small-scale natural gas reserves, so as to leave open the possibility of drawing more heavily on the Groningen reserve (estimated at 1 100 bn m^3) as and when necessary.[30] In its recent Communication on the EU's oil supplies, the Commission declared that it intended to look into how it might be possible to increase the quantities held in strategic petroleum reserves by reorganising them on a Community basis.

Conclusion : Given the external risk factors present (whether related to volumes, prices, investment levels, geopolitical factors, etc.), the best guarantee of security of energy supply is clearly to maintain a diversity of energy sources and supplies. Present forecasts suggest that it will be impossible to arrest the Union's growing quantitative dependence. Enlargement will only serve to reduce diversity of external supplies. At the same time, the strong fall in the price of oil products at the beginning of the 1980's and the lacklustre efforts to promote energy savings and renewable energy have meant that the Union dependence has remained at high level. Between 1975 and 1985, the improvement in energy efficiency was 24%, whereas it was 10% between 1985 and 1999. This underlines the importance of acting on the demand side and assuring a secure energy supply at the Community level.

II LESS THAN PERFECT ENERGY OPTIONS

As 2010 approaches, numerous Member States, as well as the applicant countries. will have to make choices regarding energy investment, primarily in the electricity sector. Current channels determine the choice of investment, unless there is a major technological breakthrough that changes the energy landscape. These changes might centre on decentralised production of electricity through mini gas turbines or fuel cells. These options are fundamental because over the next 30 to 50 years they will dictate the structure of energy consumption. They therefore have to be carefully thought through.

At the end of the 1970s, coal and nuclear energy were thought to be the only alternative to oil. The countries participating in the G7 Summit in Tokyo (May 1979) undertook to encourage energy saving and the production of coal and nuclear energy. Similarly, the Council resolution of 1980 set the objective of *"covering 70 to 75% of primary energy needs for the production of electricity by means of solid fuels and nuclear energy"*. With hindsight this outlook is now somewhat dated. The 20th century began with the might of coal, progressed through the predominance of oil and ended with the breakthrough of natural gas.

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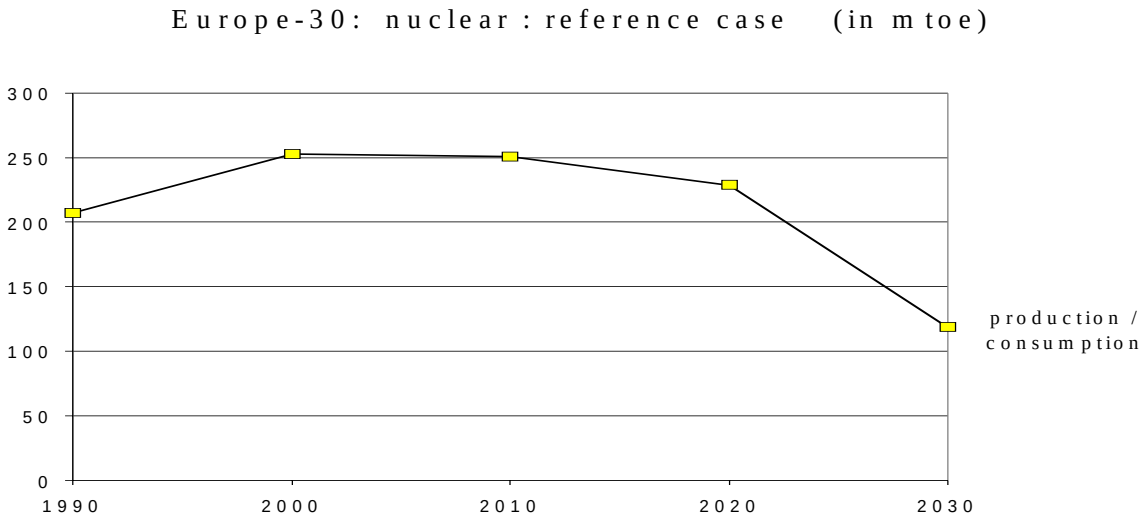
which has more than 500 salt caves, thus providing ideal storage conditions. The reserve was drawn on in 1991 during the Gulf War, and again a second time a few weeks ago, when 30 million barrels were released – barely equivalent to two days' demand.

30 This policy is combined with measures to encourage the exploration of North Sea resources.

A. Nuclear energy and solid fuels: the undesirables

Nuclear energy and solid fuels are the undesirables among energy products although their contribution within the global energy balance, which is restricted almost exclusively to the generation of electricity, is enormous. These two sources of energy account for 35 and 26% respectively of the electricity produced.

1. Nuclear energy: a source of energy in doubt



The hopes generated in the second half of the 20th century by the use of nuclear fission for civil purposes must be seen against the investment in this sector and its achievements in energy and technology terms. Regardless of their natural resources in energy products, all the Member States that had the means embarked on major civil nuclear programmes. Tainted by the original sin of dual usage (civil and military) in the fuel cycle, the development of nuclear fuel centres around the Euratom Treaty, the 1968 Treaty of Non-proliferation (entered into force in 1970) and the rules of the IAEA.

a) Achievements of the Euratom Treaty

The aim of the Euratom Treaty, which was signed in 1957, was to provide the European Community with an alternative source of indigenous energy supply in order to bring a halt to the growing dependence on oil from the Middle East. The Treaty was meant to enable Europe to develop its know-how and obtain the means of exploiting nuclear energy for civilian purposes. Pooling resources (know-how, infrastructure, financing and control) was meant to translate into faster progress at lower cost.

The Euratom Treaty presents a certain originality compared with the EEC Treaty, being organised around specific industrial objectives and using instruments that sometimes departed from the Treaty of Rome.

Even though problems appeared very early in the implementation of the Euratom Treaty, in particular the chapter on supply, these should not hide its achievements.

- The dynamism created by the Euratom Treaty in **research** and technological development is clear for all to see. The Single European Act adopted this precedent of providing a framework

for nuclear research for the whole of the Community's research and technological development programme. Within the framework of Euratom, the integration of all European fusion activities played a key role in giving European research its position of excellence in this domain.[31]

- From the beginning of the Treaty major **investment** was needed to build and maintain new nuclear power stations. The Treaty assigned the Commission the task of examining the investment plans scheduled in the Member States, by virtue of which it has so far passed judgement on 238 investment projects for which it has checked both the merits and compatibility with the Euratom Treaty.

These investments exceed €400 billion, of which the Community budget contributed €2.9 billion. This has contributed to the Community's industrial development, which today has mastery of the entire nuclear fuel cycle, with the exception of waste management.

Nuclear power stations installed on the territory of the Community cover 35% of its electricity needs. By extending the life of nuclear reactors beyond the initial expectations, thanks primarily to better knowledge of the performance of materials, the nuclear energy sector has become competitive and is a source of considerable income for operators. The latter no longer need public aid or Euratom loans[32]. These loans are currently being used by applicant countries to help modernise their installations.

- **Health** and radiation protection standards established at Community level are enshrined in the legislation of each Member State. Over and above the actual activities of the nuclear industry, these standards also concern the use of radioactive materials in medicine, research and industry.

- Euratom **safeguards** give the Community undeniable credibility in terms of the non-proliferation of nuclear materials. The Euratom Supply Agency's target of diversifying supply also means that the Community does not overly depend on a single geographic region for its uranium requirements (see graph above, part 1, I.B.2.b).

Implementation of the main provisions of the Euratom Treaty, therefore, difficult though it was, has been a success overall. In the current circumstances a renewal of interest in the Euratom Treaty and the alternative it offers in the production of electricity have kept it very much to the fore. The expertise acquired will be invaluable, particularly in the process of enlargement.

b) ***Nuclear energy in limbo***

The potential health and environmental hazards from nuclear fission mean that public opinion is to some degree opposed to it. The Three Mile Island accident in the United States gave rise to the Swedish referendum on nuclear energy.

The arrival of pressure groups and ecological parties onto the political stage of the Member States and the Chernobyl accident (26 April 1986), undeniably the most serious accident in

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31 The JET (Joint European Taurus), a European company in the sense of the Euratom Treaty, has been an essential element in the scientific and technical advances in European fusion. Its results have helped the Union to look forward, with its international partners (USA, Japan, Russia), to the possibility of a research project such as the ITER (International Thermonuclear Experimental Reactor).

32 The system of setting ceilings in the amount set for the civil responsibility of operators in the case of a major accident could amount to a state aid.

the history of atomic energy, marked a turning point in the development of Europe's nuclear industry. Five out of the eight Member States with nuclear power have now adopted or announced a moratorium.[33] France, the United Kingdom and Finland have not taken a decision to stop nuclear energy, but, except possibly Finland, there are no new reactors likely to be built in the next few years. Italy renounced nuclear energy following a referendum in 1987, Germany has announced its decision to shut down its last reactors in 2021 and Belgium will do the same in 2025.

Applicant countries, some of which have undertaken to shut down their nuclear reactors that are not particularly safe,[34] take a mixed view of the alternatives to nuclear energy because of the impact on their economies. While Turkey has put off building a nuclear power station indefinitely, Poland would like to keep its options open. It is also possible that some applicant countries might consider the possibility of new power stations. Consequently, the problem of the safety of nuclear installations in applicant countries and the decommissioning of non-upgradable facilities becomes a priority and will be closely monitored before their accession to the European Union.

The Cologne European Council (3-4 June 1999) underlines that "it is important that nuclear safety standards are high in Central and Eastern Europe, which will require a major investment effort. These standards must be set against the standards in force in each of the Member States that have nuclear energy. The Commission is now carrying out the necessary tasks following the demand at the European Council of Helsinki to examine the means of treating the question of nuclear safety in the framework of enlargement. The Commission has joined the Member States' safety authorities in this process in order to prepare a negotiating position.

The future of nuclear energy is uncertain, particularly in Europe. It depends on several factors, including: a solution to the problems of managing and stocking nuclear waste, the economic viability of the new generation of power stations, the safety of reactors in Eastern Europe, in particular applicant countries, and the fight against nuclear proliferation in the CIS. Policies to combat global warming should also play a fundamental role.

Concerns about global warming have changed the perception of energy supply constraints. The question is particularly pertinent for nuclear energy which avoids 312 Mt of emissions of CO_2 per year in the European Union (7% of all the greenhouse gases emitted in the Union), the equivalent of the CO_2 emissions produced by some 75 million cars.[35]

c) Nuclear waste

From the time that nuclear energy started being used it was thought that the period of operating power stations had to be accompanied by a policy on storing, warehousing and treating waste. In most countries in the world this issue focuses on highly radioactive waste, which accounts for 5% of the total volume of nuclear waste and 95% of radioactivity.

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33 Sweden–1980, Spain-1984, Netherlands-1994, Germany-1998, Belgium-1999.

34 Lithuania: Ignalina 1 and 2; Bulgaria: Kozloduy 1 to 4; Slovakia: Bohunice VI

35 For example, the Swedish Government's decision to shut down the nuclear facility in Barsebäck on 30/11/99, after 23 years, creates a production shortfall of 4 billion kWh per year, which has to be made up by electricity imports from coal-fired Danish and German power stations. This leads to an indirect increase in Sweden's CO_2 emissions of around 4 million tonnes per year, i.e. about 8% of total emissions in Sweden.

Definitive storage is feasible and construction and operating techniques are mature enough to be applied. The most advanced countries in this area appear to be the United States, Sweden and Finland. Nonetheless, the practical problems of long term storage remain to be solved.

Estimates of storage costs vary from one country to another, but they form a small part of the total cost of kWh production. On the other hand, the degree of concentration (in a scenario high on nuclear energy usage the area needed for storing all waste is around 300 km^2) would help to circumvent the problem in terms of dispersion, unlike other sources of power generation.

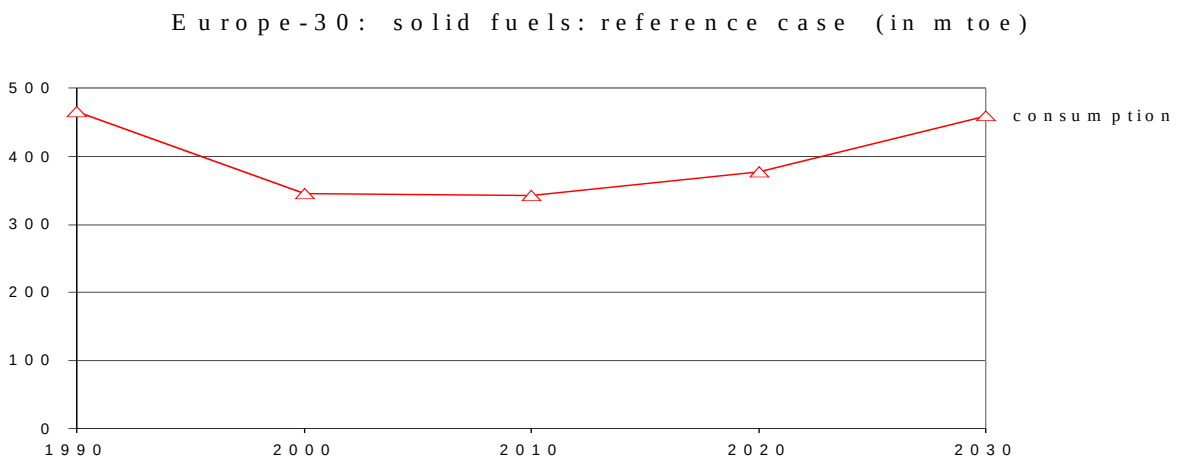
Current research, such as partition-transmutation, sets out to reduce the presence of long-lived elements. Research focussing on waste management has to be continued, but they do not appear to offer an alternative in the short to medium term.

Establishing an integrated programme for waste management needs answers to the public's questions over safety, from the transport of nuclear materials through to storage itself, along with the question of reversibility, to allow future generations to use new, more effective waste treatment techniques as a function of scientific progress should they feel the need. A consensus can only be achieved on this issue by providing the public, and especially its representatives, with clear and accurate information and with credible input on the part of the safety authorities in each Member State. These are the ones who can assure the public that any decisions taken are in the interest of present and future generations.

Nuclear cannot develop without a consensus that gives it a long enough period of stability, bearing in mind the economic and technological constraints of the industry. **This will only be the case when the waste issue finds a satisfactory solution with maximum transparency.** Research in this area should be oriented towards waste management.

The European Union must retain its leading position in the field of civil nuclear technology, in order to retain the necessary expertise and develop more efficient fission reactors and enable fusion to become a reality.

2. Coal: a glorious past



a) Background

Because of their impact on Europe's economies (production of electricity and coal and steel), coal[26] and steel were regarded as the cornerstones of Europe and the basis for European harmony. When the Treaty was signed in Paris in 1951 the reconstruction of Europe required considerable quantities of energy products. Demand far outstripped supply and the fear of shortage dominated policy in this sector. The High Authority of the ECSC thus encouraged greater production through the creation of new mines and the conclusion of long-term supply contracts.

Since the 1960s, however, the coal-mining industry has gone into rapid decline due to competition from coal from outside the Community and the advent of other fuels to produce electricity and heat. Following successive phases of restructuring of the coal industry, therefore, coal production in the European Union of 15 Member States dropped from around 600 million tonnes in the early 1960s to less than 86 million tonnes in 2000. Competition from other energy products, the slackening of the oil constraint as from 1986 and environmental concerns have all highlighted the weaknesses of solid fuels.

b) Constraints

Coal has built-in constraints that put it in a weak position in respect of oil and gas, its direct competitors. Being a solid and heavy ore, it is bulky and requires large storage areas. With a lower calorific value than oil and gas it does not have the ease of use of a liquid or gaseous fuel. It also generates pollution at every stage of the production and utilisation cycle.[36] On the credit side it must be stressed that the transport of coal by sea (90% of coal traded on the world market is transported by sea) does not entail the same environmental hazards as the transport of oil and gas.

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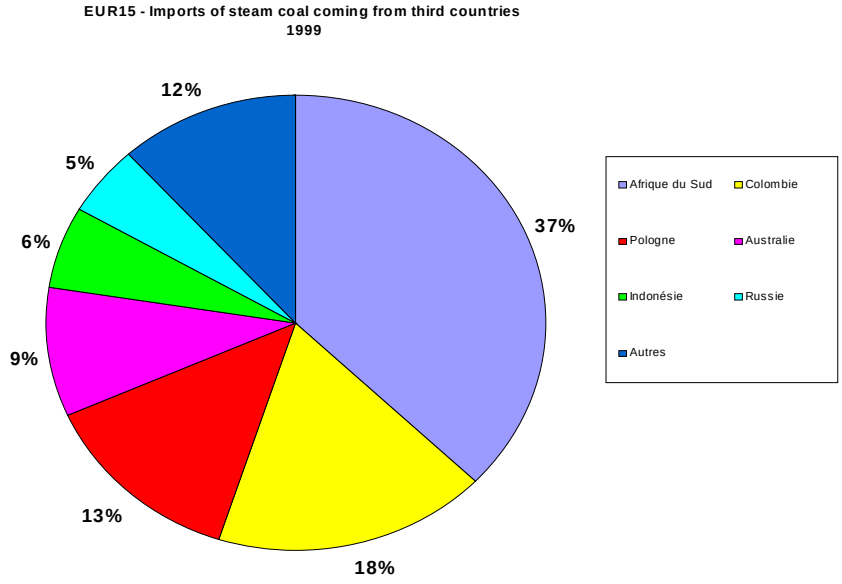
26 The term coal refers to solid fuel in general. For reference, a distinction is made between four families of coal by decreasing order of calorific value: anthracite, pit coal, lignite and peat. Coal, anthracite and lignite briquettes come under the ECSC Treaty whereas lignite and peat are regulated by the EEC Treaty.

27 All handling from extraction to final use generates dust. Storage in the open air can cause pollution through rainwater run-off. Coal combustion leaves ash and causes the emission of gases that are damaging to the quality of air, water and soil (CO_2, NO_x and SO_2).

The physical disadvantages of coal have considerably reduced its markets for expansion. However, where in the power generation sector coal is not a dominant source of energy, as in Denmark, Germany, Greece, Ireland and the United Kingdom (more than 45% of electricity is generated on the basis of coal in these countries), it is often used as a back-up fuel. In 1996, for example, the shortage of hydroelectricity in northern Europe and repairs to French nuclear facilities created an additional demand for coal. Fluctuations in hydroelectricity have a considerable impact on coal consumption, the most susceptible countries to these fluctuations being Austria, Sweden, Portugal, Finland, Italy, France and Spain.

c) Trump cards

Pursuing the coal option in Europe is primarily for regional and social reasons. The cost of imported coal, the diversity of outside suppliers[37] and the relative stability of prices compared with oil and gas are factors which offset the considerable constraints on coal.



Being sold on a competitive international market, the price of imported coal shows unequalled stability compared with other imported energy products. By way of example, steam coal prices varied by USD 16 (between USD 54 and 38/tce) over a period of ten years (1986-96).

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37 In terms of the geographical diversification of coal supply in the European Union, the traditional exporters of coal (Europe, United States, Russia and Ukraine) have been joined by Canada, South Africa and Australia. More recently new exporters have emerged, such as Indonesia, Colombia and Venezuela.

The average price over those ten years was USD 47. During that same period the price of heavy fuel expressed in tonnes coal equivalent varied even more, and more frequently, the price ranging from USD 41.11 to 100.67.

The effects of such a difference in price on the balance of payments should not be underestimated, especially for countries without their own domestic energy products. The Danish coal option over the past twenty years certainly has to be listed among the economic advantages of coal.

The flexibility of coal contracts and the development of a spot market have allowed the price of coal to adjust constantly to the market situation. The lack of any economic and political risk and the opening-up of the market in terms of supply-side players explain the relatively minor, upward and downward price fluctuations of coal compared with oil and even natural gas. Keeping the prices of oil and gas at a high level and having greater recourse to imported coal in Europe could put considerable pressure on prices.

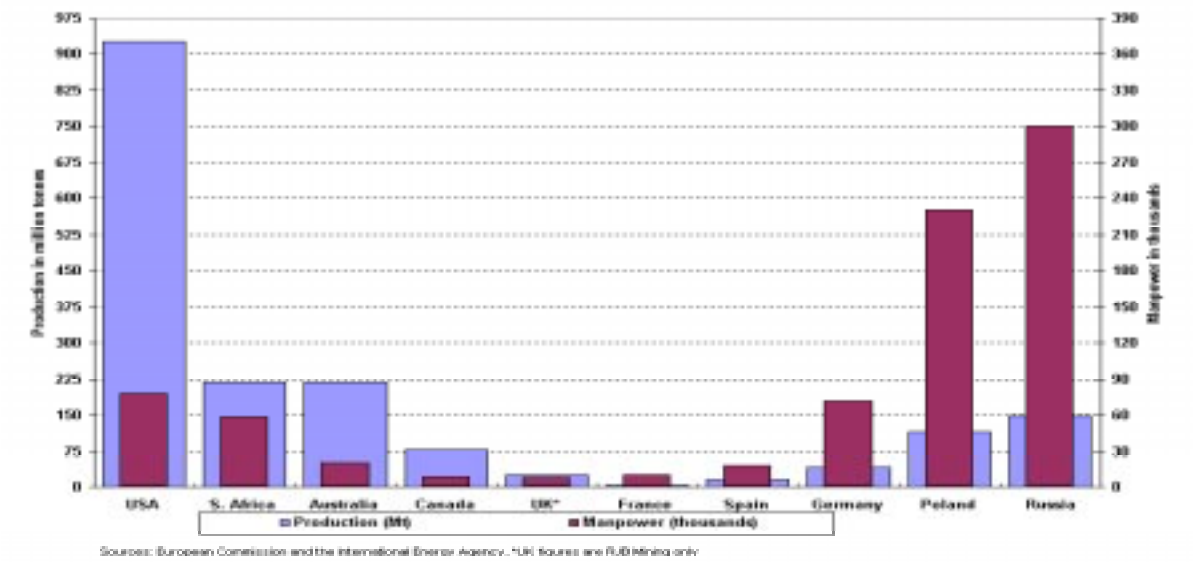
d) The future

The lack of competitiveness of European coal-mining, both now and in the future, has led several Member States to abandon coal. This throws up undeniable political problems in other countries, in particular Germany. The coal compromise concluded in 1997, for example, between the Federal Government, the Länder and the undertakings concerned provides for a reduction in state aid from DM 9.1 billion in 2000 to 5.5 billion in 2005, production being reduced to 21 million metric tonnes and employment to no more than 36 000 miners.

The fact that closure decisions taken or still to be taken by several Member States are unavoidable must also be applied by the same token to applicant countries, particularly Poland.

Being an industry with high labour intensity, it contributed to the full employment economy of post-war coal regions. The policy of sustainable social and regional restructuring pursued by the European Union within the framework established by the ECSC Treaty will have to be adapted to applicant countries producing solid fuels when they join the European Union.

Production and labour costs in the coal industry



The primary objective of the ECSC Treaty signed in Paris in 1951 was to establish a common market in coal and steel and to contribute to economic expansion, growth of employment and a rising standard of living in the Member States. In this context the Community institutions had the task of promoting the most rational operating policy, modernising production and improving quality.

The future of coal in Europe today lies in global terms of security of supply since coal has no prospect of competitiveness either in the European Union or in any of the applicant countries. In the circumstances, we ought to be asking ourselves whether it might not in fact be necessary to maintain a production base which could give access to reserves in the event of a serious crisis while at the same time applying the most advanced technologies. The European Union should look at whether this concept might form part of the framework provided for by the Directive on the liberalisation of the electricity market under security of supply.

It is also in this context that the control of State aid to production after expiry of the ECSC Treaty in 2002 needs to be looked at. One possible solution would be to define a system of control of national aid to the coal industry which meets the need for security of supply by maintaining **minimum access to reserves** and ties in with social and regional perspectives.

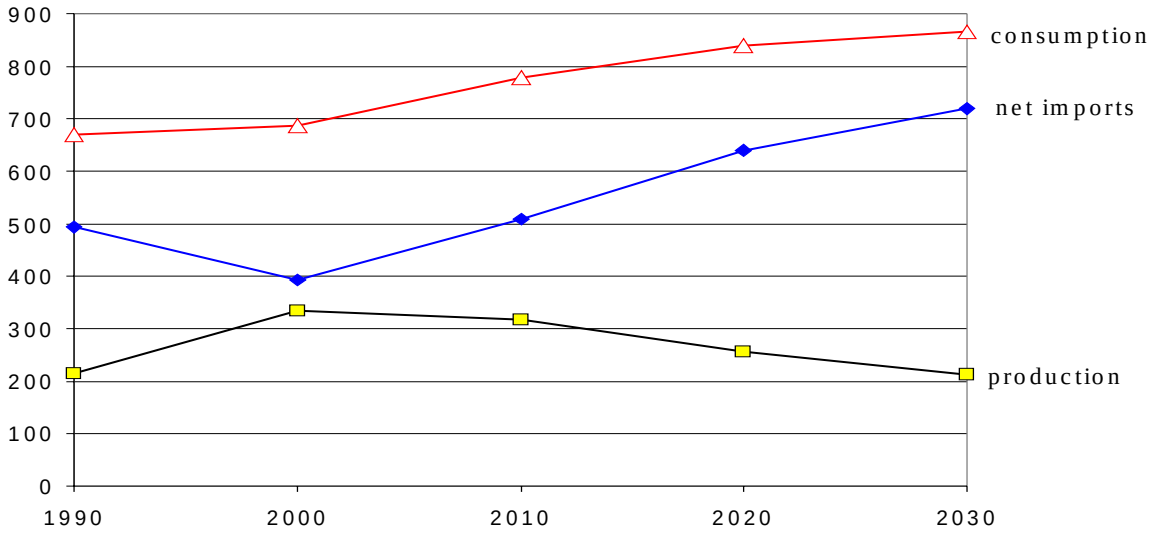
Although in the short to medium term there are no major problems regarding security of supply in solid fuels, coal's future depends largely on the development of techniques which make it easier to use (like gasification) and lessen its environmental impact in terms of pollutant emissions through clean combustion technologies and CO_2 sequestration.

The production of coal on the basis of economic criteria has no prospect either in the European Union or in the applicant countries. Its future can only be maintained within the framework of the European Union's security of supply. The upcoming expiry of the ECSC Treaty will not help to provide a simple answer to this matter

Conclusion: Under the pressure of ecological concerns, solid fuels and nuclear energy have fallen from grace and seem set to play less of a role in the production of electricity. However, given the **present facilities and technologies**, reducing these two sources of energy at the same time could give rise to economic tensions and threaten supply without an active policy of demand management.

B. Oil: still the favourite

Europe-30: oil: reference case (in mtoe)



The advantages of oil in terms of calorific value and ease of use readily explain its rapid breakthrough in the Western economies in the immediate post-war period. Its properties gave rise to road transport 99% dependent on oil. With greater or lesser speed it replaced coal for heating and then for the production of electricity.

Although oil is being phased out of our economies to a certain extent, as a result of the oil crises, it remains an essential economic component in the Member States, primarily in transport. Transport currently accounts for more than half of oil consumption. While the oil market is a high-tension market, whether this be due to producer-consumer dialogue, prices on the international market, quantities available, its impact on the environment or accidents at sea with wide media exposure, it has to be said that it continues to enjoy the favour of public opinion.

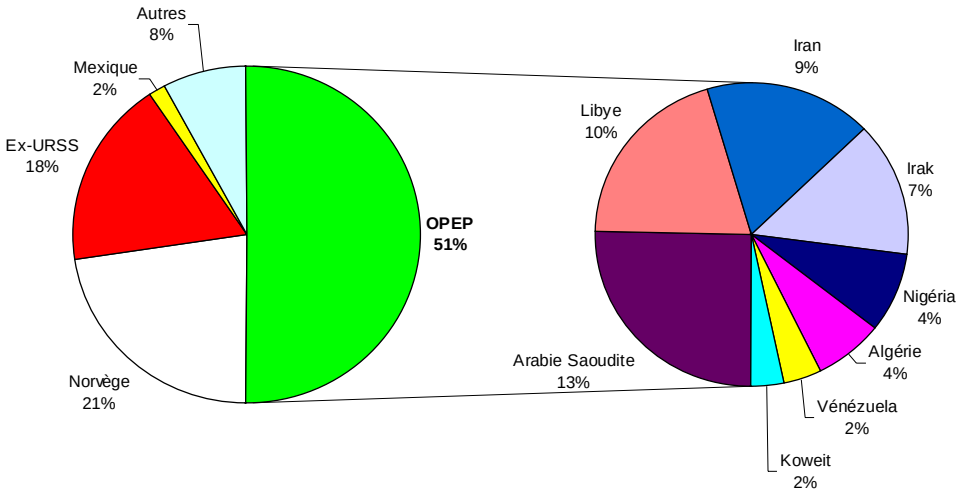
The prospects of the oil market depend on the development of alternative sources of energy and on improvements in energy efficiency for transport. An analysis of current trends would indicate that consumption in Europe will increase appreciably, with a much higher growth rate in applicant countries because of their need to catch up in the passenger and goods

transport sectors. The exhaustion of internal resources will also heighten dependence on outside oil. The development of supply on the international oil market will be a determining factor in this respect.

1. Dependence on oil

More than 70% of the world's oil reserves are located in the member countries of OPEC. In 2020 OPEC will cover 50% of the Union's needs with production of the order of 55 million barrels a day, as against 32 million barrels a day in the year 2000. This willingness on the part of OPEC is reflected by production costs which will remain extremely advantageous even in a scenario of low prices. The average cost of OPEC production is currently around USD 2 a barrel. Significant profit margins will provide an incentive that OPEC will find hard to resist.

Europe-15
1999- Origin of crude oil imports



The volume of non-OPEC production, at an average cost at present of USD 5 a barrel, but with a marginal cost of more than USD 10, will be closely linked to price movements, since reserves will continue to be plentiful. Some oil production areas in Russia and the Caspian Sea basin are extremely important for the European Union in this respect. It is thought that a crude oil price of about USD 20 should make it possible to guarantee the investment in production in non-OPEC regions, which will be needed because of rising demand over the next twenty years.

2. Geopolitics in oil

Recent events on the oil market illustrate that, while OPEC is sometimes described as a weak, heterogeneous “cartel”, centralising forces are prevailing at the moment, even if Saudi Arabia, Venezuela, Iran and Kuwait appear to have had most influence on decisions taken over the last two years. The interests and constraints of the states which make up OPEC are multiple and complex, and to a large extent divergent.

Some member countries are in favour of maximising prices in the short term as they have low reserves, a large capacity for absorbing oil revenue and a high degree of production capacity utilisation (Algeria, Venezuela and Iran). Others, such as Saudi Arabia and other Persian Gulf producers, prefer to vary prices over the longer term, since they have abundant reserves, so as to prevent the emergence of alternative energy sources and at the same time maintain oil's position on the world energy scene in the medium and long-term, together with their market share.

Geopolitical factors have also played a part in these developments. The differences of opinion in OPEC, which were already apparent at the time of the Gulf War, internal tension regarding the oil embargo on Iraq, uncertainty surrounding developments concerning Iran and Libya plus the common position of Arab countries on the Israeli-Palestinian conflict are all factors that affect the smooth functioning of the oil market.

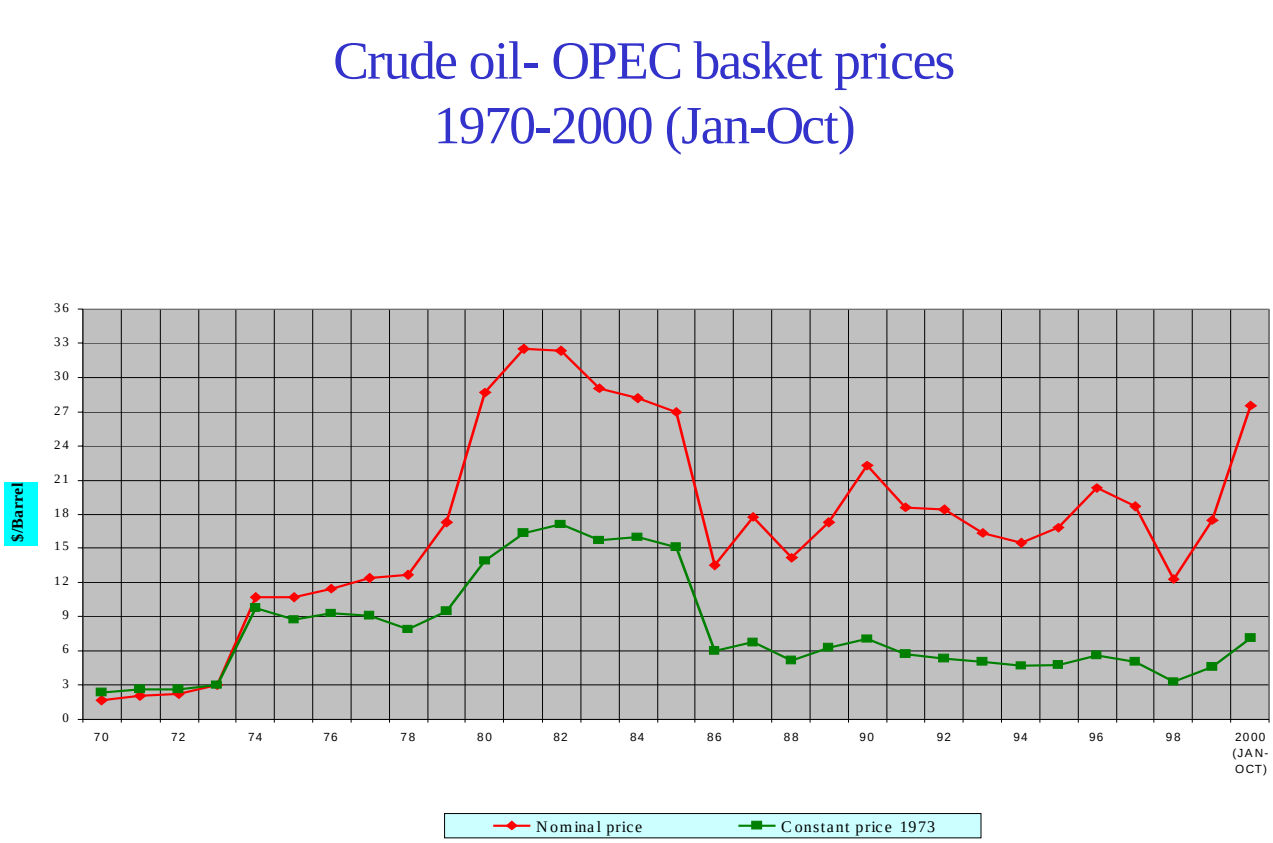
Iraq's role in the years ahead is also a major unknown. In 1999 Iraq managed to increase production to 2.8 million barrels a day and achieve just over USD 5.2 billion in oil exports authorised by the United Nations Security Council Resolutions under the "Food for Oil" programme. If the sanctions were lifted and assistance obtained from foreign investors, production could soon rise to 3 to 4 million barrels a day.

There is no reason to fear a physical shortfall in the foreseeable future, nor is it possible to anticipate OPEC's behaviour as a “cartel” and the political concerns which may occasionally affect its attitude. However, several factors stand out which are likely to have a decisive effect on price levels, namely, the economic growth rates of importing countries, the progress made in curbing demand, the addition of new reserves and the tightening of environmental protection standards.

In the long term, given the concentration of reserves in OPEC countries, it will be technological developments that pose the principal threat to OPEC, namely, new production techniques in difficult areas, using non-conventional oil, and the development of new fuel substitutes and the technologies associated, chiefly in the transport sector.

The **role of the countries of the former Soviet Union** may also prove to be particularly important for the European Union as, in 1989, they were still the world's leading oil producers, with production of more than 11 million barrels a day. Production in this region could double over the next twenty years from 7.8 million barrels a day in 2000 to 14 million in 2020. The known reserves in the **Caspian Sea basin** (25 billion barrels) are roughly the same as in the **North Sea and the USA.** Potential reserves could exceed 200 billion barrels, i.e. 25% of known reserves in the Middle East.

3. Effects of oil prices



While industrialised countries were at breaking point following the two oil crises (1973 and 1979), this is no longer the case today (threefold rise in the price of oil in a year). Energy diversification, the almost general exclusion of oil products from the production of electricity and structural changes in Europe's economy, which has changed from being an industrial society to a services society, have lessened the impact of erratic fluctuations in the price of oil. Thought should be given to methods of payment, in particular the possibility of billing the Union's energy purchases in Euros, thereby reducing the impact of exchange rate fluctuations. Also, the high level of taxation on oil products in Western Europe considerably reduces the impact of price increases on inflation. **For all non-producing developing countries, the cost is still higher and this can prevent them from breaking out of the vicious circle of poverty.**

More particularly, the increase in oil prices affects those populations already on the threshold of poverty and threatens them with even greater levels of economic and social exclusion. The Commission will seek to facilitate exchanges of experience on appropriate practices designed to alleviate the effects of oil price increases on those most in need and to reduce the risks of social exclusion in line with the Lisbon conclusions.

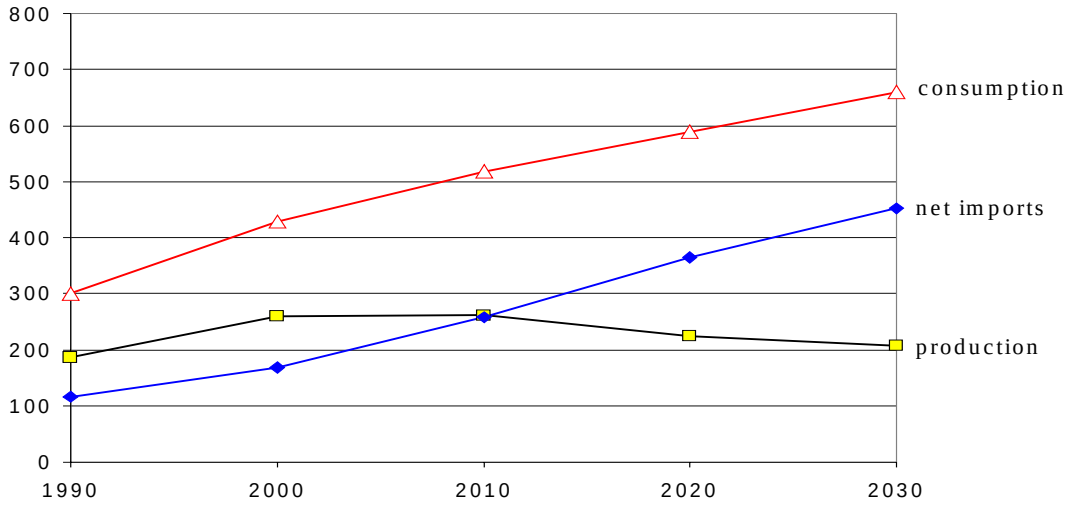
Unless specific measures are taken to disengage the oil sector, especially in transport, oil dependence could reach 90% by 2020. Intensive efforts are needed to replace oil with other alternative sources of energy and to curb consumption, in the road transport sector where oil consumption has risen from 18% in 1973 to 50% in 2000. The current absence of any real oil substitute (biofuels, natural gas), principally in the transport sector, would make any prolonged oil crisis critical.

Europe's economy must learn to live with oil prices above USD 20.

C. Natural gas and renewable energy sources: seductive alternatives

1. Natural gas: towards new dependence

Europe-30: natural gas: reference case (in mtoe)



a) Expansion of natural gas

Natural gas, which was discovered at the beginning of the 1950s, took decades to earn its spurs in the energy sector. Once considered to be a second-rate energy product (by-product of the exploitation of oil), it has now become a multi-faceted source of energy. Easy to use, with its own distribution network, it has since gained a footing in all sectors of energy consumption, be it power (24% of the gas consumed, including combined heat and power), the production of heat or, more recently, transport. Some 70% of natural gas is currently consumed in the industrial sector (26%) and residential sector (30%), but the sector for expansion is in the generation of electricity where it accounts for 15% of production.

Some countries are seeing a rapid rise in the percentage of natural gas used to produce electricity. This will have to increase quickly to provide part replacement of coal in the production of electricity. By the end of the decade, thermal power stations operating on natural gas should account for about two-thirds of the increase in demand (investment in mixed power stations and combined cycle gas turbines). Extrapolating market trends,

expectations in 2020-2030 are that almost half of electricity will be produced by natural gas (40%), i.e. 45% of the natural gas consumed.

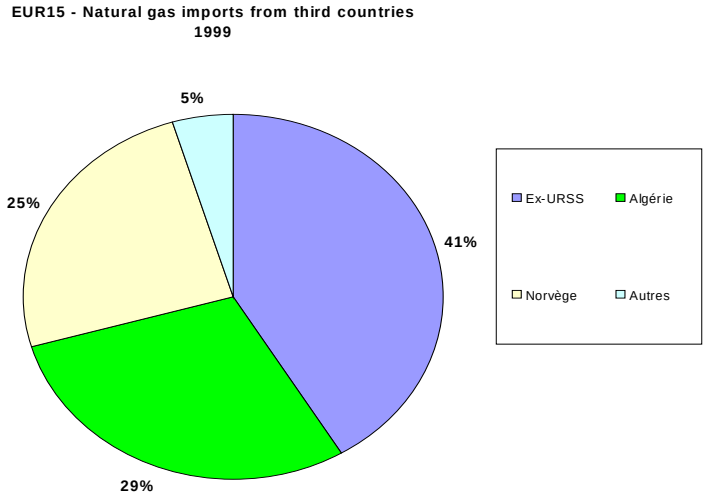
b) International gas market

While natural gas now seems to be a product for energy diversification that is essential to providing a healthy energy consumption balance, its rapid growth on some markets, such as electricity, households and the production of heat, could give rise to a fresh structural weakness in the European Union. By 2010 demand could increase by 85 millions toe to 410 million toe. Among the applicant countries from Eastern Europe the demand for gas could increase by 40% to 80 million toe in 2010.

The natural gas market has little in common with the oil market apart from being indexed on the price of oil. Its frequent geological proximity has placed it right away in the hands of oil companies, which explains the index-linking. The economic reason for this index-linking is due to the competition that gas will provide for oil.[38] While this index-linking was presented at the time that natural gas was making a breakthrough on the markets as a means of gradually introducing this product, this mechanism now no longer has any economic justification and should ultimately be replaced by a price based on supply and demand for gas. This cannot happen until a genuinely integrated internal gas market is established which is not restricted to the liberalisation of national markets.

While there is no danger in the medium term of cartels forming on the international natural gas market among such widely differing producer countries, it has to be observed that the natural gas market is rigid. The combination of price indexing, supplies under long-term "take or pay" contracts and imports into Europe primarily through gas pipelines makes the gas market into an regional market characterised by reduced competition between exporters, of which the principal ones are Russia, Norway and Algeria, and tomorrow no doubt Iran and Turkmenistan. With regard to the major reserves located in Russia (one-third of world reserves), a certain increase in dependence on that country appears inevitable. It should be noted in this connection that the continuity of supplies from the former Soviet Union, and then Russia, over the last 25 years is testimony to an exemplary stability. A long term strategy in the framework of a partnership with Russia would be an important step to the benefit of supply security.

[38] Index-linking is based on a "netback" calculation mechanism from the price of oil products competing on the same markets, which gas companies call the "market volume approach", as passed on to the import price at the frontier.



Major changes on the international gas market have to be expected in the future. Some experts are predicting rises in the price of natural gas of close to 20% by 2010. Under the joint effect of an emerging spot market in the European Union through the completion of the internal market and demand-side pressure compounded in particular by concern for global warming, changes can be expected to pricing rules (i.e. end to index-inking of gas prices on oil prices), either in the standard manner of a competitive market reflecting production costs or through the formation of a "gas cartel". It is difficult to say how likely this is at the current time, which is why any structural trend of excessive price increases has to be prevented and abundant and diverse supplies guaranteed.

c) Transport networks

In the long run the growth in demand and the increase in intra-Community trade produced by the internal market will generate a greater need for transport infrastructure (intra- and trans-European transport networks, port infrastructure for liquefied natural gas (LNG), for which financing still needs to be found. It should be said that the cost of transporting gas differs according to whether it is transported by pipelines or ship (LNG). The transport of gas requires infrastructure that is very difficult to built in both cases. The profitability of these two types of transport depends primarily on distance.

As regards gas supply, the European Union is geographically well placed, thanks to the existence of gas pipelines, in relation to the export centres of Norway, Russia and Algeria. LNG supply completes and diversifies the supply of natural gas from the Middle East, Maghreb and Atlantic countries (Nigeria, Trinidad). In the future the Middle East (Iran and Qatar) and central Asia could become major suppliers of natural gas.

An analysis of the situation regarding the reserves of the Union's current and potential principal suppliers shows a tendential imbalance in supply from Russia which currently accounts for 41% of the European Union's gas imports. This rate of dependence should increase under the effect of enlargement and pressure of consumption to over 60%.

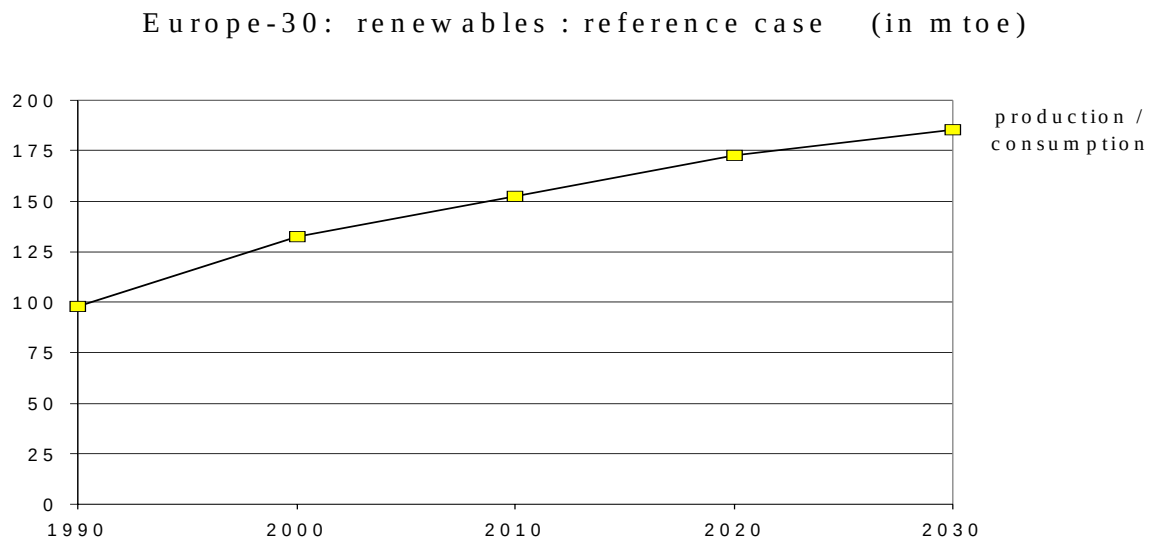
While gas supplies diversity may seem relatively limited both within and outside the Community when considering the number of producing countries, it is worth noting that, in 1996, it took no less than 33 individual gas companies to produce around 94% of total West European production from a very large number of fields. The three largest of these alone produce between 10 and 15%. Moreover, imports of gas from other geographical areas, including LNG imports, are likely to increase in future. This illustrates the potential for supply-side competition within as well as outside the EU.

The construction of new import routes by pipeline or LNG currently being studied (Iran, Qatar[39]) will help to increase the geographical diversification of gas supply and to maintain a buyer's market. That said, the high cost will not go unmarked on the price paid by the consumer or on the increased risk in respect of transit countries.

In the long run, the supply of gas in Europe risks creating a new situation of dependence, all the more so given the less intensive consumption of carbon. Greater consumption of gas could be followed by an upward trend in prices and undermine the European Union's security of supply. As long as the European Union's external supply of gas depends on 41% of imports from Russia and almost 30% from Algeria, geographical diversification of our supplies would appear desirable, particularly in LNG. By comparison, Europe's oil and coal supply is more diversified. The development of a long term energy partnership with key suppliers such as Russia is therefore essential.

[39] Qatar has three times as many known reserves as Algeria and Norway.

2. New and renewable sources of energy: a political priority



Renewable sources of energy have considerable potential[40] for increasing security of supply in Europe. Developing their use, however, will depend on extremely substantial political and economic efforts. These efforts will only succeed if they are accompanied by a real policy of demand geared to rationalising and stabilising energy consumption. In the medium term, renewables are the only source of energy in which the European Union has a certain amount of room for manoeuvre aimed at increasing supply in the current circumstances. We cannot afford to neglect this form of energy.

a) A potential to be exploited

Renewable energy sources (renewables) currently account for almost 6% of Europe's supply, including 2% just for **hydroelectricity**. The target of doubling the share of renewables in the production of electricity, which has been regularly set since 1985, has not been achieved.[41] The Member States have to consider this target as one of theirs and set their national targets in tandem with the Union's. This is still not the case in all Member States and progress needs to be made along these lines.

Between 1985 and 1998 the increase in energy production from renewables was significant in relative terms (+30%), but still fairly insignificant in absolute terms (from 65 to 85 million toe - including hydroelectric power). This small global foothold masks shares that vary appreciably from one country to another. There are four countries that use renewables to a significant extent, Portugal (15.7%), Finland (21.8%), Austria (23.3%) and Sweden (28.5%) drawing on their forestry and water potential.

Renewable energy's share of global consumption is closely linked to consumption trends and energy-saving. The progress made in the renewables sector is offset by the increase in consumption. It has stagnated at around 6% of global consumption despite consistent annual growth in the sector of 3% and spectacular growth of more than 2000% in the **wind energy sector** in ten years. It has to be said that supply-side efforts will only succeed if they are accompanied by policies to rationalise the demand for energy.

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40 See Part I – B.

41 OJ C 241, 25.09.1986.

In the years ahead, renewables' share in energy consumption will have to increase in absolute terms. Their proportion (in relative terms) in the energy balance will depend largely on being connected to the electricity network and being competitive in decentralised production.

The Commission has set the target of doubling the share of renewables in global energy consumption from 6% in 1997 to 12% in 2010. This increase should provide a new incentive for SMEs and will also have beneficial effects on employment and will make for European technologies that can be exported to developing countries.

Member States therefore have to adopt national objectives that are aligned with the proposal for a directive on electricity generated from renewable sources.

b) Differing levels of growth potential

The target of doubling the share of renewables forms part of a strategy of security of supply and sustainable development. It needs a major effort, however. The investment needed to achieve this target has been estimated by the Commission at €165 billion between 1997 and 2010. A particularly big effort will have to be made in the electricity sector to achieve the target set out in the proposal for a directive on electricity produced from renewable sources of 24% of green electricity in 2010 as compared with 12% now.

This target will be all the more difficult to achieve in that for **hydroelectricity**, which accounts for one-third of renewable energy sources at the present time, the possibilities of expansion are practically nil, the development of new useable sites meeting with strong local resistance. Small-scale hydropower is the only sector with any prospect. Consequently, the other forms of renewables (biomass, wind energy, solar power, geothermal) will have to provide almost all the growth needed. What really needs to be achieved is a four-fold increase in proportionate share rather than a doubling.

Biomass, for its part, could significantly reinforce sustainable security of supply. Biomass is a widespread and versatile resource that can be used just as easily for heating as for electricity. Bio-energy sources of supply include agricultural and forest residues and waste streams from new energy crops. The enormous potential of forest and agricultural residues has so far not been exploited.

Despite their high production costs, it is important to ensure the continuing and growing presence of **biofuels and other alternative fuels** in the fuel market. Biofuels can be divided primarily into biodiesels (70 to 80% coming from organic oils and sunflower, etc.) and alcohols coming from beetroot, wheat, sorghum, etc. Numerous production options are available, preference being given to high-yield crops with low intermediate input and no effect on biodiversity. Biodiesel could be used without any major technical problems to replace normal diesel. As for alcohols, these can be mixed with conventional petrol up to a level of around 15% without any technical modifications having to be made to the vehicle fleet.

In terms of environmental impact, biofuels are very attractive, emitting between 40 and 80% less in the way of greenhouse gases than other fossil fuels. They also give off less particulate and carbon monoxide and hydroxide. Biofuels will also help to create jobs in rural areas and thus preserve the rural fabric by providing agriculture with new outlets. In this respect, care needs to be taken to ensure that bio-fuels for not lead to a continuation of highly intensified forms of agricultural production. In the longer term, the possibilities for other renewable sources of fuels, such as hydrogen, need to be exploited.

The proportionate share of biofuels in the European Union is still small, amounting to 0.15%, of the total consumption of mineral oils as fuel in 1998. The principal obstacle to their use is the price differential with fossil fuel which currently varies from 1.5 (biodiesel) to 4 for products before tax. As part of the target of doubling the share of renewable energy sources by 2010, the Commission put the contribution of bioenergy in its 1997 White Paper[42] on renewable sources of energy at 7% of total consumption by 2010. It was stressed, however, that an increase of this kind in the role played by biofuels could only really be achieved if the following conditions were met:

- **Member States should make a firm commitment to achieving the ambitious and realistic objective of the White Paper for 2010, namely, 7% of biofuels and a target of 20% for 2020 for all fuel substitutes;**

- **The gap between the prices of biofuels and competing products should be reduced by measures which, initially, could be of a fiscal nature;**

- **Oil companies should undertake to organise large-scale distribution by way of voluntary agreements rather than Community regulations.**

- **Research in this sector should be intensified**, with a view, notably, to explore new solutions linked to the utilisation of alternative energy sources, such as hydrogen (which, together with methanol, is the fuel used in fuel cells and which can be produced from several sources of primary energy, including renewable sources).

Efforts should also focus on electricity power from **wind** energy, including small-scale **hydropower** projects (under 10 MW), which have so far not been taken into account.

To date renewable sources have been promoted in a number of programmes of varying importance at national and Community level. As indispensable as it is, this approach is not enough and may be backed up by a package of support for research and aid for the investment, operating and use of these energy sources in accordance with Articles 87 and 88 of the Treaty on European Union. In proposing the directive on renewable sources of energy, the Commission has set out the framework within which electricity produced from certain renewable sources of energy, in particular **wind energ**y, could in time become competitive with conventional sources. This approach will be backed (within the limits authorised in the prevailing Community regulatory context) by a new proposal on energy-saving in buildings, which will make for far more decentralised promotion of other sources of energy (solar, biomass) since resources in this area have to be seen at local level.

c) Obstacles to the development of renewables

Regardless of the type of renewable source of energy, it has to be borne in mind that there are first the type of all obstacles of a structural nature to its development. The economic and social system is based on centralised development around conventional sources of energy (coal, oil, natural gas and nuclear) and above all around the generation of electricity.

However the most important problem is financial. We have to be aware that some renewables need significant initial investment, as was the case for that matter with other energy sources, such as coal, oil and nuclear energy**. One possible way of financing renewables could be to subject the most profitable sources of energy - nuclear, oil and gas - to a contribution**

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42 Document COM(97) 599 of 26 November 1997

towards the development of renewable energy sources. An example of this might be a parafiscal tax to finance a regional or national fund for the necessary start-up investment. Also, before they can achieve a profitability threshold, several renewable sources may need aid for relatively long periods. This type of aid has already been put in place in some Member States, either through fixed prices for renewable energy sources, or through the obligation to purchase green certificates, or else through invitations to tender for a certain capacity.

Finally, and this is a problem to be solved under the umbrella of subsidiarity, national, regional and local regulations need to be adapted for land planning and use so as to give clear priority to the installation of generation plants for electricity from renewable energy sources. It is somewhat paradoxical that, when nuclear first began to be developed, the public was not able to oppose the installation of a nuclear reactor but that it can now obstruct the development of installations for renewables. It also has to be stressed that administrative and environmental obstacles are now much bigger than when conventional sources of energy were being developed and these are reflected by additional investment costs.

Several trends are emerging in different areas. Whereas renewables were associated in the past with a decentralised form of energy of limited production, wind parks, some offshore, are now being developed. This helps to integrate renewables into centralised production and consumption on a large scale.

Short of a technological breakthrough the position of renewable energy sources on the market could be improved by high oil prices or through inclusion of the "price of emission certificates" in the investment cost of conventional sources of energy.

However, the renewable energy market in the European Union cannot be expected to develop regularly without a voluntarist policy in the medium term on the part of the public authorities. This policy could fall within a raft of decisions stretching from drastic fiscal measures in favour of renewable energy sources or the obligation on the part of electricity producers and distributors to purchase a minimum percentage of electricity produced from renewable sources of energy through to aid to research or to financing mechanisms (interest subsidies, guarantee funds, parafiscal tax on other sources of energy). Certain renewables should benefit from aid in the framework of Community competition rules, in order to help them to reach comparable markets to those for conventional fuels.

For renewable sources of energy to take off (wind energy, in particular) financial or fiscal incentives are needed. The target of 20% substitute fuels by 2020 will probably remain a dead letter, without favourable fiscal measures, regulations for their distribution by oil companies and voluntary agreements with industry. It is unfortunate that at Community level there is no harmonisation on taxation in favour of biofuels, particularly as the Commission put forward a proposal to that effect in 1992 and, on the contrary, efforts made along these lines within certain programmes have been called into question for legal reasons.

Conclusion: No one sector can meet the energy requirements of the present or an enlarged European Union. Relations between the various energy sources are changing radically: diverging specialisation between oil and coal and complementarity between coal and nuclear energy, for example. Gas is in competition with all energy products on all markets.

The pressure on global demand for natural gas, the export capacities of producer countries (Algeria, Russia, Norway, Netherlands) as well as new producers (such as countries in the Middle East), the gradual exhaustion of hydrocarbon reserves, the relative upward trend in prices, the difficulties encountered in implementing nuclear programmes, and the environmental challenge of using coal are all factors that influence the European Union's conditions of supply.

Current energy demand is covered by 41% oil, 22% gas, 16% coal (hard coal, lignite and peat), 15% nuclear and 6% renewables. If nothing is done, the total energy picture in 2030 will continue to be dominated by fossil fuels: 38% oil, 29% gas, 19% solid fuels, and 8% renewables and barely 6% nuclear.

The European Union lacks the necessary powers to act on supply conditions to ensure the best possible management of security of supply. Although room for manoeuvre is limited, two avenues can be explored.

First of all, if only because it is an attractive market, the European Union can negotiate a strategic partnership with its supplier countries in order to improve security of supply. It has begun to do this with the Russian Federation by offering it aid to improve its transport networks and develop new technologies within a political framework that could stabilise supply and guarantee investment.

Secondly, the European Union must focus particular attention on generating financial aid for renewable sources of energy which, in the very long term, are the most promising in terms of diversification of supplies.

Nonetheless, the European Union will only reduce its external energy dependence through a determined policy of demand management.

This policy of demand management is all the more necessary in that it is the only way of meeting the challenge of climate change.

PART TWO: A NEW REFERENCE FRAMEWORK FOR ENERGY

Any consideration of the future of Europe's energy supply, especially options for diversification, has to include two new factors that have recently emerged. The first is climate change. Whatever the scale of this phenomenon, it is a fact and it poses a threat to harmonious world development. It has to be said that, even though the European Union has subscribed to the Kyoto commitments, it has not yet given itself effective means of combating the effects of imate change. A proactive policy in favour of sustainable development (Article 6 of the EU Treaty) would simultaneously reinforce security of supply and action to tackle climate change.

The second factor is the establishment of a progressively integrated energy market. It is in the light of this that measures have to be adopted to offset the challenge of climate change at European level. By establishing this energy market, national options or company strategies will have an effect that goes beyond the national level.

I. THE CHALLENGE OF CLIMATE CHANGE

Today, security of supply on Europe's energy market must take account of the imperative to combat climate change and pursue sustainable development (Articles 2 and 6 of the Treaty). The European Union will not be able to meet the commitments given at Kyoto unless significant measures are taken to reduce demand. The measures will have to be in tune with the concern to reduce dependence on imported energy supplies.

Taxation, state aid and demand policy are ill-suited to providing answers to these questions.

A. New issues

In recent years; the statistical and scientific evidence has shown that the climate is being disrupted by the build-up of greenhouse gases as a result of our pattern of development.

1. Combating climate change: an urgent need

According to the Intergovernmental Panel on Climate Change, since 1990 global warming has been speeding up. The earth has warmed up by an average of 0.3 to 0.6°C. As a result, the oceans have risen by between 10 and 25 cm. In the space of half a century the ice cap has become an average of 40% thinner. The successive temperature records provide firm evidence that global warming has intensified over the last 25 years.

<u>The causes: anthropogenic emissions</u>

Global warming is the result of intensification of a natural phenomenon essential to the survival of the planet: the greenhouse effect. Greenhouse gases retain some of the heat from the sun as it is reflected back off the earth, thereby keeping the average ground temperature at 15°C, instead of the -18°C which would prevail without them.

Since the first industrial revolution, however, the concentration of greenhouse gases[43] in the atmosphere has increased substantially while the natural capacity to absorb them has been declining. The concentration of CO_2 - the gas primarily responsible for the greenhouse effect - has risen by 30% since 1750.[44]

Some 94% of man-made CO_2 emissions in Europe are attributable to the energy sector as a whole.

Fossil fuels are the prime culprits. In absolute terms, oil consumption on its own accounts for 50% of CO_2 emissions in the European Union, natural gas for 22% and coal for 28%. In terms of consumer sectors, electricity generation and steam raising are responsible for 37% of CO_2 emissions, transport for 28%, households for 14%, industry for 16% and the services sector for 5%. Some 90% of the projected growth in CO_2 emissions will be from the transport sector. By way of illustration, **every year an average car pumps out four times its own mass in CO_2.** In other sectors the figures are probably lower than in 1990.

The dependence of the transport sector on fossil energy - and the fact that roads bear the most responsibility for the growth in mobility demand - results in emissions of greenhouse gases which are a by-product of burning fossil fuels. During the last decade, these gases, and in particular CO2, were recognised as a serious threat for future generations. They produce a warming of the atmosphere which translates into an increasingly serious climate change. Even if the impact of the EU, with 14% of the world CO2 emissions, remains limited, the EU has to set an example in this field by implementing a strong policy aimed at significantly reducing the production of these gases. Assuming its global responsibility, the EU committed itself in Kyoto to reducing between now and 2008-2012, its greenhouse gas emissions by 8% compared to 1990.

The energy consumption of transport represented in 1998 28% of the CO2 emissions, the principal greenhouse gas. According to the last estimates, if nothing is undertaken to reverse the growth trend, CO2 emissions due to transport would increase by approximately 50% between 1990 and 2010 reaching 1113 million tonnes of emissions, compared with 739 million in 1990. Once again, road transport is the principal cause as it alone accounts for 84% of CO2 emissions ascribable to transport. Air transport represents 13%. It is well known that the combustion engine is lagging behind in terms of energy efficiency, in particular because only a part of the fuel used serves to drive the vehicle[45].

Reducing oil dependence - and improving energy efficiency in transport - constitutes an environmental necessity and a technological challenge. In this context, the Community wishes to put emphasis on a series of measures with a view, notably, to reducing emissions of CO2 from private and business cars and their fuel consumption.

b. <u>The consequences: a succession of natural disasters</u>

Although scientists agree on the cause of this speeding-up of global warming, the scale of the phenomenon and the severity of the consequences are still being debated.

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43 Six greenhouse gases are generated by human activity: carbon dioxide (CO_2) which is the biggest contributor (80%), nitrous oxide (N_20), methane (CH_4), hydrofluorocarbons (HFCs), perfluorocarbons (PFC) and sulphur hexafluoride (SF_6).

44 Intergovernment Panel on Climate Change, 1995.

45 A study by the French transport Ministry shows that the energy efficiency of a private car (in km per kilo of oil equivalent) is half that of the underground train. The efficiency of a thermal car motor is in the order of 17% ("Pour la Science", Jan 1998).

Raging fires, torrential rain, long heatwaves and thinning of the ice cap are all cited as consequences of the build-up of greenhouse gases. According to the Intergovernmental Panel on Climate Change, although these phenomena are not particularly surprising in themselves, the growing numbers and frequency of such events are giving cause for concern.

The worst is yet to come but remains unknown. The Panel estimates that if nothing is done the average temperature on earth could rise by a further 1 to 3.5°C by 2100. This would raise sea levels by between 15 and 95 cm. Coastal areas, but also entire islands and archipelagos, could be wiped off the map as the ice melts and oceans swell. The consequences could be catastrophic since they combine with other aggravating factors linked to economic activities as a whole and land use. Droughts and floods alike are expected to be more severe and more frequent, shaking the foundations of agriculture.

2. A major challenge: meeting international commitments

To stabilise the CO_2 concentration at the current level, emissions would have to be cut by 50 to 70% immediately. Simply to soften the expected impact, action would have to be taken immediately. For example, to keep the temperature increase by 2050 down to around 1.5°C and to contain the rise in sea levels to 2 cm every ten years, estimates suggest that the industrialised countries would have to cut their emissions by at least 35% between 1990 and 2010.[46] **If it is impossible to stop the phenomenon, it must be slowed down. The longer we wait, the more drastic the measures taken will have to be.**

Although transport accounts for only 28% of total CO_2 emissions, it will be the main reason for the European Union failing to meet the commitments given at Kyoto unless radical changes are made rapidly.

In particular, 90% of the expected increase in CO_2 between 1990 and 2010 will be attributable to the transport sector. Road transport is particularly to blame, since it generates 85% of CO_2 emissions from the transport sector. The fact that an average lorry generates six times more CO_2 per tonne/km than a train puts into perspective the full significance of Community action to rebalance the modal split.

This is why it is time to be blunt about the position of road transport for goods haulage and the position of private cars in cities.

The Commission's forthcoming White Paper on the future development of the common transport policy will stress the urgent need for specific measures in this field.

a. The Kyoto commitments: a historic turning point

The campaign against climate change led to agreement on a package of objectives at the Earth Summit held in Rio in 1992 under the auspices of the United Nations. The resultant Convention was followed by a Protocol signed in Kyoto in 1997 containing more detailed commitments which, once ratified, will be more binding on the industrialised countries.

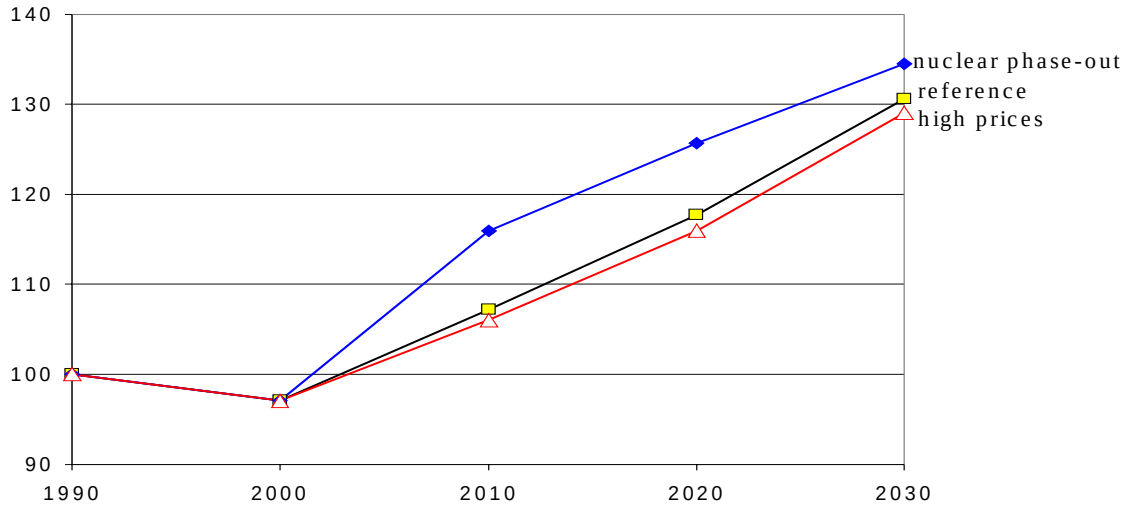
The European Union has given an initial commitment to stabilise its CO_2 emissions at 1990 levels in 2000 and then to reduce its overall greenhouse gas emissions over the period from 2008 to 2012 by 8% compared with 1990 levels, equivalent to a 346 million tonne reduction in CO_2. Under a burden-sharing agreement concluded within the European Union, Germany is

[46] "Environment at the turn of the century", European Environment Agency, 1999.

committed to a 21% cut and the United Kingdom to 12.5%, while France and Finland must stabilise their emissions.

b. A difficult commitment to fulfil

Europe-30: energy related CO2 emissions (1990=100)



At the meeting held in The Hague in November 2000, the discussions on how to apply the provisions in the Kyoto Protocol on reducing greenhouse gases was postponed until Spring 2000. Before the agreement can enter into force, it must be ratified by 2002 by at least 55 countries accounting for 55% of total emissions from the industrialised countries. The European Union is doing all it can to ensure that the Kyoto Protocol enters into force in 2002.

Since 1990 greenhouse gas emissions have continued to rise relentlessly in most industrialised countries. Europe has succeeded in stabilising its CO_2 emissions in 2000 at the 1990 level. However, this has been due largely to cyclical factors such as the economic slowdown in the wake of the 1991 Gulf crisis, combined with industrial restructuring in the United Kingdom and the new German Länder.

According to the European Environment Agency's projections,[47] total emissions of greenhouse gases by the Union of 15 Member States are expected to increase by at least 5.2% between 1990 and 2010, if no action is taken. The applicant countries in turn have appreciable room for manoeuvre compared with 1990 as a result of the economic recession which followed the collapse of the iron curtain.

Total emissions by the applicant countries are set to decline by 11% but must be expected to catch up rapidly as a result of strong economic growth in the future (around 4% per year on average). During the transition period emission permits might be exchanged between the Member States and the applicant countries.

Europe contributes only 14% to total annual world-wide CO_2 emissions, far behind Asia (25%) and North America (29%). The Kyoto Protocol can only be a first step towards

47 "Environment at the turn of the century", European Environment Agency, 1999.

reducing greenhouse gas emissions. Greater long term objectives are necessary and will contribute towards the future energy policy framework and sustainable development in the European Union. It is therefore up to the European Union to devise the whole gamut of technologies for the saving of energy and renewable energy as well as more generally a sustainable model of energy use and production.

An ambitious policy to tackle climate change should not endanger economic development. Such a policy should serve to promote innovation and structural changes and lead to more efficient production systems and improved European competitivity.

The decisive moves on climate change will be made above all outside Europe. It is therefore up to the European Union to devise appropriate technical solutions[48] and to invent a new exportable development model which allows for the application of flexible mechanisms, such as a clean development model.

The priority objectives of the political measures must be to reduce consumption and to increase the share taken by less carbon-intensive energy products, particularly in road transport and buildings. In this context developing countries should be encouraged to their energy policies to less carbon-intensive energy products, especially new and renewable forms of energy. The Union could back up the domestic efforts of non-EU countries, with priority for countries experiencing rapid economic growth (Latin America in particular), by a policy of investment in clean, advanced technologies. Action to tackle climate change reinforces security of energy supply.

Conclusion: Compliance with the Kyoto commitments and control of greenhouse gas emissions in general are essentially a matter of energy and transport policy. Without drastic measures in both these sectors, climate change can only be effectively countered if the European Union makes a firm commitment, as this Green Paper recommends, to undertake concrete measures (notably fiscal and regulatory) geared to energy-saving and the promotion of renewable energy sources (in buildings, for example). These measures are all the more necessary in that the new energy market in Europe is rather demand-driven.

B. Inappropriate answers

The challenge of climate change has not been backed by a reform of taxation and State aid for energy products to meet the new trends. Nor has it been translated into ambitious plans for demand, particularly energy-saving.

1. Fiscal disorder

Energy products make up most of the tax revenue in the Member States. Although these products are heavily taxed the tax itself various from product to product and from Member State to Member State.

Despite major disparities between the Member States, taxation, particularly in terms of "excise duty", can be an effective tool in energy policy. The aims of this kind of policy, like the internalisation of costs linked to degradation of the environment or application of the polluter pays principle, can be effectively attained by tax incentives. Given the rigidity of

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[48] Technological hopes exist but are difficult and costly to implement, such as underground burial of CO_2, the development of new energy-generating technologies producing no carbon dioxide, or production of carbon sinks by means of reforestation or development of marine plankton, etc.

demand compared with prices, the level of taxation has to be high enough for a coherent price signal to be given over long periods and for the fiscal measure to be accompanied by simple methods of implementation, possibly progressive, accessible to all parties concerned and inexpensive at administrative level.

A more harmonised Community framework of taxation on energy products is needed to prevent distortion of competition.

a. Fiscal disparities

- *General trends*

Since 1980, tax revenue from duty on energy and transport has increased slightly from 5.7% to 6.5% of the total tax revenue and social security contributions (between 1980 and 1997). This trend is in line with the "green tax reforms" introducing new taxes reducing the levies applicable to employment.

There are major disparities between the Member States. The causes of the different levels of taxation are very complex. They point to tax approaches accentuating either a main objective of generating budget revenue, economic policies to develop sectoral competitive advantages or even environmental, social and regional considerations.

There is nonetheless one constant: most of the revenue drawn from energy taxation is from mineral oils. Accordingly, tax accounts on average for 69% of the price of diesel and 75% of the price of petrol.

Revenue from energy and transport taxes as a percentage of total tax revenue and social security contributions (1997)

	Energy	Transport	Total taxes for energy production
Belgium	3.5	1,9	5,4
Denmark	4.5	4,3	8,8
Germany	4.4	1.0	5.4
Greece	8.1	1.1	9.2
Spain	5.3	0.6	5.9
France	4.3	0.5	4.8
Ireland	4.9	3.9	8.8
Italy	7.2	1.1	8.3
Luxembourg	7.2	0.3	7.5
Netherlands	4.4	3.3	7.7
Austria	3.7	1.5	5.2
Portugal	7.2	2.5	9.7
Finland	4.8	2.2	7.0
Sweden	5.2	0.7	5.9
RU	6.3	1.6	7.9
EU 15	**5.2**	**1.3**	**6.5**

- *The principles of taxation on energy products: the source of fiscal disparities*

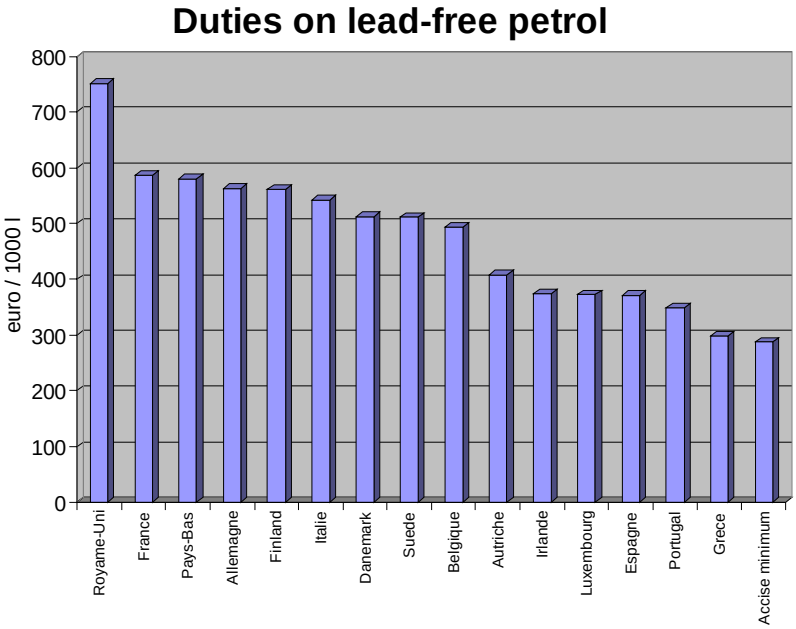
The end price of energy products comprises three types of tax: VAT (*value added* duty proportional to the selling price of the product), excise duties (specific duties proportional to the physical quantity of the product) and dedicated taxes and duties.

Excise duty on mineral oils and VAT are covered by a Community system of taxation. However, there is no Community framework for other energy products or other taxes.

- *Excise duty*

The approach taken to determine excise duty rates differs from one Member State to another. Their nature also varies considerably. Some Member States (Denmark, Finland, the Netherlands and Sweden) have CO_2 taxes, others do not. Some impose taxes on nuclear energy (Sweden) or to support national industries (coal in Spain).

As regards excise duty on mineral oils, the Member States decided unanimously in 1992 to introduce a minimum Community rate as a function of the use of each mineral oil (fuel, industrial and commercial use, heating). In practice excise duty often exceeds the minimum rates, which have not been adjusted since 1992. Rates differ enormously from one Member State to another.



Also, several special arrangements allow Member States to waive or reduce excise duty on oil products. Several exemptions or reductions are expressly provided for by Community legislation. A good example is the total exemption from excise duty on fuel used for commercial air services and commercial navigation in Community waters.

Community legislation also allows Member States to ask the European Commission for exemptions or reductions other than those expressly provided for by Community legislation.

- *VAT*

In terms of VAT the 6th Directive provides that all energy products except natural gas should be subject to a standard minimum rate of 15%. Only gas and electricity can qualify for a reduced rate. Reduced rates on other products, which existed in 1991 can nonetheless be maintained in the form of transitional measures. The real situation is therefore very complex, as is borne out by VAT on electricity, which varies between 5% in Denmark and 25% in Sweden.

VAT rates in the Member States - 2000
(products and services as %)

Country	VAT - standard rate	Passenger transport	Natural gas	Electricity
Austria	20	10	20	20
Belgium	21	6	21	21
Denmark	25	exempt	25	25
Finland	25	8	25	25
France	19.6	5.5	19.6	19.6
Germany	16	16 - 7	16	16
Greece	18	8	8	8
Ireland:	21	exempt	12,5	12,5
Italy	20	10	10	10
Luxembourg	15	3 - 0	6	6
Netherlands	17.5	6	17.5	17.5
Portugal	17	5	17	5
Spain	16	16-7	16	16
Sweden	25	12	25	25
UK	17.5	0	5	5

- Other tax revenue

For other taxes and duties on energy the Member States have developed numerous tools, which differ in area of application, methods of calculation and rates, to the detriment of the unity of the internal market.

The level of taxation applied to energy products differs appreciably from one Member State to another, oil products being a point in question. Excise duty on diesel varies from € 245 per 1000 litres in Portugal to €777 per 1000 litres in the United Kingdom, the Community minimum being €245. It can therefore be said that the total tax burden for fuel amounts to 50 to 60% in countries with lower taxes (Greece, Luxembourg, Portugal and Spain) while it is as high as 75% in the United Kingdom.

As regards the **applicant countries**, all have introduced excise duty on petrol (leaded and unleaded) and on diesel. Rates in these countries are generally lower than in the Member States. Duty on other motor fuels (LPG and kerosene) and heavy and light fuels has been introduced in a few of these countries. Applicant countries have to increase the rates or

introduce excise duty on accession, even though that may cause a certain amount of economic and social tension.

Apart from Lithuania, which applies an *value added* tax on electricity, Central and Eastern European countries have not introduced taxes on natural gas, electricity or coal.

Excise duty rates in applicant countries (beginning of 2000)

	Leaded petrol	Unleaded petrol	Diesel	Light petroleum	Heavy petroleum
	EUR/ 1000 l	EUR/ 1000 l	EUR/ 1000 l	EUR/ 1000 l	EUR/ton
Bulgaria	206	188	47	6.3	11.3
Czech Republic	294	294	221	221*	0
Estonia	192	192	127	14	0
Hungary	0	343	296	296**	0
Latvia	224	190	178	18	3.2
Lithuania	0	208	111	0	4.7
Poland	288	266	196	24	24.1
Romania	232	225	116	0	0
Slovakia	0	223	173	0	0
Slovenia (incl.CO_2 tax)	384	324	330	25.8 (66.2)	15.5 (63.6)
Minimum EU rate	**337**	**287**	**245**	**18**	**13**

2. Incompatibility of taxation with the needs of society

- The tax hierarchy

The principle of fiscal neutrality avoids distortion in the choice of factors of production and in consumer choice. The latter point is of particular relevance to the energy sector.

Taxes on energy products in the Member States often follow the same hierarchy between products. Coal and natural gas are the least taxed and oil the most heavily taxed. Taxes are spent on renewable sources and coal benefits from State aid in the coal-producing countries.

Coal is relatively lightly taxed, except in the northern EU States. The tax rates vary from zero (in ten Member States) to as much as 60% for industrial uses[49] in Finland. Although it is

[49] The figures available are not very detailed.

perfectly logical to relieve coal of any tax burden while it is receiving substantial state aid, the result is to promote imported coal to the detriment of alternative but more heavily taxed energy sources such as natural gas and oil.

Natural gas is generally more heavily taxed than coal, but apart from in Denmark, Austria, Italy and Sweden, the rates are still low. They range from 5% (VAT) in the United Kingdom to around 50% for domestic users in Italy and Denmark. For industrial uses and for electricity generation the range is from zero to 15%.[50]

Renewable energy sources currently benefit from tax exemptions or reductions, but not equally across the Member States. The lack of harmonisation in the European Union sends an inconsistent message conflicting with the security of supply objectives. Some renewable energy sources should be given favourable tax treatment. Some energy production from renewable sources is already exempt from all taxes, such as solar heat and power for domestic use. Another segment, including wind power, hydroelectricity, electricity from biomass and biofuels, is sold on the market and can be taxed. In the case of biofuels, for example, excise duties are applied to a selling price which is already three times higher than the cost of European fuels, inevitably dooming biofuels to marginalisation on the market. However, the current Community legislation allows no exemption for biofuels, apart from in pilot projects.

It should nonetheless be noted that measures have already been taken to promote renewable energy sources. Measures in favour of fuel substitutes, for example, have been adopted to help natural gas and LPG to gain a foothold. In the longer term, the proposal for a directive on energy products will allow tax exemptions for hydrogen and biofuels.

- *Effect of fiscal disparities*

An example will illustrate the inconsistency in the transport and energy taxes. On the same 600 km route between a capital city and a regional centre, airlines compete against high-speed trains, with all the congestion problems which this can cause, particularly on the routes out of the capital. Aviation spirit used by the aeroplane is exempt of all taxes, whereas the railway travellers, through their ticket, have to pay VAT on electricity and, in some cases, duties.

- Fiscal disparities lead to paradoxes in the choice of energy sources[51].

For **electricity generation,** taxes and excise duties seem to have a neutral effect on consumer choice. In the Netherlands, for example, coal is heavily taxed, which favours production from other sources and electricity imports from Germany, produced from solid fuels. Similarly, the green ticket in the United Kingdom boosted exports of electricity from nuclear power stations in France.

Some studies show that the taxes currently applied in the Member States do not always act as an incentive for consumers because they are too low.

In the case of **heat generation for industrial uses**, once again the tax burden is neutral as regards the choice of fuel, except in Greece, where it tips the balance in favour of solid fuels.

For **domestic heating,** natural gas holds such a disproportionate competitive advantage that consumer choice is not steered by taxation, except in Spain and Ireland.

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50 The figures the Commission has are not very clear.

51 See tax study in Annex 2

As regards **private cars,** diesel vehicles offer tax advantages in Belgium, France, Germany, the Netherlands and Sweden[52]. Given the rigidity of demand in both the short and medium term, excise duties on fuels are not yet at a sufficient level relative to prices to steer consumer choice. Although they have only a marginal effect on decisions, other forms of taxation such as vehicle registration tax and road tax should be taken into account.

- Lack of harmonisation in energy taxation can lead to **distortion of competition between Member States**

The very different rates of excise duty in the Member States on fuel, especially diesel for utility vehicles, are a classic example. Frontier trade in these products is greatly affected by the different rates of tax. Similarly, increases in fuel prices, even when made in a general context of energy tax stability, have resulted in disorganised reactions among the Member States, often based on reductions in energy and transport taxes designed to support the road transport sector in particular. Sometimes losing sight of the need for restructuring in this sector, tax initiatives taken by the Member states merely exacerbate the distortion of competition that already exists in the Community.

As for oil, as stressed at the ECOFIN Council in Versailles (September 2000), attempts to offset rises in oil prices by lowering taxation should be discouraged.

Given the massive proportion of tax in the price paid by consumers, a fairly widespread idea, and one taken up by OPEC, is to offset the price rises for oil products by lowering taxes. Capitulating on this front would amount to transferring tax revenue to the member countries of OPEC and encouraging them to keep their rates artificially high since the effect of crude increases on consumer prices would be offset by tax reductions.

The current rise in fuel prices should also be seen in relative terms. During the last twenty years prices including taxes have been at higher levels at constant rates. In France, for example, the price paid by motorists at the pump averaged FF 6.6 in 2000, as against FF 5.9 in 1990 and FF 7.3 in 1985. In terms of cost per kilometre, this rise is further offset by technical developments. A car in 2000 uses half as much petrol as twenty years ago.

Piecemeal tax cuts are not fully compatible with European law, as mentioned above, Community law allows Member States to apply for exemptions from or reductions in excise duties other than those expressly permitted. The number of such applications has multiplied. Several Member States have recently announced reductions in excise duty on diesel fuel for road haulage. The Commission has proposed to the Council that the number of these exemptions be reduced and limited over time.

- The lack of harmonisation in energy taxation can also lead to excess **tax competition**. A Member State wishing to introduce a tax on an energy product could be prevented from doing so if this product is not taxed in a comparable way in a neighbouring country, for fear of delocalising some of its economic activities. Member States thus lose some of their decision-making independence on tax matters.

Generally, the lack of Community energy taxation structures affects the unity of the internal market and the liberalisation of gas and electricity markets could even come under threat. It also reduces Member State's scope for carrying out the necessary tax reforms. Similarly, it is incompatible with certain policies with which it interacts, including with security of supply.

[52] see tax study in Annex 2

Community regulations have numerous advantages over laws adopted in a national context, particularly in terms of the functioning of the internal market and harmonisation of competition within the EU. The Community is the optimum level at which to set the main guidelines for energy, transport and environmental tax policy.

The Community is also the right framework in that problems of actually implementing certain aspects of energy or environmental protection policy are linked to state aid rules.

Upward harmonisation of tax rates between Member States is therefore unavoidable. This is the essence of the Commission's proposal in its **draft directive on the taxation of energy products**[53], which has been before the Council of Ministers since 1997. Although it does not introduce a new tax, the draft aims to make it possible to restructure national taxation systems and achieve objectives in environment, transport and energy while complying with the single market. However; adoption is being blocked in the Council, in particular by Spain. **It is essential that discussions be restarted to allow this directive to be adopted soon.**

A foreseeable adjustment would be a stabilisation mechanism for VAT revenue that could be used in the event of significant fluctuations in oil prices. In this context, the Commission will continue to explore the advantages of such a mechanism, taking into account the objective of harmonising energy taxes upwards[54]. A first analysis shows that VAT revenue is little affected by increases in the price of oil because of reductions in VAT revenue on other consumption.

Conclusions: The fiscal disorder prevailing in the energy sector often runs counter to the objectives of transport and environmental policy. The unanimity rule stands in the way of any real harmonisation of taxation levels. **Until such time as the European Union can obtain real harmonisation of national taxes on energy, there are unlikely to be any Community taxes introduced in the short term, such as the taxes on pollutant emissions or carbon dioxide. All attempts along these lines so far have failed.**

2. The opaque nature of state aids

State aid is a powerful lever for keeping the internal market working smoothly. Up until now, however, the Commission has followed a case-by-case approach, particularly on aid for electricity generated from renewable sources and on transitional arrangements (stranded costs) provided for in the electricity Directive.

At the present time no precise inventory of all the forms of aid that the Member States grant to the different energy products exists at Community level. The Commission has already embarked on this task in an attempt to determine whether certain sources of energy are not put at an advantage through the aid in disregard of the objectives of energy policy or the fight against climate change. This was indeed the case once. Today the situation is somewhat confused, particularly in respect of distortion of competition. An inventory of state aid to energy should indicate the merits of certain forms of aid for the future. Some sectors should no longer benefit from aid (e.g. oil, gas, and nuclear power). On the other hand, they should collaborate to help renewable sources of energy to take off.

A revision of the framework for state aids is underway with a view to helping new and renewable sources of energy gain a foothold. Decisions are also awaited on "stranded cost" to

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53 COM(97)30 final, OJ C 139, 6.5.1997.

54 Commission communication of 11.10.2000 "Oil supply in the European Union" COM(2000)631 final.

clarify the question of transitional arrangements. This is also a key point for setting a framework for the restructuring underway in applicant countries.

The Commission will soon finalise the new framework for state aid pour the protection of the environment. This framework includes specific provisions to facilitate the development of renewable sources.

The state aids should therefore be examined with regard to transport policy, energy policy, security of energy supply and the need to promote renewable energy.

The Commission will make a systematic inventory of state aid to see whether it ties in with the political priorities of the EU.

3. Ineffective demand management

Energy saving took off to some extent after the oil crises, but over the last ten years it has dropped off appreciably, improving by only 10% in ten years against 25% in the 1980s.

Measures in favour of demand management have been mainly at national level, with disparate results across the Member States. Some have opted for incentives while others have gone for more binding measures. The challenge of climate change and preparation of The Hague Conference have also prompted some Member States to announce more ambitious programmes, although these have not been reflected by lower consumption in line with the problems to be solved. The Member States have shown little inclination for developing wide-ranging measures at Community level with binding objectives.

Community action to date has been limited. Europe has failed to continue the implementation of the considerable efforts to improve energy efficiency which were agreed after the first oil crises. In 1993 the European Union adopted the "SAVE" Directive. Under this Directive Member States are required to develop and implement energy savings in the residential, tertiary and industrial sectors[55].

In comparison to the draft proposal of the Commission that gave clear guidance on measures to be adopted at national level, Member States insisted in the decision process on maximum flexibility in being able to choose which measures are most appropriate to their national circumstances. This has considerably reduced the impact of the Directive. Moreover, eight Member States have either failed to implement parts of the Directive or failed to report results. As a consequence, infringement procedures were initiated in October 2000.

The SAVE and ALTENER Directives were adopted in the early 1990s. These are policy-oriented programmes which focus on non-technological measures to better exploit the economic potential of existing innovative practices in the energy market and energy aspects within the transport sector. The annual budgets for 2001 and 2002 are envisaged to be €14.0 and €11.0 million for SAVE and €17.5 and €17.3 million for ALTENER. These are very modest amounts which do not amount to a real Community policy.

Experience with SAVE and ALTENER has shown that limited results have been obtained with the exception of selective measures:

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[55] Energy certification of buildings; billing of heating and cooling costs according to consumption; third-party financing in the public sector; thermal insulation of new buildings; regular inspection of boilers; and energy audits of energy-intensive industries

- A comprehensive strategy for improved energy efficiency for domestic appliances (e.g. refrigerators, washing machines, and ovens). The preparation of the technical requirements for labels and standards has been done with studies supported by the SAVE programme. Actions include the labelling Directive for appliances and the minimum efficiency standards Directives for refrigerators and boilers. Monitoring of the implementation of the Directives has been crucial for their success and was done by SAVE projects such as the *Cool Labels* Study dealing with refrigerators. Refrigeration appliances offered for sale today consume about 27% less energy than equivalent appliances sold in 1992, much as a result of labelling and standards.

- The ALTENER project *AFB-NET V* in Finland in the field of biomass. Biomass has a very large potential in the renewables sector. This network has triggered extensive European level co-operation among industry, the research and development sector and energy authorities. The project evaluates among other issues international biomass trade and provides price comparisons.

The experience demonstrates that labelling directives on appliances and efficiency standards on refrigerators and boilers have proved to be very effective where properly implemented.

Latest estimates[56] calculate out of the huge technical potential for improved energy efficiency (estimated at 40% of current energy consumption) considerable economic potential for cost-effective improvements in energy efficiency of at least 18% of current energy consumption. This potential is equivalent to over 160 Mtoe, roughly the final energy demand of Austria, Belgium, Denmark, Finland, Greece and the Netherlands combined. The non-realisation of that potential is a result of market barriers which prevent the satisfactory diffusion of energy-efficient technology and the efficient use of energy. In some sectors there are extreme potentials: the *Study on European Green Light* for example has shown that between 30% and 50% of electricity used for lighting could be saved by investing in the most efficient lighting systems. Similar levels of efficiency can be achieved through more efficient energy saving stand-by mechanisms in computers, office equipment and household TV's, video recorders etc.

The *Action Plan on Improved Energy Efficiency in the European Community* which was adopted by the Commission in April 2000 proposes an indicative target for improvement of energy intensity by an additional one percentage point per year above the estimated forecast. This can realise two-thirds of the available cost-effective saving potential by the year 2010, equivalent to over 100 Mtoe, avoiding CO2 emissions of almost 200 Mt/year. (These need to be developed in an energy efficiency scenario)

Meeting the Community-wide target of doubling the use of co-generation to 18% of EU electricity production by 2010 is expected to lead to additional avoided CO2 emissions of over 65 Mt CO2/year by 2010. The potential for co-generation is, however, much greater and with the right framework in the liberalised market it has been estimated that CHP could triple by 2010 leading to an additional reduction of CO2 of around 65 Mt per year.

Particularly promising developments that could contribute to the de-coupling of energy demand from economic growth is the development of initiatives on Integrated Resource Planning (SAVE study) and energy services

[56] MURE model.

More recent work in the framework of the European Climate Change Programme[57] has confirmed these economic potential. The interim report on Energy Consumption Working Group has identified that, on the consumption side, it estimated that replacing existing equipment or when adding equipment to the stock with minimum LCC models could save around 350 TWh of electricity in the domestic, tertiary and industrial sectors.

With the exception of a number of measures taken under the SAVE and ALTENER Directives, the European Union has regrettably failed to make more of the lessons learnt from its support for and promotion of new technologies, in particular through its research programmes, concerning both the dissemination of results and the introduction of new standards to improve energy efficiency in buildings, transport, industry, etc.

In future, all new available technologies (clean cars, fuel sales, insulation, solar energy, etc.) should benefit from Community support. This will be geared more to the demand for support from potential users (town, municipality, region) than support for the supply of technology which has existed for some time. In other words, it would be better to change tack in favour of viability of demand which, by extension, would gradually create markets of sufficient size. These economies of scale would make these technologies cheaper. Certification and standardisation efforts should be supported in parallel. If big conurbations encouraged the use of hybrid electric cars, for example, and limited access to cars that pollute, this type of support would be more effective than aid to industry. Large-scale experiments provide proof-of-concept showcases.

Conclusion: The Commission is therefore considering a clear legislative framework for the priorities of future policies on energy efficiency and renewable energy sources (demand-side management). In its outline of energy strategy (see Part Three of this Green Paper), therefore, the Commission places the emphasis on concrete measures to reduce growth in demand.

II. GRADUAL INTEGRATION OF ENERGY MARKETS

Although it has no competence in the field of energy, the Community has nevertheless been able to adopt a number of measures resulting in the completion of the internal market, notably in gas and electricity, with an initial effect of substantially reducing prices.[58]

A. The internal market in natural gas and electricity

1. Market dynamics

a) Falling prices

Just as in the case of telecommunications or financial services, the objective of creating the internal market in energy is to make the economy more competitive. At the start of the 1990s European industry was paying an average of 40% more for its electricity than its US rivals. The impact on prices has already been a success: many Member States have gone beyond the requirements laid down in the Directives on electricity and natural gas[59] with the result that two-thirds of the market in electricity and 80% of the market in natural gas has been opened up.

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57 (COM(2000)88 final

58 To date the milestones on the way to opening up the electricity and natural gas markets to competition have been five Directives covering price transparency (1990), the transit of electricity and gas through grids (1990 and 1991), the internal market in electricity (1996) and the internal market in natural gas (1998).

59 Directives 96/92/EC and 98/30/EC.

Prices to industrial consumers have fallen by 15% on average and by up to 45% in certain Member States, such as Germany[60].

b) A harmonised legal framework

Unlike the USA, Europe has a uniform legal framework for opening up the markets. This is governed by a single directive which imposes minimum obligations on all Member States. By contrast, in the USA there is no federal law laying down such rules, but the market is being opened up state by state.

This European framework provides for a degree of interconnection and, hence, of network security far beyond the level existing in the USA. This helps to avoid the risk of power cuts since the network operators can call on neighbouring operators via a co-ordination body.

c) *A public service tailored to the new market structures*

In the case of electricity and natural gas, a number of public service aspects must be taken into account, such as security of supply, quality of service and universal service.

On this last point, Member States impose minimum conditions on network managers in the form of public service obligations. The transmission and distribution companies have to guarantee a network connection on reasonable terms to all citizens. Under no circumstances could completion of the internal market override the need to guarantee a service tailored to

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60 Given the profound changes in the energy markets in the European Union both due to liberalisation of energy markets and due to environmental regulation, the costs of generation of electricity have changed. As can be seen in Table x the cost of electricity generation is the lowest for combined cycle gas turbines followed closely by energy generated from imported coal. Given the current subsidies to wind energy in many Member States, their generation costs are already fairly competitive. The generation costs of nuclear power are, however, about 40% higher than the cheapest alternative, gas. The figures do not include the negative environmental impact of energy generation.

Production costs of electricity of different technologies

	Production costs cents/kWh	Generation cost compared to gas
Coal (imported)	3,29	3%
Coal (domestic, with subsidies)	4,20	32%
Gas (CCGT)	3,18	0%
Nuclear	4,51	42%
Wind (with subsidies)	4,46	40%

Source: Annex 3 Notes: CCGT = Combined Cycle Gas Turbines. The production costs of different Member States have been weighted by the amount of electricity produced. The costs are based on a utilisation rate of 7000 hours per year

underprivileged citizens (jobseekers, remote households, disabled persons, etc.). This universal right to be connected to the electricity grid and to be supplied at a reasonable price must be preserved. The Directives contain a number of rules to make sure that the Member States keep in place the means needed to achieve this.

Experience has shown that the gradual completion of the internal market has brought no deterioration in public service standards; on the contrary, quality of service has improved.

d) Restructuring of the market

The traditional monopoly holders in the natural gas and electricity sectors have planned ahead for the opening-up of the markets. In response to the competition they have carried out far-reaching restructuring. As in other sectors of the economy, this is an unavoidable consequence of the internal market.

Since 1998, mergers and acquisitions have gained pace, particularly in the electricity sector. In the case of electricity, concentration appears natural for production and transmission activities, which are bound by network operation constraints and which, therefore, can capitalise on economies of scale.[61] What is more, these two subsectors account for a large share of the costs (for example, together they represent 75% of electricity generation costs in the United Kingdom). Separation of transmission from production has emerged as a key factor in creating the conditions for true competition and liberalisation. In the nuclear equipment-making and nuclear fuel sector, concentrations are also underway (BNFL-Westinghouse-ABB, Framatome-Siemens) with a view to creating strong industrial clusters in Europe which will be competitive on international markets.

It is hard to say at this juncture where this trend towards greater concentration will end. It should allow diversification of the risks in the case of investment in new technologies and new sectors and, hence, contribute to security of supply for the Union and maintain economic growth.

2. Obstacles to be overcome

a) *Sluggish intra-Community trade*

The completion of the internal market is obstructed by the low level of intra-Community trade in electricity, accounting as yet for only 8% of total electricity production. This level of trade is much lower than in other sectors that have gained much from the internal market, such as telecommunications, financial services and industrial products. The juxtaposition of fifteen fairly liberalised national markets has not yet led to a fully integrated internal market, as the European Council in Lisbon and Feira wished. Nevertheless, the competition between producers in the Community has pushed national prices down which, paradoxically, has limited trade. Beyond progressive establishment of tariff policies and charging for the use of grids, underdevelopment of the transmission infrastructure poses a security of supply problem.

b) *Insufficient networking*

Networking is of primordial importance to smooth operation of the internal energy market. The transmission system and "route" configuration play a central role in flexibility of supply (volume of trade) and consumer choice.

In the past the principal objective of interconnections was not to expand trade but to seek greater security of supply to soften the impact of one-off incidents. The main bottlenecks are

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61 Electricity Market Reform, IEA Handbook, 1999.

in Southern Europe, as can be seen from the total or partial isolation of the Iberian peninsula and Greece.

A lack of network infrastructure and the maintenance of the quality of supplies (network stability) can slow the integration of national markets and thus limit security of supply.

Stimulation of intra-Community trading in **electricit**y depends on optimum use of the existing interconnections between the Member States. These must continue to be the focus of study from the angle of competition rules.

The construction of new infrastructures should also be encouraged. It is not a financial problem since the undertakings are prepared to invest in new networks in response to the demand on the market. Generally, it is more of a political problem. Often, plans to construct new interconnection capacity run up against constraints calling for a balance to be struck between the public interest, whether Community or national, and local reservations about new infrastructure. Construction of new transmission lines often raises local opposition at strategic points, for example, around the Pyrenees or Alps, making it difficult to go ahead with the scheme.

To overcome these problems, efforts must first be made to upgrade the capacity available on existing lines. To smooth the way for construction of new infrastructure, consideration could be given to a European interconnection plan identifying schemes of "European interest" which would provide a means of finding ways to clear these hurdles, after consultation with the elected representatives at national and regional level.

The situation with **natural gas** is different, since over 50% of the natural gas consumed in the Union already crosses at least one frontier before reaching the end-user. Over the last few years a number of new gas pipelines have been brought into service to integrate the network, both within the Union and with outside suppliers.

However, in the short to medium term, after completion of the internal market in natural gas, more intensive use of the network could create bottlenecks (for example, in the Benelux countries or between France and Spain) as well as interconnection and network interoperability problems. These were previously masked by the existence of monopolies which settled such issues amongst themselves under administrative arrangements. Consequently, identification of required new interconnections, allocation of the limited existing capacity and setting of appropriate tariffs for funding new infrastructure will be the objectives to be pursued in collaboration with the industry and the national regulators.

Security of supply must also be improved by stepping-up interconnection capacities with and between the applicant countries. In the longer term, continuing liberalisation on a continental scale - taking account of fair conditions - will also help to increase interconnections between non-EU countries (Russia, Ukraine, the Caspian Sea and the southern Mediterranean).

The complex way in which the networks work, operate and link up calls for public support in this area.

Operation of the internal market must not be hampered by physical constraints. The Union has an important role to play in giving the networks a Community dimension so that they meet the needs of the internal market and of all the Member States and applicant countries.

A European mechanism for collaboration between interested parties with a view to defining a European plan for the major missing interconnection infrastructure could resolve these problems.

c) New security of supply concerns

Steps must be taken to avoid seeking an immediate return on investments on an open market to the detriment of investments in branches which are capital-intensive (coal, nuclear energy, etc.) or do not necessarily yield a return in the short term (renewable sources).

With this in mind, the directive on the internal market in electricity offers the Member States the option of giving priority to indigenous sources, i.e. renewable energy sources or waste for producing heat or for combined heat and power production. It also allows the possibility of giving priority to indigenous primary energy sources to supply not more than 15% of the energy required to generate the electricity consumed at national level. In the case of new investments, the Member States must keep potential control over the choice of fuels. Similarly, Member States may suspend third-party access to the networks whenever necessary, particularly to safeguard security of supply.

There is a risk that the choice of primary energy sources for electricity generation could jeopardise security of supply by over-concentration on a single source. Although there is no imbalance in this area at the moment, in years to come such problems could arise as natural gas gains ground. The liberalisation of the gas sector will open up new supply opportunities for the applicant countries who obtain most of their supplies from Russia. The Member States and the Community must keep a close watch. The Directive authorises the Member States to take the necessary measures to achieve this. Where a primary energy source is too important or develops so rapidly that it endangers overall security of electricity supply, the Directive authorises the Member State to fix the nature of the primary resources for any new capacity. However, such measures will have to be co-ordinated with the Commission and checked at Community level to ensure that they are appropriate.

The directive on the single market in natural gas authorises Member States to impose on natural gas undertakings, in the general economic interest, public service obligations which may relate to security, including security of supply. Also, in the event of a sudden crisis in the energy market posing a threat to system integrity, the Member States may take the necessary temporary safeguard measures. However, such measures are reserved for exceptional individual cases.

Another factor which must be kept under control is any unleashing of consumption as a result of the falling prices of certain energy sources. Some experts estimate that the internal market could push up consumption around 20%.

Security of supply must be clearly recognised, on a par with environmental protection, as an essential public service objective. Amongst the services which States must guarantee, the right to connection to the network, the rules on repair times and the requirements on network deployment are all public service obligations which contribute to security of supply. The obligations to generate a minimum quantity of electricity from renewable resources in turn can improve security of supply and make it possible to maintain alternative resources. Energy-saving standards and measures must also be defined. The national regulator has an essential part to play in this. He alone has the necessary impartiality and detachment to apply measures in this area, while respecting the configuration of the market.

Conclusions: The integration of energy markets contributes to security of supply, provided that these markets are truly integrated. The opening-up of the EU's energy markets provided for in the existing directives is not enough to create a single energy market in Europe. A new form of government intervention is called for.

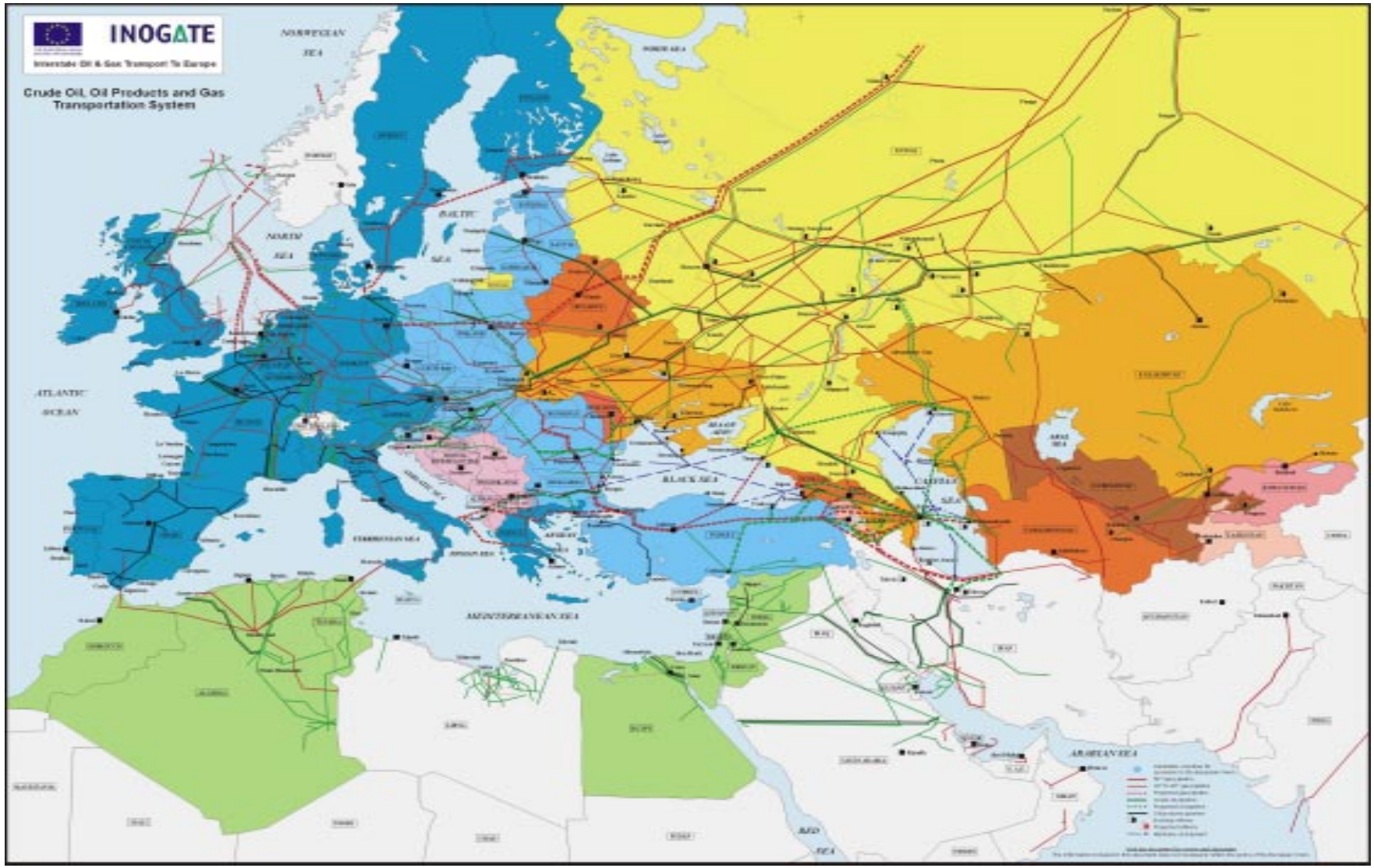
In line with the mandate given by the European Council in Lisbon, steps must be taken to speed up completion of the internal energy market. **In order to provide a framework for a fully open market, there is a need for greater separation between electricity generators and transport network managers, non-discriminatory network access by new generators**

and distributors, minimal charges for cross-border trade, clearer public service obligations and widespread establishment of an independent national regulator.

Based on experience, two new components are needed. All the national regulators should sit on an advisory body to assist the Commission with the smooth operation of the internal market.

Finally, it is necessary to draw up a plan of major interconnection infrastructure of European interest.

The social consequences of opening up markets will receive special attention in the forthcoming package of proposals.


INOGATE
Interstate Oil & Gas Transport To Europe
Crude Oil, Oil Products and Gas Transportation System
NORWEGIAN SEA
NORTH SEA
BALTIC SEA
ATLANTIC OCEAN
BLACK SEA
MEDITERRANEAN SEA
ARABIAN SEA
RED SEA

B. The internal market in oil products

Although the oil market is far more competitive than the markets in other energy sources, efforts must still be made in the refining and distribution sector in order to create a more open market.

1. Market Structure

The question motorists always ask when they see that the price at the pump has shot up is: "Does the increase really reflect a rise in the price of crude?" Until March 2000 the answer was "yes". It can be seen that in 1999 there were two closely correlated trends, with the rise in petrol prices lagging slightly behind that of crude oil. From March 2000, however, they moved apart. Petrol prices began to outstrip those for crude. Very recently, refining margins have therefore reached levels unprecedented since the Gulf War.

Comparing pump prices of oil products before taxes and duties in different Member States reveals substantial differences. For example, the price of “Euro Super 95” at the end of May 2000 was €452/1 000 litres in the Netherlands, but €344 in the United Kingdom (€346 in France), a difference of 31%. These differences, worrying as they are, existed before the current price surge and therefore have no causal relationship with it.

In recent surveys on the application of the Community merger control regulation, the Commission decided that that were no reasons to believe that the crude or refined oil market was not competing. These markets are transparent and prices are publicly displayed on spot markets.

It is, however, correct that, downstream, market imperfections exist. For example, the final price before taxes varies widely from one Member State to another. This does not necessarily indicate an infraction of competition rules but indicates that markets are inadequately integrated. These differences can be explained by the different cost factors and market structures in Member States. For example, the prices are very low in the Netherlands where the market is controlled by a small number of actors. They are even lower in Britain and France where motorists benefit from the competition produced by non-specialist distribution (supermarkets).

This diagnosis raises the question as to whether competition law is being infringed, notably by the formation of possible cartels (price fixing). The national authorities in a number of Member States have begun to investigate this. In Italy the competition authorities have imposed sanctions on oil companies. In Sweden, matters are at the proposal stage.

2. Competition policy

It is important to assure that the fuel distribution market remains open to new operators, notably independent ones. This is a way to guarantee that markets remain competitive. For this reason an inquiry is underway into the barriers which independent operators face (whether resulting from private or public decisions). The results will allow the Commission to evaluate the conditions for competition in the internal market and to define possible actions in the area of competition rules.

This Community action reinforces steps taken by national competition authorities. Some of them have already launched enquiries into infringements of competition law; in some cases suspicions have been confirmed.

It would be worth making a systematic comparison of prices of oil products in the Member States so as to reveal the disparities that exist.

The Commission will also continue to be vigilant in applying the merger control rules in this sector, as in the cases of BP/Amoco and TotalFina/Elf. Any price agreement or abuse of a dominant position should be severely punished.

Conclusion: Climate change and the growing integration of the European energy market (incidentally better integrated than that of the United States) are an opportunity for the European Union to consider taking measures to improve demand management. Effectively, the only way of influencing supply is to make serious efforts with renewable sources. Let us be realistic: promoting such forms of energy cannot be the only response to the complex problems raised by security of supply.

PART 3: SECURING THE FUTURE: OUTLINE OF ENERGY STRATEGY

The objective of greater security of energy supply to ensure that in 30 years' time the Union will not depend on external supplies for 70% of its energy is very difficult to achieve because of the general context of instability limiting the room for manoeuvre, in particular in the supply of energy products. This is why, in order to engender public debate, the priorities outlined in this Green Paper are basically focused on action that is both specific and internally coherent to limit demand.

I THE WEAKNESSES IN CURRENT ENERGY SUPPLY

The EU's security of supply must face various challenges created by the current situation of energy supply and if nothing is done they will be confirmed in the future.

A. Hurdles to security of supply

The hazards for energy supply are various – physical, economic, social or environmental.

1. Physical risks

Permanent **physical "disruption"** can occur when an energy source is exhausted or production is stopped. It is not excluded that Europe will eventually run out of Community gas and oil resources at reasonable cost. It is likely that Europe will have to abandon coal production, as some countries have already done. Nor is it excluded that nuclear energy will be given up following a major accident at a power station. The consequences of such a situation in terms of transfer of demand to other products (oil, natural gas, nuclear power, coal, and renewables), the functioning of the market, energy dependence and environmental objectives must be examined.

There are also temporary disruptions, the consequences of which can be disastrous both for consumers and for the economy in general. These can result from a strike, a geopolitical crisis or a natural disaster. This Green Paper is only concerned with temporary disruptions insofar as they are a sign of structural supply difficulties on a Community scale. For example, the difficulties France experienced as a result of the damage caused by the storm in December 1999 showed to what extent the electricity networks were still essentially organised on a national basis.

2. Economic risks

Economic "disruptions" are caused by erratic fluctuations in the price of energy products on the European and world markets. The internal market allows us - thanks to competition - to optimise resources and reduce costs, but the European market is still linked to prices on the world market. Oil and gas account for over 60% of fuel consumption in the residential and tertiary sectors. Transport accounts for half the outlets for petrol. The rise in fuel prices, mainly oil and gas, creates monetary and trade imbalances which are harmful to the EU's economic health. In this context, **geopolitical** considerations - such as OPEC, the recent difficulties in the Middle East, the embargo on Iraq and uncertainties regarding developments in Libya and Iran - are a major factor, though it is not possible to define exactly what influence they have had.

The tripling of the price of crude oil in 1999 and its effect on the price of natural gas would have a significant impact on the energy bill and the Member States' economies, were prices to remain at that level. The increase in the price of crude led to a net transfer from the European Union of nearly an extra EUR 22,7 billion between January and May 2000. The spectacular

rise in oil prices since 1999, combined with the fall of the Euro has already increased the Union's inflation rate by one percentage point. Economic growth seems to be feeling the effects but growth in GDP remains around 3%. The current situation is leading to a drop in growth rate: 0.3% in 2000 and 0.5% in 2001. Loss of confidence among market operators and consumers would aggravate the situation.

3. Social risks

The instability of energy supplies, whether linked to erratic fluctuations in prices, relations with producer countries or a chance event, may cause serious **social disruption**. Today, petrol is vital for the functioning of the economy, like bread. Any disruption of supply is likely to lead to social demands, if not social conflict. The situation is similar to that created by a bread shortage two hundred years ago. Current events show us that increases in fuel prices can also incite corporatist behaviour. The strike in autumn 2000 by those particularly affected by the rise in oil prices, notably truck drivers, is an example of this. We must not forget that the first two oil crises helped put an end to full employment.

4. Environmental risks

Lastly, there are what might be termed **environmental disruptions**: damage to the environment caused by the energy chain, whether accidentally (oil slicks, nuclear accidents, methane leaks) or as a result of polluting emissions (urban pollution and greenhouse gas emissions). All policies now include an environmental dimension, but special attention should be given to global warming. Under the Kyoto Protocol the European Union has set itself the target of reducing its annual greenhouse gas emissions by 8% between now and 2008-2010 compared with the 1990 level. After that, yet more will have to be done. However, action to reduce greenhouse gas emissions cannot be limited to the framework of the Kyoto Protocol. Given the environmental consequences of the growth prospects in certain sectors such as transport, a long-term policy needs to be implemented going well beyond 2010.

B. Forecasts illustrate potential instability

In order to quantify the main challenges ahead concerning energy security, the work that was carried out in Energy Outlook 2020[62] has been extended by updating the baseline scenario and by extending the analysis to 2030. Furthermore, the analysis covers 30 countries, i.e. the EU countries, the candidate countries as well as Norway and Switzerland.

1. Presentation:

a) *Assumptions for a dynamic extrapolation of current trends*

This updated forecast reflects the continuation of existing trends and policies for the next 30 years. It presumes that all current policies and those in the process of being implemented at 31 December 1999 will continue in the future. Thus, for example, no additional policies to reduce greenhouse gases are included in the forecast. GDP is expected to increase by 90% between 1998 and 2030. Major factors for economic and energy growth include the following:

- continuation of technological progress improving energy efficiency;

[62] European Union Energy Outlook 2020, Energy in Europe Special Issue, November 1999; European Commission.

- continuation of opening up of EU energy markets to competition which is assumed to be fully implemented by 2010;
- restructuring of the EU economy towards activities with a high added value to the detriment of energy intensive production;
- restructuring of the electricity and heat generating sector through technologies involving the efficient use of natural gas;
- continuation of policies promoting the use of renewable energy including the granting of subsidies on equipment and preferential tariffs supporting demand;
- the voluntary agreements concluded in 1998 and 1999 with European, Japanese and Korean car industries (ACEA, KAMA, JAMA) under which for 2008 (ACEA) or 2009 (KAMA, JAMA) CO2 per km emitted by new automotive vehicles will be reduced to 140 grammes;
- With regard to nuclear energy, it is assumed that Member States without nuclear power will not change their policy. Taking account of the disengagement or statements of phasing out nuclear power (Belgium, Germany, the Netherlands, Spain, Sweden and the United Kingdom), it is assumed in the forecast that after the nuclear power plants will come to the end of their technical and economic life, they will be replaced by other technologies. The Netherlands is assumed to phase out nuclear power in 2010. In this modelling, nuclear production will have ceased in Germany after 2025, while in Belgium nuclear declines rapidly after 2020 to reach only a tiny fraction of its present level in 2030. Finland and France are assumed to carry on using nuclear power. Power plants are assumed to decommissioned after 40 years of operation, except in Sweden, where the rate is assumed to be faster.

Oil and gas prices are assumed to rise moderately. Oil is assumed to have a trend value (in 1999 prices) of about 27 €/bbl in 2030. Gas prices are assumed to follow oil prices. Coal prices on an abundant world market are assumed to increase only slightly (they remain below an equivalent of 10 €/bbl).

b) *Results*

European Union

In the European Union, gross energy demand is projected to be 11% higher in 2030 than in 1998. Energy demand is projected to rise much slower than GDP (which is expected to increase by 90% between 1998 and 2030). There is therefore a marked de-coupling of energy demand growth from economic growth.

Moreover, there is considerable structural change in energy consumption. The fastest growing fuel is natural gas: + 45% between 1998 and 2030. Oil remains the most important fuel despite projected modest growth up to 2030; its share in 2030 is still expected to be 38%, while it was 42% in 1998. The use of solid fuels is projected to decline up to 2010 but if no strong climate change policies are undertaken, the use of coal is projected to increase again. This would imply that solid fuel consumption would be about a third higher in 2030 than in 1998.

The contribution of nuclear power is projected to peak around 2010. However, with nuclear plants reaching the end of their life, in 2020 nuclear output is somewhat lower than in 1998 (-4% by 2020). The output is projected to decrease by about 50% between 2020 and 2030.

Renewables grow resiliently in relative terms, by + 45% between 1998 and 2030. However, the share of renewables is projected rather small (6.7% in 2010 and 7.7% in 2030) despite the

assumption that current support schemes in the Member States will be continued. Clearly, the 12% renewables target for the EU requires additional policy measures.

Although there is a significant de-coupling of energy consumption from economic growth, energy demand is projected to increase further. Similarly, energy imports are likely to continue growing. Given that energy production in the Community is expected to peak around 2010 the share of imports in energy demand will rise considerably. In fact, energy import dependency is projected to increase significantly, from under 50% in 1998 to 71% in 2030.

Moreover, rising energy consumption leads to higher CO2 emissions. Between 1990 and 2010 – the base year of the Kyoto protocol and the middle of its target period (2008-2012), CO2 emissions in the Community are projected to grow by 5%. This is much lower than the growth of energy demand due to higher shares of natural gas, nuclear and renewables by 2010.

Fuel switching from coal to natural gas is expected to continue after 2010 helping to contain CO2 emission. However, with present policies towards nuclear and the current level of support for renewables, as well as without additional climate policies, the share of zero carbon fuels would decline after 2010. As a result CO2 emission growth would continue with emissions exceeding the 1990 level by 12% in 2020 and 22% in 2030.

Europe-30

Extending the analysis to cover 30 European countries leads to results that are more or less similar to those for the current EU. There are two reasons for this. Firstly, the current EU accounts for almost 80 % of the energy consumption of Europe-30. Secondly the group of candidate countries and direct neighbours are projected to become more similar to the energy structure of the EU over the next decades. Nevertheless, as Norway – which is a major oil and gas exporter – is included in Europe-30 in this analysis – import dependency for Europe-30 would be lower.

In Europe-30, energy consumption is expected to rise by 25 % between 1998 and 2030 reflecting both strong economic growth and considerable energy intensity improvements. The strongest growing fuels are natural gas, renewables, solid fuels and oil while the nuclear contribution is expected to decline as a result of closing unsafe nuclear plants in candidate countries as well as present governmental attitudes towards nuclear in certain Member States. The share of renewables in the Europe-30 would increase from 6.8 % in 1998 to reach 8.1 % by 2030.

Import dependency of Europe-30 is expected to rise from 36% in 1998 to reach 60% in 2030. This is due to continuously growing energy consumption and a decline in North Sea oil and gas production as well as lower production of solid fuels and nuclear.

CO2 emissions in Europe-30 are projected to grow by 7 % between 1990 (the Kyoto base-year) and 2010. In 2030, CO2 emissions are forecast to exceed the 1990 level by 31 %.

2. Conclusions drawn from the updated scenario

Both EU 15 and the wider Europe of 30 countries rely heavily on oil and gas for energy. Overall, oil and gas imports are projected to increase significantly. Also real prices are projected to increase.

Table: Share of oil and gas in total energy consumption in 1998, 2010, 2020 and 2030

	1998	2010	2020	2030
EU	64%	66%	66%	67%
Europe-30	61%	63%	65%	66%

Renewables penetration is projected to remain low and to fall short of the 12% target. Clearly, additional policy efforts are required to attain this target. Furthermore, without additional policies, CO2 emissions are projected to exceed their 1990 level by 2010 and continue to increase thereafter at an increasing rate.

Table: Projected increase of CO_2 emissions in 2010, 2020 and 2030 related to 1990 (base year of the Kyoto Protocol)

	2010	2020	2030
EU	+5%	+12%	+22%
Europe-30	+7%	+18%	+31%

Import dependence is projected to increase steadily in both the EU and in Europe-30. By 2030, import dependency is expected to reach over 70% in the current EU and 60% in Europe 30. Compared with the present levels of about 50% for the EU and 36% for Europe-30, Europe is becoming increasingly reliant on imports for its energy supplies.

Table: Projected import dependence of EU, and Europe-30 in 1998, 2010, 2020 and 2030

	1998	2010	2020	2030
EU	49%	54%	62%	71%
Europe-30	36%	42	51%	60%

Because of the strong de-coupling of energy use from economic growth, the ratio of energy import quantities to GDP declines. While net energy imports in absolute numbers are projected to increase by 81% from 648 Mtoe in 1995 to 1175 Mtoe in 2030, compared against the development of total economic output (GDP), net import intensity is projected to decrease by 11% between 1995 and 2030.

However, with the assumed increase in energy import prices by 86% for oil, by 81% for gas and by 5% for coal between 1995 and 2030, the cost of energy imports is projected to rise faster than GDP. Thus, it is projected in the forecast that the share of energy imports of GDP will grow from 1,2% in 1995 to 1,7% in 2030.

These trends raise questions concerning alternative developments:

- To what extent would an accelerated nuclear phase-out (than foreseen in the forecast) further increase CO2 emissions and import dependency?

- What effects on CO2 and import dependency could be expected, if current support to renewables were *either* reduced or discontinued *or* substantially improved, including a substantial increase in RTD expenditure on renewables?

- To what extent would substantially higher import prices for oil and gas (resulting e.g. from a disturbance in world energy supplies) give rise to lower demand for these fuels? Would this lead to lower import dependency and lower CO2 emissions considering that higher oil and gas prices could favour more carbon intensive fuels such as coal?

- What are the implications of reaching the first commitment period (2008-2012) target of the Kyoto Protocol (–8% of 1990 for six greenhouse gases) and the subsequent (more demanding) second and third period targets? In particular, what would this imply for further improvements of energy intensity and the role zero carbon fuels, such as renewables and nuclear? Finally, what would this imply for the security of energy supply in the European Union?

- By the end of the period, nuclear generation capacity in the EU will have been reduced substantially as a result of the policy decisions taken by Member States. What are the possible implications for economic, environmental and energy policies?

The forecasts confirm that there are the following challenges:

- energy import dependence is around 70% in 2030

- renewable energy does not reach its target of 12% share of primary energy

- Kyoto objectives are not met

- the absence of nuclear would make it even more difficult to tackle climate change in the long term.

The analysis also shows that there are energy policy options which favour zero-carbon fuels that simultaneously reduce energy dependency and CO2 emissions. Further efforts to decrease energy intensity would also contribute towards lowering price risks from world markets through lower import dependency as well as towards reducing CO2 emissions. Areas for improving energy intensity, i.e. tackling energy demand without compromising economic growth, include the building and the transport sectors.

II TOMORROW'S PRIORITIES

The traditional approach to the security of supply problem is to concentrate on increasing supply, both internal and external. From this viewpoint, the EU should extend and develop its range of domestic energy sources and endeavour to secure external supplies.

However, future prospects and developments observed on the energy markets limit the possibilities for action in this respect. A lack of political consensus on a Community energy policy limits the possibilities to intervene. Only a policy geared to controlling demand can lay the foundations for a sound energy supply security policy.

A. Controlling the growth of demand

The situation in Europe today is such that we must develop a new strategy on the demand side. If the EU cannot reverse current energy consumption trends - energy and transport use, especially in urban areas - it will have to resign itself to massive dependence on imports for its energy supplies and will have trouble meeting its commitments under the Kyoto protocol. In these circumstances, it must turn its attention to the most effective instruments for controlling demand: taxation and legislation and other market instruments.

1. Horizontal policies

Security of supply can only be improved if there is widespread individual awareness that uncontrolled energy consumption is harmful. This needs to be supported by a horizontal policy which ensures that energy prices reflect real costs and encourages energy saving.

a) Completion of the internal market

To strengthen the internal market in gas and electricity we need more competition between national energy operators and the introduction of new regulatory powers and reasonable transit costs. To this end the Commission will be presenting a proposal at the Stockholm European Council. The proposal is an integral part of a European policy for securing energy supply. Greater opening up of the market, on both the supply and demand sides, encourages operators to widen their energy options. In this way, enhanced gas-to-gas competition on an integrated European market could be conducive to uncoupling the price of gas from that of oil.

b) Energy taxes

In an increasingly open market, taxation is still the most flexible and effective instrument for encouraging operators to change their behaviour. In the last few years, the European Commission has proposed measures to which the Council has not yet responded. In the light of new constraints affecting security of supply, the Commission's taxation proposals of 1992 and 1997 could be usefully supplemented by a new proposal designed to steer energy

consumption towards more environmentally friendly technologies, which will help to bolster security of supply.

The Commission will consider whether it is opportune to couple upward harmonisation of tax rates on fuel (structural component) with a Community mechanism for stabilising VAT revenue in the event of significant fluctuations in oil prices (components dependent on circumstances). In this case, the impact which such measures will have on SMEs should be investigated.

The fiscal instrument should aim to eliminate national distortions and distortions between energy producers, encourage more energy saving and lead to the internalisation of damage caused to the environment (internalisation of external costs and the contribution to the reduction of CO2 emissions).

c) Energy saving schemes

Europe has not always kept up the efforts to save energy after the oil crises in spite of the considerable potential in this field.

At the Stockholm European Council, the European Commission will accordingly present a plan to save energy and diversify sources by improving energy efficiency in accordance with prioritisation in the various sectors, particular in buildings, and providing support for the development of a new generation of vehicles with precise targets for 2010. This will replace the relatively ineffective incentives which have existed up to now at Community level. Efforts will focus on two priorities:

- on the vehicles front, technological developments will help to improve the fuel efficiency of conventional vehicles and to progress towards more efficient electric and hybrid vehicles as well as battery-driven vehicles;

- regarding fuel, measures must be stepped up to encourage the use of fuel substitutes, especially for transport and heating (biofuels, natural gas for vehicles, in the longer term hydrogen). A 20% target for 2020 does not seem unreasonable.

Even though industry, particularly the energy-intensive sector, has made considerable progress in achieving high levels of efficiency, there is still considerable potential for additional costs-effective improvements.

d) Dissemination of new technologies

The efforts made at national and Community level under various programmes have led to new technologies that consume little energy but are not very competitive. Consequently, Community programmes should promote the establishment of markets to absorb these new technologies on the basis of large-scale trials (e.g. in the major conurbations).

Improving programme concentration and wider dissemination of their results are crucial conditions for ensuring that technological discoveries are more widely and rapidly used.

2. Sectoral policies

a) The imbalance between modes of transport

The imbalance between different modes of transport has grown in recent years, and road transport is now the greatest consumer of oil products (over 80% of final demand for oil in the transport sector is for road transport). Between now and 2010, with economic growth

boosting transport demand, goods traffic is expected to increase by 38% and passenger traffic by 19%. If the trend recorded in recent years continues, the imbalance will become more marked, with further expansion of the road transport sector. In 1970, road haulage represented less than half of inland goods transport (in tkm), today the figure is 80%, in 2010 it could reach 90%.

It is in this sector that the greatest efforts must be made to reduce emissions. In 2010, if current trends were to continue, emissions would be up by 40% compared to 1990 levels. A special effort must be made in this sector. The Commission has therefore set itself the objective, for 2010, of maintaining the market share of the different modes at 1998 levels. This in itself is very ambitious, since it means reversing a trend which appeared to point to an inexorable decline of the market share of certain modes, such as rail. An important decision to liberalise the market for rail freight by 2008 has just been taken. Extensive measures will have to be taken to made these modes of transport more competitive compared with road transport.

The revision of the common transport policy will look at possible solutions, including[63]:

- Revitalising the railways, modernising public services, particularly for rail, and opening up to competition; encouraging the development of short sea shipping and the use of inland waterways.

- Reorganisation of the road transport sector. These include, *inter alia*, reviewing the conditions of access to the road haulage profession, tightening up the enforcement of social and safety regulations, and encouraging regrouping and the diversification of logistics-related activities. Over-capacity in this sector in the Union is estimated at 30%, so it should be restructured through social measures, not tax cuts.

- Infrastructure investments to get rid of bottlenecks in the rail network and develop a transeuropean rail freight network. This requires novel financial solutions, e.g. using investment funds built up using tolls on competing road routes.

- Rationalising the use of conventional private cars in town and city centres and promoting clean urban transport are also priority objectives and likewise efforts towards using hydrogen as the fuel for vehicles of the future. Among the initiatives might be the promotion of the commercialisation of zero or low polluting vehicles(for private and commercial use). The development of a new generation of electric, hybrid (electric motor combined with thermal motor) or gas-powered cars or, in the long term, vehicles running on fuel cells are also very promising.

- Further, in order to promote more environmentally friendly and efficient ways of using energy, the cost of transport should, in future, take account of the principle of "polluter pays". Also, transport prices and policies should reflect these additional costs leading to changes in individual and public choices. Without this, society's tolerance in the face of a general deterioration in living conditions could reach its limits. This concerns in particular urban mobility, where more space needs to be made for more efficient and cleaner public transport.

b) Buildings: major energy savings to be made

63 These measures will shortly be the subject of a White Paper on transport.

Greater use of available and economically viable energy-efficient technologies should reduce the use of energy in buildings by at least a fifth, that is 40 million toe per year[64]. This is equivalent to around 10% of current net oil and oil product imports and around 20% of the EU's greenhouse gas reduction commitment under the Kyoto protocol.

Greater energy savings in buildings, as well as reducing our overall energy requirements and improving the security of our supply, also reduces CO2 emissions and makes homes and workplaces more comfortable. It promotes social inclusion by raising the living standard of many people in the EU. Moreover, the introduction of energy saving measures in the building sector has considerable job-creating potential.

The Commission will propose regulatory measures on energy saving in buildings which will replace existing incentives. They may include the following elements :

- ***Targeted energy-saving rules.*** The introduction of such rules could have positive results. Investment projects for existing buildings could be reviewed and controlled by rules on the insulation of residential buildings. Energy consumption standards per m³ might need to be adopted in order to set up a proper system for the energy certification of buildings. The introduction of standard energy certificates would make the energy variable a factor on the property market and create demand for energy-efficient buildings. Such certificates could provide the fiscal basis for encouraging investment in energy saving.

- ***Encouraging the use of renewable energy sources in new buildings***. Rules could include provisions governing heating and air conditioning systems which, for example, would have to be linked to renewable energy sources (multi-fuel investments). The integration of photovoltaic technology and solar panels in roofs or façades should also be encouraged. Precise targets for the integration of these technologies in new buildings could be fixed.

B. Managing supply dependence

While improved and durable energy supply security for the European Union depends primarily on the adoption of policies controlling demand, a responsible policy for managing dependence must also consider supply, even if the EU's power to act and margins for manoeuvre are very limited in this respect, as seen above.

1. Internal supply

a) Development of less pollutant energy sources

Nuclear energy and solid fuels have been decried, oil is subject to geopolitical hazards which are hard to control, renewables are failing to penetrate the market because they present technological difficulties and are not profitable enough. Natural gas supplies could in the long run be subject to risks of instability. Demand is changing, adapting to the new rules governing the operation of the market and taking increasing account of environmental concerns.

- New and renewable energy sources

Hydroelectricity does not have much potential in Europe for improving security of supply. New and renewable forms of energy, however, are the first option for action in relation to security of supply, the environment and rural populations.

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64 According to some estimates, the energy-saving potential in the building sector would be much greater when energy prices are rising.

Sustained efforts should be made to promote the penetration of new and renewable energy sources (such as hydrogen and co-generation) in our economies. The European Union has set itself an ambitious target in this respect: 12% of energy consumption in 2010 should come from renewables. This means, above all, mobilising aid to promote their development and use. Renewable forms of energy can only reach a sufficient level of competitiveness if they receive aid for a relatively long time.

These forms of energy do not have the same development facilities that other sectors had. Moreover, aid for renewables is justified on the grounds that conventional energies do not contribute much towards the external costs they entail which been the subject of thorough quantitative evaluations. For example, the CO2 emissions they produce are not taxed. This is why today renewables - generally unprofitable - could be financed by temporary levies on a share of the profits of other operators in the energy sector (oil, gas, nuclear).

- Nuclear energy

The nuclear option must be examined in terms of its contribution to security of supply and greenhouse gas emission reductions . Nuclear energy saves Europe around 300 million tonnes of CO_2 emissions per year. This is equivalent to taking 75 million cars off the roads. This is entirely without prejudice to the sovereign decisions of the countries that have decided to phase out nuclear power plants or put a moratorium on investment in this sector. The present phase-outs do not affect the Community's ability to fulfil Kyoto objectives by 2012. With the current state of the art, giving up nuclear energy would mean that 35% of electricity produced would have to come from conventional energy sources and renewables.

Hence the following priorities:

- ***Supporting research into the reactors of the future, notably nuclear fusion, and continuing and stepping up research into irradiated fuel management and waste storage.*** The Union must maintain its leading-edge technological capability, know-how and potential for exporting to third countries, notably with respect to supply of equipment, enrichment, manufacture and reprocessing of spent fuel, and waste management.
- ***The European Union is examining the ways of treating the question of nuclear safety in the enlargement process,*** as requested by the Helsinki European Council.
- ***The European Union should ensure that commitments are met*** with respect to the closure and dismantling of reactors which cannot be modernised. Financial help should be available for this.

b) Preserving access to resources

In order to widen and renew policy of fuel stocks, the European Union could:

- examine ways of strengthening its strategic oil stocks mechanism, by taking on a greater role in stock management. **In order to combat speculative moves, means of intervention are needed, like on the money markets, to make prices more stable**[65] **or respond to exceptional demand**. The EU should consider establishing a strategic oil reserve for helping to mitigate and modify erratic price fluctuations and serve as a safety net in addition to the 90 days' existing reserves for finished products. Initially, part of the stocks covering more than 90 days could be managed at Community level and where necessary be used for anti-speculative measures.

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65 Cf. the Commission's Communication entitled "The European Union's oil supply" COM (2000) 631

- *consider extending the stocks mechanism to natural gas.* It must be remembered that 40% of Community needs are cover by imports and that this figure will rise to 60% in 2030. The Union needs to guard itself against excessive vulnerability, resulting from too great a degree of dependence.

- *analyse whether to maintain access to Community coal reserves and whether to maintain a minimum production platform for this purpose*. This raises the question of a platform for primary Community production, which could be 15% of the share not covered by the rules provided for in the Directive on the internal market in electricity.

2. Maintaining competition

In order to prevent economic risks in oil supply and limit the consequences, in particular the social consequences, the Commission must tighten the control of competition rules in the oil sector downstream (refining-distribution).

It is essential to ensure that the fuel distribution market remains open, in particular for independent operators. This is a guarantee for competition in the market. This is why an inquiry into barriers to independent operators (whether from public or private decision) is being carried out. The results will allow the Commission to evaluate the conditions for competition in the internal market and to define the actions which could be taken with regard to rules of competition. It would be useful to make a systematic comparison of prices of oil products in the Member States in order to highlight disparities.

3. Ensure external supplies

The European Union must use its political and economic influence to ensure flexible and reliable external supply conditions.

a) Relations with producer countries : making our voice heard

- The European Union must establish an **ongoing dialogue with producer** countries and not only in response to major movements on the market**.** This will lead to greater transparency on the market and obtain stable prices. It is important to be aware of the expectations of several producer countries regarding political developments in the Middle East. **Such dialogue must facilitate the improvement of pricing mechanisms, the conclusion of agreements and the use of reserve stocks for mutual benefit.**

  This dialogue should be extended to all matters of common interest, in particular protection of the environment (flexibility mechanisms) and technology transfer.

  At Mr Prodi's initiative, **an energy partnership with Russia** is in preparation as confirmed by the statement adopted at the end of the "Russia-European Union" Summit held in Paris on 30 October 2000. Russia said that it was prepared to work towards improving the Union's long term security of energy supply and, as President Putin stated, concerning prices and quantities, to put the emphasis on balance.

  For its part, the European Union is prepared to mobilise European technical assistance to facilitate European investments in transport and production in the energy sector (oil, natural gas and electricity). Specific measures should be carefully studied whether they concern a precise legal framework for investments in the energy sector, questions relating to taxation or a guarantee mechanism for investments. These measures should be finalised within the framework of a co-operation and partnership agreement between the European Union and Russia.

- **In addition, we should keep a watchful eye on the development of oil and gas resources in the Caspian sea basin and in particular on transport routes to open up oil and gas production.**

b) Strengthening supply networks

To improve Europe's energy supply, it is not sufficient to ensure the steady procurement of energy sources at reasonable prices and on a long-term basis. It is also necessary to have a supply network with security guarantees. The way in which energy is transported is of fundamental importance for the security of supply. For instance, the European Union imports 90% of its oil by sea. Consequently, it is committed to strengthening the rules and regulations on ships (ban on single hull) and should restore its supply balance by shifting the emphasis towards oil pipelines.

- The construction of new oil and gas pipelines will make it possible to import oil and gas from the Caspian Sea basin and the southern Mediterranean, thereby improving security of supply by diversifying geographic sources of supply. Hence the emphasis in technical assistance programmes such as MEDA and TACIS on improving energy infrastructure.

  In this context, in the MEDA framework, financing should be available for refining ideas and feasibility studies concerning regional infrastructure networks which aim to link national networks among themselves (South-South), or to link these up to transeuropean networks (Transmediterranean). By giving them the label "Euro-Mediterranean partnership"[66], it would be possible to give an additional dimension to large regional projects.

  Likewise, the INOGATE[(67)(68)] and TRACECA[69] programmes are indispensable instruments to open up resources in particular countries (Azerbaijan, Kazakhstan, Turkmenistan).

- In particular, the European Union should ensure that the provisions of the Energy Charter and those of the protocol concerning transit are implemented as soon as possible, mainly by the applicant countries and the NIS. Special attention must also be given to the INOGATE umbrella agreement.

- For imports of electricity, there should be better interconnections between the networks of the Member States and those of the Union with the applicant countries and Russia. This means that, within the Union, bottlenecks should be removed by constructing infrastructure currently lacking. All the Member States would thus be able to benefit from new sources of supply. However, care should be taken to ensure that the development of trade does not in the medium term lead to the placing on the Community market of electricity produced in nuclear power stations whose safety is not guaranteed.

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66 COM(2000) 497 "Reinvigorating the Barcelona Process"

67 Russia has made the first steps towards joining INOGATE and has asked for a EUR 2 million participation.

68 INOGATE: INterstate Oil and Gas. Programme for the development and rehabilitation of oil and gas pipelines in the countries of the former Soviet Union

69 TRACECA: programme for the rehabilitation of transport in the countries of the former Soviet Union. This programme has for the first time enabled the transport of goods from the Caspian Sea by rail.

GUIDELINES FOR THE DEBATE

Three main points emerge from the Green Paper:

- The European Union will become increasingly dependent on external energy sources; enlargement will not change the situation; based on current forecasts, dependence will reach 70% in 2030.

- The European Union has very limited scope to influence energy supply conditions; it is essentially on the demand side that the EU can intervene, mainly by promoting energy saving in buildings and the transport sector.

- At present, the European Union is not in a position to respond to the challenge of climate change and to meet its commitments, notably under the Kyoto Protocol.

In these circumstances, the Commission would like the debate on the future strategy to be structured around the following principal questions:

1. Can the European Union accept an increase in its dependence on external energy sources without compromising its security of supply and European competitiveness? For which sources of energy would it be appropriate, if this were the case, to foresee a framework policy for imports? In this context, is it appropriate to favour an economic approach: energy cost; or geopolitical approach: risk of disruption?

2. Does not Europe's increasingly integrated internal market, where decisions taken in one country have an impact on the others, call for a consistent and co-ordinated policy at Community level? What should such a policy consist of and where should competition rules fit in?

3. Are tax and state aid policies in the energy sector an obstacle to competitiveness in the European Union or not? Given the failure of attempts to harmonise indirect taxation, should not the whole issue of energy taxation be re-examined taking account of energy and environmental objectives?

4. In the framework of an ongoing dialogue with producer countries, what should supply and investment promotion agreements contain? Given the importance of a partnership with Russia in particular, how can stable quantities, prices and investments be guaranteed?

5. Should more reserves be stockpiled -as already done for oil - and should other energy sources be included, such as gas or coal? Should the the Community take on a greater role in stock management and, if so, what should the objectives and modalities be? Does the risk of physical disruption to energy supplies justify more onerous measures for access to resources?

6. How can we ensure the development and better operation of energy transport networks in the European Union and neighbouring countries that enable the internal market to function properly and guarantee security of supply?

7. The development of some renewable energy sources calls for major efforts in terms of Research and Technological Development, investment aid and operational aid. Should co-financing of this aid include a contribution from sectors which received substantial initial development aid and which are now highly profitable (gas, oil, nuclear)?

8. Seeing that nuclear energy is one of the elements in the debate on tackling climate change and energy autonomy, how can the Community find a solution to the problem of nuclear waste, reinforcing nuclear safety and developing research into reactors of the future, in particular fusion technology?

9. Which policies should permit the European Union to fulfil its obligations within the Kyoto Protocol? What measures could be taken in order to exploit fully potential energy savings which would help to reduce both our external dependence and CO2 emissions?

10. Can an ambitious programme to promote biofuels and other substitute fuels, including hydrogen, geared to 20% of total fuel consumption by 2020, continue to be implemented via national initiatives, or are co-ordinated decisions required on taxation, distribution and prospects for agricultural production?

11. Should energy saving in buildings (40% of energy consumption), whether public or private, new or under renovation, be promoted through incentives such as tax breaks, or are regulatory measures required along the lines of those adopted for major industrial installations?

12. Energy saving in the transport sector (32% of energy consumption) depends on redressing the growing imbalance between road haulage and rail. Is this imbalance inevitable, or could corrective action be taken, however unpopular, notably to encourage lower use of cars in urban areas? How can the aims of opening up the sector to competition, investment in infrastructure to remove bottlenecks and intermodality be reconciled?

13. How can we develop more collaborative visions and integrate the long-term dimension into deliberations and actions undertaken by public authorities and other involved parties in order to evolve a sustainable system of energy supply. How are we to prepare the energy options for the future.

COMMISSION OF THE EUROPEAN COMMUNITIES

Green paper

TOWARDS A EUROPEAN STRATEGY FOR ENERGY SUPPLY SECURITY

ANNEXES

ANNEX 1

TECHNICAL BACKGROUND DOCUMENT ON SECURITY OF ENERGY SUPPLY

SUMMARY

The following summary brings together the principle conclusions of the European Commission's Technical Background Document to this Green Paper. This document is available in its entirety from the Commission's services.

The purpose of an EU energy supply security policy is to secure, for the EU, the immediate and longer term availability of a diverse range of energy products at a price which is affordable to all consumers (domestic and industrial) while respecting environmental requirements.

The current debate on energy supply security is conditioned by the following developments analysed below: a) energy demand is rising, both across the EU and candidate countries; b) demand for conventional energy sources (oil, natural gas, nuclear) is rising, c) demand for imported energy sources, such as oil and natural gas, is also rising and d) at least in the short term, without targeted measures, cleaner, more efficient and renewable energy technologies are unlikely to greatly influence these trends. The first challenge for energy supply policy is not to deny or over-dramatise this situation, but to manage it and prevent it developing into a crisis. The second challenge is to balance the need for energy supply policy to cover rising energy needs with environmental, political, social, technical and economic objectives. The third challenge is to develop instruments, such as new and renewable energy technologies, diversification measures and energy efficient practices, which will reduce dependence on imported fuels, cut energy demand, reduce the connection between economic growth and energy consumption and thus improve energy security in the long term.

European energy supply faces different forms of risk – physical, economic and environmental. Thus, there may be a *short term* physical disruption or a *longer term*, perhaps permanent, interruption to supplies of one or more energy sources, or of one or more fuels from a single geographical area. Economically, Europe is susceptible to changes in energy prices – such as the recent rises in the oil price. Finally, environmental pressures are beginning to bear on energy production and use and, ultimately, on supply decisions.

Context

The context for European energy supply policies has changed over the last 30 years as a result of political, environmental, economic and energy market developments, such as enlargement, climate change and liberalisation of energy markets. Policies for a secure energy supply must respect this new framework. Recent developments in energy markets and energy related

policies (environment, economy etc) create new tensions and constraints for governments and administrations. On the one hand, they provide additional targets, as in the case of climate change and the Kyoto Protocol (see below), but on the other, they remove traditional regulatory instruments, such as the direct management of utilities by government, which is no longer applicable in the internal energy market.

These changes mean that it is necessary to look at the whole spectrum of energy supply and demand. This is the purpose of the current document. In general, the short (5 -10years) and medium (10 – 20 years) term. A secure energy supply depends not only on the security of a single energy source, but on the balance of energy markets and the possibility of replacing one source with another source or with other energy policy instrument (e.g. energy savings). Available options need to take into account not only energy supply objectives, but also the wider context outlined below.

At first sight, the aims of energy supply security, competitiveness, environment protection and liberalisation are not always fully compatible. Enlargement of the EU is a further challenge. The task for policy makers will be to reconcile these wider objectives with the aim of assuring secure energy supplies and to develop policies, incentives and instruments, for example energy efficiency, demand side management, diversification of fuel sources and new technology, which can serve shared goals.

Primary energy sources – oil

In terms of risk to security supply, oil remains the most important sources of energy. EU dependence on imported oil is starting to grow despite recent falls. The cost of producing oil in the Middle East is low and supplies in this area are relatively abundant. However, uncertainty surrounds future investment levels and physical availability of Middle East reserves. North Sea oil is expensive to exploit and reserves are limited – at best an estimated 25 years' supply at current production levels. In the past, reductions in energy intensity and the replacement of oil in heat and power applications transformed the market for oil. Nonetheless, demand continues to rise. Unless a breakthrough is reached which removes the almost complete dependence of the expanding transport sector on oil, Europe's reliance on Middle East – and OPEC - oil is likely to be virtually complete in the long term, providing that supplies are technically and geopolitically available. Decisive elements for future oil requirements are the dependence of the growing transportation sector on oil, the risk of price fluctuations, and the development of alternative transport fuels.

Natural gas

Europe's increasing demand for imported natural gas will confirm the need for strong political and physical links to North Africa and Russia, and increase the attraction of suitable pipeline links to the Middle East and Central Asia. Enlargement is likely to confirm market trends for gas, while increasing the EU's dependence on Russia's vast reserves. As in other energy sectors, diversification of supply sources has to be a political priority.

The short-term supply situation for gas is relatively comfortable in terms of reasonable reserves within an economic distance. In the medium term, it remains to be seen whether gas is able to defend or even increase its market share if, as seems inevitable, supply costs rise due to more challenging exploitation conditions and longer transportation distances. Likewise, in the event that Russia and the former Soviet republics are called upon to supply the growing markets of East Asia, EU countries could face significant competition and

increased prices. A set of measures aimed at promoting technological developments, supply diversification and gas-to-gas competition, integration of markets in a wider Europe as well as reinforced relations with external supply and transit countries could enhance supply security.

Solid Fuels

From an economic and energy supply viewpoint, coal is attractive. There are extensive world-wide reserves, including in Europe, and competitive markets keep prices low and stable. However, coal has been phased out from homes (in earlier "clean air" legislation) and, more recently, electricity generation, where gas is the preferred choice. Restructuring of the steel industry has also removed an important customer.

In the long term, coal is likely to remain of interest as new technologies come on stream which reduce extraction costs, reduce emissions and dramatically increase its efficiency. After the expiry of the ECSC Treaty in 2002, mechanisms will remain to monitor prices and promote clean technologies. Thus, it is likely that coal will continue to be used for electricity generation in the long term, to the benefit of energy diversity and security of supply.

Uranium (Nuclear energy)

Nuclear energy in the EU accounts for approximately 23% of installed electricity generation capacity but for 35% of electricity production. Nuclear electricity in Europe depends, with today's technology, on an imported raw material, uranium. The Euratom Treaty, which has security of nuclear fuel supplies as one of its objectives, provides for a specific policy instrument for nuclear fuel supplies via the Euratom Supply Agency. Sources of uranium are more diversified, geographically and physically, than oil and gas. The further steps of the nuclear cycle are largely domestic and, following recycling, the imported resource becomes a domestic resource.

Enlargement of the EU is likely to confirm this situation, because, in general, many of the applicant countries are in a similar situation to nuclear producers within the EU.

Nuclear energy has the attraction that it produces very few emissions of greenhouse gases. Maintaining nuclear energy's current share in electricity generation would keep CO2 emissions in this sector to roughly their 1990 level but would require the construction by 2025 of 100 GWe (some 70 reactors) of nuclear capacity to replace reactors reaching their end of life and to meet increased demand. Keeping existing nuclear plants open for their normal lifetime of 40 years without building new ones would entail exceeding the 1990 emissions level by 4% (Source: Dilemma study). If existing nuclear plants were phased out and replaced with other conventional generating plant, it would become impossible to achieve Kyoto objectives.

Technically, nuclear could provide a non fossil-fuel burning source of electricity that would be capable of filling a substantial part of the gap in electricity supply that would be created if fossil fuel electricity generation were to be drastically reduced as a response to Kyoto. However, the construction time for a nuclear power plant is significantly longer than for fossil fuel plants and newly liberalised electricity markets coupled with public and political opposition to nuclear power (largely related to health and safety factors) are restricting factors. Lifetime extension of existing plants is a step which could be considered. Given the timetable for Kyoto commitments, such issues need to be addressed promptly.

Some Member States (Italy, Sweden, Germany, and Belgium) have decided to phase out nuclear. In others (France, UK, Finland), nuclear is due to remain a key energy for the foreseeable future. Looking beyond 2010, the long lead-in time for new nuclear energy technology means that it is essential to maintain long-term research, partly to find a solution to the problem of waste, and partly to hand down nuclear expertise to future generations.

Renewable energy sources

Renewable energy sources (RES) are attractive to energy supply for environmental and geopolitical reasons. Although, in general, the fuel source is cheap or free, the technology has generally not reached a sufficiently mature stage in order to RES to be economically attractive. Theoretically, renewable energy has the potential to provide a safe, clean and affordable energy supply using indigenous sources, without threat of external disruption or exhaustion of reserves. The Commission has set a target to double the share of renewables from 6% (mostly large hydro) to 12% of total primary energy production in 2010. However, in order to reach this target, specific and targeted action will be necessary. As well as technical barriers, a major obstacle is the high cost of RES technologies compared to the cost of fossil fuels based technologies. This suggests the need for appropriate financial incentives to promote renewables. Another obstacle is the exclusion of external costs from the price of fossil fuels, coupled with an inheritance of subsidies on the part of conventional energies (including nuclear). This implies a distorted market to the detriment of RES. In those sectors where technology is more advanced, e.g. wind, costs have fallen dramatically over the previous decade and continue to fall.

With appropriate investment in the research, development, demonstration and promotion of renewable technologies, for short, medium and long term commercialisation, renewable energy has the potential to help to resolve, in an environmentally and economically acceptable way, many issues facing Europe's long term energy supply. In particular, full development of renewable energy sources could play a large part in reducing greenhouse gas emissions from electricity production. However, this would require the early introduction of targeted measures, economic incentives and vigorous marketing.

Supply disruption

There are three sources of threats to secure energy supply – economic, physical and environmental, as described above. Disruptions to energy supply, whether actual or threatened, can have dramatic effects on society and the economy. Thus, the disruptions to oil supply in the 1970's, which were both economic and physical, led to international action to improve supply security, through the (newly created) IEA and the EU. More recently, the principles of subsidiarity and liberalisation have underlined the responsibilities of Member States and utilities for governing their own stocks, reserve planning and crisis mechanisms in the event of a disruption to supplies. New crisis management systems may be developed as a result of liberalisation, as the roles of companies and regulators become more clearly defined. Oil is the focus of recent legislation which improved the quality of the EU's strategic stocks of 90 days of consumption. Efforts are currently underway to improve the EU's crisis management system. For gas, a committee has recently been established at EU level to monitor short and long term security of supply developments. For uranium and coal stocks, reporting mechanisms exist. In general, the impact of the single market and competition has been to put pressure on utilities to reduce their stockpiles.

Demand for Energy

Risks to energy supply can be quickly and cheaply addressed by reductions in energy demand. Managing energy demand is an important instrument in reducing consumption, preserving finite reserves, mitigating supply difficulties and facilitating sustainable growth. Energy intensity has been falling and is expected to decrease further, but electricity intensity will increase as the EU economy moves to more services and high added value activities. EU energy efficiency has gained 7% since 1990, but only 3% since 1993, although economic growth has resumed. Improvements in energy efficiency have failed to keep up with growing demand, such that consumption has continued to rise. Rising consumption, encouraged by rising purchasing power, increases pressure on energy supplies. In general, reducing demand is not a priority for privatised utilities. The risk is that, without new incentives and promotion of energy efficient products, consumer interest in energy efficiency will decline and the demand for new, more efficient technologies will decline.

Unless energy efficiency improvements keep pace with increased demand, increased demand will lead to higher consumption and greater strain on energy supplies. The recent trend has been that rises in consumption have outstripped investments in energy efficiency. For example, buildings are gradually becoming better insulated, but demand for other appliances and services, requiring increased energy use, often offset efficiency gains. Likewise, road vehicles have improved their efficiency, but cars have become bigger, heavier and with more energy-consuming devices. Despite significant increases in petrol prices recently, the number of cars and passenger kilometres is expected to rise. The challenge in this area is to reverse the trend of rises in consumption outstripping gains in energy efficiency.

The enormous potential for energy savings in the buildings and transport sectors indicates the progress which could be made in reducing consumption and improving supply prospects if these sectors were to be targeted. However this would require a combination of factors, such as energy prices which reflected wider costs to society, regulations to eliminate inefficient products or practices and consumer education. Nevertheless, the additional benefits of such action, for example in reducing emissions, cutting energy bills and creating jobs, argue for urgent action.

Fuel Balance

On the positive side, it is unlikely that the EU's global energy market will be so dependent on a single sector as it was in the 1970's, when oil accounted for over 60% of primary energy supply. This figure is now down to 44%. However, it remains the case that the transport sector's almost complete dependence on oil, coupled with its stubbornly rising demand for oil and, consequently, dollars, is an Achilles' heel for Europe's economy. A further improvement in energy supply prospects is the creation in recent years of new European networks and decentralised generation. Further, the world energy market is now in many ways globally organised and interdependent, the result of which is that market changes affect economies similarly across the globe. Nevertheless, the EU's control or influence over its energy supply could still be hampered, particularly in a risk situation, as a result of its growing dependence on imports from areas outside its traditional economic sphere. In the short and medium term, this appears to be a trend which affects all conventional energy sectors. It is therefore imperative that solutions should be found which increase diversity of fuel supply, give emphasis to reliable and stable external supplies and improve the viability of indigenous resources, while in parallel reducing the overall need for energy.

Energy technology

Energy technology will be critical in meeting the needs of current and future generations and de-linking economic growth from growing energy demand and environmental degradation, both in the present EU and in an enlarged Europe. In the energy field, technological change does not come cheap: research is expensive and requires a long development and lead-in period and the pay back is often uncertain. Successful marketing and consumer education are also key factors in translating technology know-how into viable products.

Governments have for many years recognised the need for intervention in the energy sector to provide the right incentives and price signals to firms and influence consumers' awareness and behaviour. Thus, public funding, including from the European Community, often has a pivotal role in financing basic research, developing innovative technologies and promoting the substantial stock of energy-efficient technologies that are close to being competitive. There is also growing interest in seeking ways of increasing the impact and appeal of new technologies by combining them in large-scale collaborative projects which cut across conventional sectors.

Energy technology is a useful instrument of energy supply security and can complement objectives in other policy areas, in particular the environment and economics. It offers the means to improve energy efficiency, reduce energy intensity and vastly increase the share of clean, durable and renewable energy use. It also has potential to influence global patterns of energy use and production, as advanced European technologies can provide developing countries with more sustainable and less damaging means towards economic growth.

Transport of fuel into the EU (Transit)

The growing demand for external energy supplies will place additional pressure on existing supply routes and necessitate the development of new routes. This has implications for the availability and price of supplies. Secure energy supplies depend not only on the availability of reserves, but also on such factors as the capacity of countries to provide adequate quantities, the willingness of third countries to permit transit, the technical and financial resources to create and maintain transit routes and an international framework which creates stable trading conditions. The need to transport energy into Europe gives added emphasis to international co-operation, both between the EU and its suppliers and among suppliers and their neighbours, foreign policy, finance, trade agreements and technical collaboration. In this context, the Energy Charter Treaty and the Energy Charter process are important tools in creating a stable framework for energy supply and energy transit for the EU.

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One of the key aims of EU energy policy is a diverse, secure, environmentally friendly and cost effective EU energy supply. This requires an appropriate political, socio-economic, business and technology climate, both within the EU and world-wide. Against this background, the Technical Background Document presents those factors related to energy supply and other relevant matters which have influenced the Commission's preparation of its Green Paper on Energy Supply Security.

ANNEX 2

NOTE ON THE IMPACT OF FUEL TAXATION ON TECHNOLOGY CHOICE

A Study Commissioned Within Framework Contract for Long Range Energy Modelling (ENER/4.1040/001)

By Prof. P. Capros, N. Kouvaritakis, Dr. L. Mantzos, V. Panos and E. L. Vouyoukas

Athens, November 2000

1. INTRODUCTION

The objective of this part of the study is to investigate the possible impact of fiscal intervention in the form of taxation or subsidies on energy consumer choices in EU Member States. In deciding on a type of equipment to invest, energy consumers start with a need for useful energy and consider alternative options taking into account their complete system costs including investment costs and fixed and variable operating and maintenance costs. Usually fuel costs form a large part of variable operating costs and taxation can substantially affect them. Clearly taxes and subsidies have often been applied precisely in order to influence choices. However it is also the case that in some instances the aims of the discrimination may refer to past policy considerations, the taxes and subsidies having survived through institutional inertia and as a revenue collection expedient without necessarily reflecting present policy concerns.

The analysis presented here utilises the latest data available on fuel taxation in EU Member States (as published by the European Commission in March 2000) and provisional data for fuel prices in 2000. Data on subsidies on coal are taken from the PRIMES model database (as they were determined after discussions with experts from the different Member States in the context of the Shared Analysis project).

The PRIMES model database was also the source for the technico-economic data on the different technologies used by energy consumers in computing the average production cost for the different energy uses.

Alternative fuels and technologies are examined in the following sectors:

1. Power generation
2. Steam generation by industrial boilers and CHP plants
3. Space heating in households
4. Private cars

The methodology adopted for carrying out the comparison was to assume for each sector that a "typical" energy consumer requiring new energy consuming equipment either to replace old equipment or in the form of new energy needs was faced with "average" conditions concerning the main parameters for the choice. It is important to note that the calculations do not refer to the economics of using existing equipment which in most cases could be cost effective irrespective of whether the consumer would have chosen to replace it by the same type of equipment or not.

Depending on the size of the equipment, economies of scale in terms of investment costs and fixed and variable operating and maintenance costs may be experienced differentially for different equipment types. The approach adopted obviously does not take into account such nuances.

Similarly bulk fuel purchases and conditions of delivery (for example interruptibility) may result in considerably lower unit fuel costs and conversely small deliveries may incur fixed surcharges. Such price modulation is normal, being based on delivery cost considerations and differs from fuel to fuel. It is not very marked for oil products which by their nature are easy to store, transport and handle but can be very pronounced for electricity, natural gas and coal. The latter's price is also subject to very wide geographical variations, the proximity of suitable ports and other necessary transportation and handling infrastructure playing a decisive role in shaping total delivery costs which can in some instances be very substantial. Here again the condensation implied by "average" conditions leaves outside such considerations.

The base year for the analysis is 2000 when in many ways conditions in the energy markets have been very different from those that prevailed during the last decade (more precisely since 1991). Since early summer there has been a strong rally of international crude oil prices accompanied and often led by even stronger movements in spot prices of petroleum products and notably the key middle distillates. Natural gas import prices which are still to a considerable extent linked by pricing formulae to spot prices of petroleum products have been rising with the appropriate time lags but the increases to gas prices to the final consumers are still relatively modest. Coal prices on the other hand do not seem to have been affected. Since average yearly prices have been used for the analysis the picture that emerges from the above developments is of clear shifts in the competitiveness of different fuels in a rather transitional environment. Furthermore although high crude oil prices of around € 36 were assumed to the end of the year it would be very risky to conclude that relative prices and their competitive implications would remain as assumed here even in the next few years given the volatility of markets recently.

The above qualifications should serve as a note of caution against an over-interpretation of the results of the present analysis especially regarding absolute levels of costs. In general a relatively small difference in competitiveness should be taken as an indication of a high likelihood that under slightly different conditions (which are anyway uncertain for the reasons stated above) rankings could be reversed.

2. POWER GENERATION

For the purposes of the analysis concerning power generation eight typical technologies were selected:

- A Pressurised Fluidised Bed Combustion plant (PFBC) representing a clean coal technology which is currently widely available
- A monovalent lignite (brown coal) power plant fitted with de-sulphurisation units, which still represents the dominant choice for generating electricity from lignite. For Finland, Ireland and Sweden under this heading are included the peat fired plants
- A monovalent low sulphur heavy fuel oil plant
- A Combined Cycle Gas Turbine (GTCC) plant which due to very important capital cost reductions and spectacular increases in overall efficiency has become the prime choice for power production over a wide range of load requirements
- A monovalent thermal plant using biomass or waste as a fuel where the type and cost of the biomass varies from country to country depending on conditions arising from industrial structure (existence of industries producing usable waste), sufficient agricultural waste in adequate density per square kilometre, the possibility of using plantations etc.
- Large on-shore wind turbines on very windy sites and hence with levels of availability that are somewhat above the average recorded in the statistics for the different countries

- Solar photovoltaic cells which naturally represent small scale applications with availability differentiated according to three insulation zones (high, medium and low) corresponding approximately to the Mediterranean, mid-latitude and Northern European countries

- A large (over one GigaWatt) Pressurised Water Reactor nuclear power plant (PWR)

Production costs were computed for three different levels of power plant utilisation (7000 hours, 5000 hours and 2500 hours) corresponding indicatively to the utilisation rates of very heavy electricity intensive industrial plant, small scale industrial uses or energy intensive services and average household equipment utilisation.

Table 1 illustrates the production cost of the alternative power generation technologies operating at 7000 hours (figures in bold indicate the "least" cost solution). At this level of utilisation, Denmark apart, the most economic options appear to be GTCC and PFBC (imported hard coal fired) technologies. PFBC plants seem to enjoy a fairly clear advantage in Germany and Italy while GTCC an even more marked advantage in Belgium, the Netherlands, Finland and the United Kingdom. These differences are almost exclusively due to variation in the price of natural gas to power generators in the various countries. Even at these high utilisation rates the PWR nuclear generating technology option is uncompetitive in almost all EU countries due to very high capital costs. The only exception is France where streamlining of licensing and construction procedures, the existence of an adequate infrastructure and learning by doing experience has meant that construction times and hence costs are significantly lower than elsewhere in the EU. However even in France PWRs remain a reasonably competitive option only for such very high loads. Wind Power is an unambiguously attractive option in Denmark due to lower costs and an adequate policy support but fall significantly short of the most economic option in all other EU countries.

Removing excise taxes and subsidies does not significantly alter the ranking of options. It works primarily in favour of GTCC, natural gas being taxed heavily in some countries (Denmark and to a lesser extent Italy and Germany). In Denmark GTCC becomes by far the most attractive option while in Italy GTCC generating costs approach PFBC sufficiently to suggest that away from specially designed coal handling port facilities GTCC would be preferable even for such high utilisation rates. As for the effect of the removal of German domestic coal subsidies although it obviously makes the option more expensive they were not sufficient to make German coal attractive for new users in the first place. As can be seen in the table, excise taxes[1] lead to market distortion, in terms of technology choice, only in the cases of Denmark and Germany (in both cases operating in favour of coal and to the detriment of natural gas). This result is largely explained by the fact that in most EU Member States the excise taxes applied on fuels used in power generation are rather small (zero in many cases) with the exception of fuel oil, which, however, is not a competitive solution.

[1] In the case of Germany there is a subsidy on domestic coal prices

Table 1: Production cost of power generation technologies at 7000 hours

Production cost (Euro'90/KWh) for power plant operating at 7000 hours									
	with excise taxes/subsidies								
	PFBC (imported coal)	PFBC (domestic coal)	Monovalent Lignite	Monovalent Fuel oil	GTCC	Monovalent biomass-waste	Wind turbines*	Solar photovoltaic*	Nuclear
Austria	0.036	na	0.040	0.054	**0.034**	0.036	0.048	0.483	0.059
Belgium	0.032	na	na	0.050	**0.028**	0.037	0.048	0.483	0.040
Denmark	0.037	na	na	0.098	0.041	0.039	**0.034**	0.644	0.059
Finland	0.032	na	0.036	0.056	**0.026**	0.039	0.048	0.644	0.038
France	**0.032**	0.041	0.039	0.056	0.032	0.040	0.040	0.386	0.034
Germany	**0.032**	0.038	0.040	0.055	0.038	0.043	0.045	0.483	0.051
Greece	0.035	na	0.040	0.056	**0.035**	0.040	0.048	0.386	0.046
Ireland	**0.032**	na	0.037	0.050	0.032	0.045	0.048	0.644	0.047
Italy	**0.032**	na	na	0.049	0.038	0.040	0.048	0.386	0.050
The Netherlands	0.036	na	na	0.054	**0.027**	0.040	0.044	0.483	0.051
Portugal	**0.032**	na	na	0.049	0.034	0.043	0.048	0.386	0.059
Spain	0.036	0.050	0.038	0.053	**0.035**	0.043	0.047	0.386	0.047
Sweden	0.036	na	0.039	0.087	**0.033**	0.034	0.048	0.644	0.047
United Kingdom	0.032	0.045	na	0.055	**0.026**	0.038	0.044	0.483	0.043
	without excise taxes/subsidies								
	PFBC (imported coal)	PFBC (domestic coal)	Monovalent Lignite	Monovalent Fuel oil	GTCC	Monovalent biomass-waste	Wind turbines*	Solar photovoltaic*	Nuclear
Austria	0.036	na	0.040	0.049	**0.034**	0.036	0.072	0.640	0.059
Belgium	0.032	na	na	0.049	**0.028**	0.037	0.072	0.640	0.040
Denmark	0.036	na	na	0.049	**0.029**	0.039	0.067	0.853	0.059
Finland	0.032	na	0.036	0.049	**0.026**	0.039	0.072	0.853	0.038
France	**0.032**	0.041	0.039	0.049	0.032	0.040	0.072	0.512	0.034
Germany	**0.032**	0.041	0.040	0.049	0.035	0.043	0.068	0.640	0.051
Greece	0.035	na	0.040	0.048	**0.035**	0.040	0.072	0.512	0.046
Ireland	**0.032**	na	0.037	0.049	0.032	0.045	0.072	0.853	0.047
Italy	**0.032**	na	na	0.049	0.034	0.040	0.072	0.512	0.050
The Netherlands	0.036	na	na	0.050	**0.026**	0.040	0.072	0.640	0.051
Portugal	**0.032**	na	na	0.049	0.034	0.043	0.072	0.512	0.059
Spain	0.036	0.050	0.038	0.051	**0.035**	0.043	0.071	0.512	0.047
Sweden	0.036	na	0.039	0.052	**0.033**	0.034	0.072	0.853	0.047
United Kingdom	0.032	0.045	na	0.049	**0.026**	0.038	0.072	0.640	0.043

*For intermittent generating options the 7000 hours refer to availability of equipment and not overall availability which is clearly much lower and has been taken into account in the calculations

When examining the cost effectiveness of alternative solutions in power generation for plants operating at 5000 hours (see Table 2) it is clear that the low capital costs of GTCC renders this option even more attractive. The only countries where PFBCs retain a clear advantage are Germany and Italy mainly due to the excise taxes applied in these countries. Obviously this advantage is virtually neutralised in the case of removal of excise taxes and subsidies. All other plant types in the list considered are clearly unattractive irrespective of the presence or not of excise taxes and subsidies. The above result is explained by the fact that at lower operating levels the role of fuel price in total operating cost becomes less significant.

At 2500 hours the findings presented above are accentuated GTCC becoming by far the dominant option everywhere. The presence of excise taxes or subsidies does not result in any market distortion as regards producer choices (see Table 3).

Table 2: Production cost of power generation technologies at 5000 hours

Production cost (Euro'90/KWh) for power plant operating at 5000 hours							
	with excise taxes/subsidies						
	PFBC (imported coal)	PFBC (domestic coal)	Monovalent Lignite	Monovalent Fuel oil	GTCC	Monovalent biomass-waste	Nuclear
Austria	0.043	na	0.050	0.061	**0.039**	0.045	0.080
Belgium	0.039	na	na	0.056	**0.032**	0.046	0.053
Denmark	**0.045**	na	na	0.104	0.045	0.048	0.080
Finland	0.039	na	0.045	0.062	**0.030**	0.048	0.050
France	0.039	0.049	0.048	0.063	**0.036**	0.049	0.045
Germany	**0.039**	0.046	0.050	0.061	0.043	0.052	0.068
Greece	0.042	na	0.049	0.062	**0.039**	0.049	0.062
Ireland	0.039	na	0.046	0.057	**0.036**	0.054	0.063
Italy	**0.039**	na	na	0.055	0.043	0.049	0.067
The Netherlands	0.043	na	na	0.061	**0.031**	0.049	0.069
Portugal	0.039	na	na	0.055	**0.039**	0.052	0.080
Spain	0.043	0.059	0.048	0.060	**0.039**	0.052	0.063
Sweden	0.043	na	0.048	0.094	**0.038**	0.041	0.063
United Kingdom	0.040	0.053	na	0.062	**0.030**	0.048	0.057
	without excise taxes/subsidies						
	PFBC (imported coal)	PFBC (domestic coal)	Monovalent Lignite	Monovalent Fuel oil	GTCC	Monovalent biomass-waste	Nuclear
Austria	0.043	na	0.050	0.055	**0.039**	0.045	0.080
Belgium	0.039	na	na	0.055	**0.032**	0.046	0.053
Denmark	0.043	na	na	0.055	**0.034**	0.048	0.080
Finland	0.039	na	0.045	0.055	**0.030**	0.048	0.050
France	0.039	0.049	0.048	0.055	**0.036**	0.049	0.045
Germany	**0.039**	0.049	0.050	0.055	0.039	0.052	0.068
Greece	0.042	na	0.049	0.055	**0.039**	0.049	0.062
Ireland	0.039	na	0.046	0.055	**0.036**	0.054	0.063
Italy	0.039	na	na	0.055	**0.039**	0.049	0.067
The Netherlands	0.043	na	na	0.056	**0.030**	0.049	0.069
Portugal	0.039	na	na	0.055	**0.039**	0.052	0.080
Spain	0.043	0.059	0.048	0.058	**0.039**	0.052	0.063
Sweden	0.043	na	0.048	0.058	**0.038**	0.041	0.063
United Kingdom	0.040	0.053	na	0.055	**0.030**	0.048	0.057

The overall taxation burden on fuels for power generation is relatively low as there is a general reluctance to tax what is effectively an input to production. The only notable exception to this in most countries is the taxation on heavy fuel oil introduced in the past in response to the oil crises of the seventies and early eighties in order to accelerate substitution away from an insecure fuel form in a sector that was characterised by the presence of many alternatives. This process of substitution is now virtually completed and the disadvantages of fuel oil burning equipment compared with new types of plant presently available is such as to make it a highly unattractive choice for new equipment even without the taxes on the fuel. In this sense the tax is currently irrelevant with regard to fuel choices (and becoming increasingly so even as a revenue raising devise).

In general the dominance in terms of competitiveness of the GTCC option for widely varying utilisation rates is very marked in virtually all EU countries. This dominance is accentuated when taxes and subsidies are removed. Subsidies and supports on renewable forms of power and notably wind power play a significant role in enhancing their attractiveness. However with very few exceptions the costs of these technologies is still high and the level of support is not sufficient to make them into credible alternatives for wide use.

Consequently the present levels of excise taxes and subsidies in power generation do not seem to have a significant impact on the competitiveness of fuels and technologies in the sector.

Table 3: Production cost of power generation technologies at 2500 hours

Production cost (Euro'90/KWh) for power plant operating at 2500 hours							
	with excise taxes/subsidies						
	PFBC (imported coal)	PFBC (domestic coal)	Monovalent Lignite	Monovalent Fuel oil	GTCC	Monovalent biomass-waste	Nuclear
Austria	0.070	na	0.082	0.083	**0.054**	0.078	0.153
Belgium	0.065	na	na	0.079	**0.047**	0.078	0.098
Denmark	0.071	na	na	0.127	**0.061**	0.080	0.153
Finland	0.065	na	0.078	0.085	**0.046**	0.081	0.093
France	0.065	0.079	0.080	0.085	**0.052**	0.081	0.084
Germany	0.065	0.076	0.082	0.084	**0.059**	0.084	0.129
Greece	0.067	na	0.080	0.084	**0.054**	0.080	0.116
Ireland	0.065	na	0.078	0.079	**0.049**	0.086	0.119
Italy	0.065	na	na	0.078	**0.059**	0.082	0.127
The Netherlands	0.070	na	na	0.083	**0.047**	0.081	0.130
Portugal	0.065	na	na	0.078	**0.054**	0.084	0.153
Spain	0.070	0.088	0.080	0.082	**0.055**	0.084	0.120
Sweden	0.070	na	0.080	0.116	**0.054**	0.068	0.118
United Kingdom	0.066	0.083	na	0.084	**0.046**	0.080	0.107
	without excise taxes/subsidies						
	PFBC (imported coal)	PFBC (domestic coal)	Monovalent Lignite	Monovalent Fuel oil	GTCC	Monovalent biomass-waste	Nuclear
Austria	0.070	na	0.082	0.078	**0.054**	0.078	0.153
Belgium	0.065	na	na	0.078	**0.047**	0.078	0.098
Denmark	0.070	na	na	0.078	**0.050**	0.080	0.153
Finland	0.065	na	0.078	0.078	**0.046**	0.081	0.093
France	0.065	0.079	0.080	0.078	**0.052**	0.081	0.084
Germany	0.065	0.079	0.082	0.078	**0.055**	0.084	0.129
Greece	0.067	na	0.080	0.077	**0.054**	0.080	0.116
Ireland	0.065	na	0.078	0.078	**0.049**	0.086	0.119
Italy	0.065	na	na	0.078	**0.055**	0.082	0.127
The Netherlands	0.070	na	na	0.078	**0.046**	0.081	0.130
Portugal	0.065	na	na	0.078	**0.054**	0.084	0.153
Spain	0.070	0.088	0.080	0.080	**0.055**	0.084	0.120
Sweden	0.070	na	0.080	0.080	**0.054**	0.068	0.118
United Kingdom	0.066	0.083	na	0.078	**0.046**	0.080	0.107

3. STEAM GENERATION FROM INDUSTRIAL BOILERS

Four different types of industrial boilers were examined in the analysis i.e. boilers using coal, fuel oil, diesel oil and natural gas. In addition three characteristic Combined Heat and Power (CHP) plants: a PFBC burning hard coal, a fuel oil plant and a GTCC plant were also considered. The GTCC CHP can attain very high overall thermal efficiencies in electricity production and by injecting additional fuel into the waste heat boiler it can produce high temperature steam which can be used for the usual industrial steam applications. The method used for the computation of costs for CHP plants was to calculate the total cost of producing the steam together with the power and then deduct the value of the electricity produced. The benchmark used for the calculation of that value was the minimum cost per kWh as it is presented in tables 1 to 3 above. In other words it is representative of the minimum price at which the co-generation producer should reasonably expect to sell the power. Clearly if instead of selling outside the industrial unit, it was assumed that the electricity was used to satisfy own demand the avoided cost could be higher and the cost of the co-generated steam correspondingly lower.

Again, as in power generation, the operating cost of the alternative steam raising systems was computed for 7000, 5000 and 2500 hours. These represent a very high, normal (two shifts) and very low load for industrial steam. The results of the comparison of steam production costs with and without excise taxes are presented in Table 4-Table 6 below.

Table 4: Production cost of steam generation from industrial boilers at 7000 hours

Production cost (Euro'90/KWh) for CHP plant / boiler operating at 7000 hours						
	with excise taxes/subsidies					
	CHP plant			**Boiler**		
	PFBC (imported coal)	Monovalent Fuel oil	GTCC	Coal	Fuel oil	Natural gas
Austria	0.008	0.031	**0.006**	0.018	0.024	0.017
Belgium	0.009	0.032	**0.005**	0.018	0.022	0.014
Denmark	**0.009**	0.085	0.014	0.019	0.047	0.022
Finland	0.011	0.041	**0.003**	0.022	0.026	0.014
France	**0.005**	0.036	0.005	0.024	0.026	0.016
Germany	**0.005**	0.034	0.014	0.037	0.023	0.019
Greece	0.006	0.032	**0.005**	0.020	0.026	0.019
Ireland	**0.005**	0.029	0.007	0.019	0.022	0.020
Italy	**0.005**	0.026	0.014	0.016	0.027	0.019
The Netherlands	0.015	0.038	**0.004**	0.018	0.025	0.015
Portugal	**0.005**	0.026	0.008	0.018	0.026	0.017
Spain	0.007	0.029	**0.006**	0.019	0.024	0.016
Sweden	0.009	0.072	**0.005**	0.018	0.041	0.017
United Kingdom	0.012	0.041	**0.003**	0.019	0.027	0.014
	without excise taxes/subsidies					
	CHP plant			**Boiler**		
	PFBC (imported coal)	Monovalent Fuel oil	GTCC	Coal	Fuel oil	Natural gas
Austria	0.008	0.024	**0.006**	0.018	0.021	0.017
Belgium	0.009	0.030	**0.005**	0.018	0.021	0.014
Denmark	0.013	0.029	**0.004**	0.015	0.021	0.015
Finland	0.011	0.032	**0.003**	0.015	0.021	0.012
France	**0.005**	0.026	0.005	0.024	0.022	0.016
Germany	**0.005**	0.026	0.009	0.037	0.021	0.017
Greece	0.006	0.023	**0.005**	0.019	0.023	0.018
Ireland	**0.005**	0.026	0.007	0.019	0.021	0.020
Italy	**0.005**	0.026	0.008	0.016	0.022	0.018
The Netherlands	0.016	0.033	**0.003**	0.018	0.022	0.014
Portugal	**0.005**	0.026	0.008	0.018	0.024	0.017
Spain	0.007	0.026	**0.006**	0.018	0.023	0.016
Sweden	0.009	0.028	**0.005**	0.018	0.023	0.017
United Kingdom	0.012	0.032	**0.003**	0.019	0.023	0.014

Table 5: Production cost of steam generation from industrial boilers at 5000 hours

Production cost (Euro'90/KWh) for CHP plant / boiler operating at 5000 hours						
	with excise taxes/subsidies					
	CHP plant			**Boiler**		
	PFBC (imported coal)	Monovalent Fuel oil	GTCC	Coal	Fuel oil	Natural gas
Austria	0.012	0.034	**0.006**	0.021	0.026	0.017
Belgium	0.013	0.034	**0.005**	0.020	0.023	0.014
Denmark	**0.007**	0.081	0.008	0.021	0.048	0.022
Finland	0.015	0.044	**0.004**	0.024	0.028	0.014
France	0.008	0.038	**0.005**	0.027	0.027	0.017
Germany	**0.006**	0.034	0.011	0.039	0.024	0.020
Greece	0.010	0.035	**0.006**	0.023	0.027	0.020
Ireland	0.009	0.032	**0.008**	0.021	0.024	0.021
Italy	**0.006**	0.026	0.011	0.019	0.029	0.020
The Netherlands	0.019	0.041	**0.004**	0.020	0.026	0.016
Portugal	0.006	0.026	**0.006**	0.020	0.028	0.017
Spain	0.011	0.032	**0.006**	0.021	0.025	0.017
Sweden	0.013	0.075	**0.006**	0.020	0.043	0.017
United Kingdom	0.016	0.043	**0.004**	0.022	0.028	0.014
	without excise taxes/subsidies					
	CHP plant			**Boiler**		
	PFBC (imported coal)	Monovalent Fuel oil	GTCC	Coal	Fuel oil	Natural gas
Austria	0.012	0.026	**0.006**	0.021	0.023	0.017
Belgium	0.013	0.033	**0.005**	0.020	0.023	0.014
Denmark	0.016	0.031	**0.005**	0.018	0.023	0.015
Finland	0.015	0.035	**0.004**	0.018	0.023	0.012
France	0.009	0.029	**0.005**	0.027	0.023	0.017
Germany	**0.006**	0.026	0.006	0.039	0.023	0.017
Greece	0.010	0.026	**0.006**	0.022	0.024	0.019
Ireland	0.009	0.029	**0.008**	0.021	0.023	0.021
Italy	0.006	0.026	**0.006**	0.019	0.023	0.018
The Netherlands	0.020	0.036	**0.004**	0.020	0.023	0.015
Portugal	0.006	0.026	**0.006**	0.020	0.025	0.017
Spain	0.011	0.029	**0.006**	0.020	0.024	0.017
Sweden	0.013	0.031	**0.006**	0.020	0.024	0.017
United Kingdom	0.016	0.035	**0.004**	0.022	0.025	0.014

Table 6: Production cost of steam generation from industrial boilers at 2500 hours

Production cost (Euro'90/KWh) for CHP plant / boiler operating at 2500 hours						
	with excise taxes/subsidies					
	CHP plant			**Boiler**		
	PFBC (imported coal)	Monovalent Fuel oil	GTCC	Coal	Fuel oil	Natural gas
Austria	0.025	0.043	**0.006**	0.030	0.030	0.020
Belgium	0.027	0.044	**0.007**	0.029	0.028	0.017
Denmark	0.020	0.090	**0.008**	0.030	0.053	0.025
Finland	0.028	0.053	**0.004**	0.033	0.032	0.017
France	0.022	0.047	**0.006**	0.036	0.032	0.020
Germany	0.015	0.039	**0.007**	0.048	0.029	0.022
Greece	0.023	0.046	**0.007**	0.032	0.032	0.023
Ireland	0.025	0.043	**0.011**	0.031	0.028	0.024
Italy	0.015	0.031	**0.007**	0.028	0.034	0.023
The Netherlands	0.033	0.050	**0.004**	0.029	0.031	0.018
Portugal	0.020	0.036	**0.006**	0.029	0.032	0.020
Spain	0.024	0.041	**0.007**	0.030	0.030	0.020
Sweden	0.026	0.084	**0.006**	0.029	0.047	0.020
United Kingdom	0.029	0.052	**0.004**	0.031	0.033	0.017
	without excise taxes/subsidies					
	CHP plant			**Boiler**		
	PFBC (imported coal)	Monovalent Fuel oil	GTCC	Coal	Fuel oil	Natural gas
Austria	0.025	0.036	**0.006**	0.030	0.027	0.020
Belgium	0.027	0.043	**0.007**	0.029	0.027	0.017
Denmark	0.030	0.040	**0.005**	0.027	0.027	0.018
Finland	0.028	0.044	**0.004**	0.027	0.027	0.015
France	0.022	0.038	**0.006**	0.036	0.028	0.020
Germany	0.019	0.035	**0.007**	0.048	0.027	0.020
Greece	0.023	0.036	**0.007**	0.031	0.029	0.022
Ireland	0.025	0.041	**0.011**	0.031	0.027	0.024
Italy	0.019	0.035	**0.006**	0.028	0.028	0.021
The Netherlands	0.034	0.045	**0.004**	0.029	0.028	0.018
Portugal	0.020	0.036	**0.006**	0.029	0.030	0.020
Spain	0.024	0.038	**0.007**	0.029	0.029	0.020
Sweden	0.026	0.040	**0.006**	0.029	0.029	0.020
United Kingdom	0.029	0.044	**0.004**	0.031	0.029	0.017

The most striking observation than can be made by looking at the above tables is that CHP, in one form or another, appears to be cost effective compared to all steam-only boiler systems in all countries, for all three utilisation rates and irrespective of whether excise duties are included or not. This is clearly due to the very high overall efficiencies that characterise CHP systems and their very competitive costs. This often overwhelming advantage does not however imply that CHP is currently capable of sweeping the whole market for new steam raising equipment. A lot depends on whether an adequate institutional and regulatory regime is in place for facilitating sales of excess electricity into the grid. Furthermore CHP plants are characterised by considerable economies of scale which may inhibit their application for small-scale steam requirements.

Among the CHP types examined the natural gas burning GTCC seems to be the most cost effective in the majority of cases, its advantage increasing with the removal of excise taxes and with the decrease of the utilisation rate. The latter occurs because of the considerably lower capital costs of GTCC CHP compared to the PFBC alternative. For the higher utilisation rates the PFBC seems to enjoy a substantial advantage in some countries (Denmark, Germany, Italy and Portugal) with high natural gas prices often due to taxation. These advantages persist in some cases (Germany, Italy) when considering the 5000-hour utilisation rate (although in this case they disappear when excise duties are removed). Such advantages as appear to be enjoyed by coal fired CHP in some countries should

however be qualified by the requirement that the plant should be located in areas with easy access to coal importing port facilities and at a considerable distance from inhabited areas for air quality reasons. Oil fired CHP is characterised by low conversion efficiencies and fails to compete successfully with coal (let alone gas) even for the low utilisation rates and even in the absence of excise duties.

As mentioned in the previous paragraph steam-only boilers suffer from considerable competitive disadvantages compared with CHP but the latter may not represent a valid option in all cases. The dominance of natural gas within the steam-only segment is if anything more complete than GTCC within the CHP. Even for very high utilisation rates and in countries where gas prices to industrial users are particularly high (Denmark, Italy, Ireland) the relative advantage of coal fired boilers is slight and is virtually wiped out once excise duties are removed. Concerning the 2500 hours per year utilisation rate heavy fuel oil boilers can be competitive in many countries vis-à-vis coal fired ones and definitely become so in the absence of excise duties. This however does not occur anywhere vis-à-vis the natural gas equivalents.

In general such excise duties and subsidies as exist in the industrial steam-raising sector seem to have some effect in encouraging coal use in cases of very high utilisation rates. It seems that these duty structures were designed to produce just this type of result in an effort to diversify supplies to industry in order to enhance energy security. The emergence of low capital cost gas technologies and especially GTCC CHP with very high overall thermal efficiencies has meant that most of the discrimination mentioned above has been to a large extent neutralised. Consequently fiscal measures seem to influence little the choices in this sector with the exception of some highly localised of its segments.

4. SPACE HEATING IN HOUSEHOLDS

In evaluating the effect of excise taxes on household choice regarding space heating equipment three alternative technologies were examined, namely central heating equipment using gas oil, central heating equipment using natural gas and electric heat pumps. One representative dwelling type was considered (of a size of 90 square meters). Differences in weather conditions in different Member States were also taken into account since the severity of weather conditions influences the utilisation rate of installed equipment. Table 7 illustrates the results of the analysis.

Table 7: Annualised system costs cost for space heating in households

	Production cost (Euro'90/toe-useful) for space heating					
	with excise taxes			without excise taxes		
	Gasoil	Natural gas	Electricity	Gasoil	Natural gas	Electricity
Austria	614	**533**	1124	508	**456**	1041
Belgium	511	**441**	952	484	**415**	936
Denmark	875	**821**	1636	477	**404**	718
Finland	583	**303**	603	478	**267**	522
France	606	**442**	1092	489	**437**	1006
Germany	574	**468**	851	478	**429**	782
Greece	891	**470**	845	532	**470**	845
Ireland	525	**478**	708	**459**	478	708
Italy	1097	**738**	851	513	**432**	744
The Netherlands	558	**460**	806	467	**353**	611
Portugal	673	**513**	1219	574	**513**	1218
Spain	662	**562**	1035	**550**	553	1001
Sweden	824	**448**	911	495	**448**	719
United Kingdom	488	**402**	741	432	**402**	741

Again natural gas central heating would seem to dominate choices of new systems to be installed in EU households. This statement must be qualified by two very important considerations:

- The extent to which the gas distribution network has reached households varies enormously from country to country. In Finland, Greece, Portugal and Sweden there has been such little development of household access to natural gas as to render the choice practically inexistent. Spain

and Denmark for different reasons have very small coverage. Even in mature residential gas markets all localities are not served by the network and extensions in some cases are unlikely in view of high costs and inadequate projected demand to justify them.

- As mentioned in the introduction the year 2000 has not been a very typical year in the sense that petroleum product prices like gas oil have increased very substantially while natural gas prices have followed suit very partially. Such differentials may not be sustainable even in the very near future.

Excise taxes appear to affect little the choices as far as the main competing systems (natural gas and gas oil fired) are concerned. The only clear reversals occur in Spain and Ireland where as mentioned earlier the residential gas distribution network is not sufficiently developed to make gas an option for the majority of cases anyway. The main reason for this relative insensitivity is that to a large extent taxation of fuels for household users seems to be non-discriminatory. This is especially the case in countries with very high taxation levels (Denmark and Italy) where excise taxes fall equally hard on the two main fuels.

This apparent stability of choices in the face of excise duties could be substantially eroded in a situation of low petroleum product prices (as was the case in the very recent past) with natural gas prices only slightly lower than the ones used in this study. In this case taxation designed to discourage the use of oil could be argued to be doing just that.

The electric heat pump alternative under the assumptions used in this study seems to be excluded on competitiveness grounds irrespective of excise taxation. However in the case of Finland and Sweden, given that the residential gas network is not developed, it could come within the valid option range on condition that taxes on gas oil are maintained (at punitive rates in the case of Sweden).

5. PRIVATE CARS

In the transport sector the analysis was restricted to the crucial sector of private cars which is currently overwhelmingly dominated by petroleum products (gasoline, diesel, LPG) and has attracted considerable policy attention both in terms of energy security (it being a major cause of growth in petroleum imports) but also in view of the very high externalities (congestion and environmental pollution) associated with it.

One representative “average” car in terms of size and accessories was considered. Countries were not differentiated in terms of average distance travelled, although such differences clearly exist, in order to maintain a measure of comparability across countries. However, issues regarding differences in terms of unit consumption across the different Member States were taken into account since they reflect a number of key factors such as driving conditions (urban versus non-urban travel, congestion on the roads etc) as well as consumer preferences in terms of vehicle power.

The taxation analysis was not limited to fuel taxes but was extended to include car acquisition taxes (registration taxes) as well as annual road taxes. Registration taxes are very important in determining the total cost of running vehicles because they are applied on vehicle costs, themselves representing a high percentage of life cycle costs. They vary considerably from country to country despite pressures in the context of EU harmonisation during the nineties. Denmark, Finland, Greece and Portugal apply very high registration taxes in one form or another, a fact which goes some way in explaining why car ownership in most of these countries falls short of what could be expected from per capita income compared with other EU Member States. On the other end of the spectrum Belgium, Germany, France, Italy and the U.K. do not apply any registration taxes other than VAT (not considered in the tax removal sensitivity analysis in this study which is specifically concerned with excise taxes). Road taxes can also be an important cost element in running a vehicle. This is particularly so in the Netherlands and Ireland but also in the U.K., Denmark and Germany whereas they are very low in Italy and Portugal. Special taxes also apply in some countries on motor insurance and many states impose tolls for the use of some highways and other transportation infrastructure (bridges, tunnels etc). The present analysis does not include such cost elements as their attribution to the costs of running

private vehicles was found to pose some difficulties and in addition they did not appear to be as significant as registration and road taxes.

Four engine types have been considered for the purpose of the analysis: standard gasoline, diesel, liquefied petroleum gas (LPG) available in limited distribution in most countries and methanol with virtually non-existent distribution network at present. The inclusion of the latter is justified by the fact that it represents the non-oil technology that is closest to market implementation at present. It was assumed that the methanol was derived from natural gas at an efficiency of 70% and that it was taxed at the same rate as gasoline in order to maintain fiscal neutrality. Diesel cars although more efficient than gasoline driven ones are heavier and more expensive than their gasoline alternatives. Likewise LPG and methanol driven vehicles are more costly to build than standard gasoline driven ones.

Two alternative cases as regards the annual mileage of cars were examined: 18000 km which is approximately the EU average for gasoline cars and 13000 km representing approximately the EU average for gasoline cars.

The tables below present the cost comparisons between the different types of cars for the two utilisation rates, with and without excise taxes.

Table 8: Unit cost per km driven for average annual mileage of a gasoline car

Transport cost (Euro'90/km driven) for private cars (annual mileage 13000 km per year)				
	with excise tax			
	Diesel	Gasoline	LPG	Methanol
Austria	0.570	**0.547**	0.602	0.581
Belgium	0.626	**0.618**	0.635	0.649
Denmark	0.976	**0.918**	1.044	0.970
Finland	0.778	**0.739**	0.805	0.785
France	0.495	**0.487**	0.511	0.522
Germany	0.629	**0.619**	0.653	0.654
Greece	0.730	**0.688**	0.770	0.723
Ireland	0.884	**0.841**	0.915	0.874
Italy	0.426	**0.409**	0.447	0.439
The Netherlands	0.929	**0.911**	0.945	0.950
Portugal	0.592	**0.553**	0.634	0.588
Spain	0.490	**0.470**	0.547	0.496
Sweden	0.581	**0.568**	0.597	0.608
United Kingdom	0.726	**0.702**	0.726	0.743
	without excise tax			
	Diesel	Gasoline	LPG	Methanol
Austria	0.345	**0.317**	0.373	0.330
Belgium	0.344	**0.314**	0.370	0.328
Denmark	0.343	**0.313**	0.375	0.327
Finland	0.344	**0.311**	0.367	0.326
France	0.341	**0.309**	0.372	0.324
Germany	0.341	**0.309**	0.369	0.324
Greece	0.341	**0.315**	0.374	0.328
Ireland	0.341	**0.308**	0.364	0.323
Italy	0.340	**0.309**	0.368	0.324
The Netherlands	0.344	**0.316**	0.363	0.330
Portugal	0.339	**0.312**	0.372	0.327
Spain	0.341	**0.310**	0.372	0.324
Sweden	0.350	**0.322**	0.374	0.335
United Kingdom	0.345	**0.312**	0.381	0.326

Table 9: Unit cost per km driven for average annual mileage of a diesel car

Transport cost (Euro'90/km driven) for private cars (annual mileage 18000 km per year)				
	with excise taxes			
	Diesel	Gasoline	LPG	Methanol
Austria	0.423	**0.413**	0.444	0.441
Belgium	**0.463**	0.464	0.464	0.491
Denmark	0.716	**0.680**	0.765	0.722
Finland	0.572	**0.552**	0.585	0.589
France	**0.368**	0.370	0.376	0.400
Germany	**0.465**	0.466	0.481	0.496
Greece	0.536	**0.511**	0.563	0.538
Ireland	0.647	**0.619**	0.666	0.645
Italy	0.318	**0.311**	0.331	0.336
The Netherlands	0.682	**0.677**	0.687	0.710
Portugal	0.435	**0.413**	0.465	0.440
Spain	0.363	**0.353**	0.412	0.375
Sweden	**0.434**	0.434	0.439	0.468
United Kingdom	0.543	**0.530**	0.535	0.566
	without excise taxes			
	Diesel	Gasoline	LPG	Methanol
Austria	0.255	**0.237**	0.275	0.246
Belgium	0.253	**0.234**	0.272	0.243
Denmark	0.253	**0.233**	0.276	0.243
Finland	0.253	**0.232**	0.269	0.241
France	0.250	**0.230**	0.274	0.240
Germany	0.251	**0.229**	0.270	0.239
Greece	0.251	**0.235**	0.276	0.244
Ireland	0.251	**0.228**	0.266	0.238
Italy	0.250	**0.230**	0.270	0.239
The Netherlands	0.254	**0.236**	0.265	0.245
Portugal	0.249	**0.233**	0.274	0.242
Spain	0.251	**0.230**	0.273	0.240
Sweden	0.259	**0.242**	0.276	0.250
United Kingdom	0.255	**0.232**	0.283	0.242

The most striking feature coming out from the figures is the extent to which taxation affects the overall cost of running private cars. In most cases it results in an approximate doubling while in some countries (notably Denmark, the Netherlands and Ireland) with automotive taxation regimes designed to actively discourage private vehicles the cost approximately trebles. It is clear that fiscal measures seriously disadvantage car ownership and use and in their absence one could suspect that their remarkable growth could become inexorable.

In comparison to this general observation the impact of excise taxes on the choice of vehicle types seems relative minor. The wide differentials between excise taxes for gasoline and diesel designed to discriminate in favour of commercial road transport, which characterised some countries in the past, have been narrowing considerably in recent years. Furthermore particularly high ex-refinery gas oil prices during the second half of 2000 have meant additional narrowing of differentials even in traditionally “dieselisation” countries like France, Spain, Italy and Belgium. Consequently, given the higher car purchase prices, diesel is only marginally more attractive than gasoline in only a few countries (France, Germany and Belgium) even at the 18000 km/year utilisation rate. This picture would be altered if higher than average mileages were considered but such an extension would go somewhat beyond the scope of the present study. At any rate such small advantages as are enjoyed by diesel in some countries disappear when excise taxes are removed the higher acquisition cost clearly outweighing the gains in fuel efficiency.

LPG seems to be reasonably competitive in some countries like Belgium, Sweden and to a lesser extent France for the higher utilisation rate. These small advantages however arise from discriminating taxation and disappear in the absence of all excise taxes, swamped by the higher vehicle acquisition costs.

The methanol car which as was mentioned earlier is still somewhat a theoretical possibility is handicapped by the higher vehicle costs but does become competitive at least vis-à-vis diesel powered vehicles if all excise taxes are removed. This eventuality is however highly unlikely in view of the importance of transportation fuel taxation for revenue collection purposes. Clearly the analysis suggests that for a large-scale introduction of methanol as an alternative transportation fuel some fiscal discrimination in its favour may be necessary. The scale of the required discrimination could however be relatively modest.

ANNEX 3

COAL AFTER THE EUROPEAN COAL AND STEEL COMMUNITY (ECSC) TREATY EXPIRES

The world coal market is a stable market, with abundant resources and a wide geopolitical diversity of supply. Even in the long term, with growing world demand, the risk of any prolonged disruption of supply, even if it cannot be ruled out altogether, is minimal. Coal is imported into the European Community primarily from its partners within the International Energy Agency (IEA) or from countries with which the Community or the Member States have signed trade agreements. These partners represent guaranteed suppliers.

At Community level, coal is regulated by the Treaty establishing the European Coal and Steel Community (ECSC Treaty), which was signed in Paris on 18 April 1951. Several regulations have been adopted on the basis of this Treaty, including Council Decision No 3632/93/ECSC of 28 December 1993 establishing Community rules for state aid to the coal industry.[(1)]

The ECSC Treaty, along with the rules adopted in application thereof, expires on 23 July 2002. We need to look, therefore, at a future Community system that will have to incorporate a component which has become very significant in recent decades, namely, state aid. Expiry of the ECSC Treaty should also provide the opportunity for a wide-ranging review of the place of coal among the Community's other sources of primary energy.

1. 1950 – 2000 : the main objectives of coal in the Community

Coal held a prime position in the supply of Europe's energy, a position enshrined in the ECSC Treaty. Indeed, the Treaty lays down that the institutions of the Community must "ensure an orderly supply to the common market, taking into account the needs of third countries" (Article 3(a)) and "promote the growth of international trade and ensure that equitable limits are observed in export pricing" (Article 3(f)).

In the first years of application of the Treaty, coal's contribution to energy supplies was provided exclusively by a flourishing Community industry in the process of modernisation. A few years later, however, saw the addition of coal imports from third countries. These imports gradually began to compete with Community coal.

The oil crises of the 1970s, which came at a time when the Club of Rome was considering limits to growth, put the issue of security of energy supply back on the agenda. In the light of these crises the Member States placed the emphasis on substitution policies designed to reduce their dependence on oil. Thus, the use of coal was one of the policies that helped to counter the oil shocks. Ambitious RTD and demonstration programmes were also set up at Community level, and national strategies to counter oil dependence focused, among other things, on encouraging coal production in the Community and coal imports from third countries.

These strategies had very different results.

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(1) OJ L 329, 30.12.1993, p 12.

In the face of an increasingly dynamic international market, the Community coal industry was forced, at the beginning of the 1980s, to begin root and branch restructuring, all the more so because of decisions to expand taken some years earlier. In terms of supply, imported coal gradually took over from Community coal, although without any increase in the risk of disruption of supply or price instability for coal.

While security of supply was the watchword of the 1970s, the 1990s saw the emergence of environmental concerns. It is becoming increasingly obvious that coal could only play a part in energy supply if it managed to control its impact on the environment. Technology will help to take up this environmental challenge, which stems principally from climate change and acidification.

Thus, while the idea underlying the signing of the ECSC Treaty was to create a common market in coal, decisions concerning this source of energy, for the last 25 years at least, have been driven far more by energy policy, especially security of supply, and environmental concerns.

2. Economic appraisal of the Community coal sector

2.1. Coal market

EUR 15 *(in million tonnes)*	1975	1985	1990	1995	1998	1999	2000 (*)
Community production	268	217.4	197	136	108	100	85
Consumption	327	343	329	280	263	253	243
Imports	59	114	132	137	145	150	154

(*) Estimates

The European Community also produces 235 million tonnes of lignite (the equivalent of 70 million tce [(2)]).

2.2. Global assessment

In 1999, coal production in the European Union amounted to around 100 million tonnes, split as follows: France = 4 millions tonnes; Germany = 41 millions tonnes; United Kingdom = 36 millions tonnes; and Spain = 16 million tonnes.

Despite the process started in 1965 to restructure, modernise and streamline the coal industry, which was accompanied by massive aid granted by the Member States, most of the coal produced in the Community cannot compete with imports from third countries. The various aid mechanisms put in place, the current arrangements being governed by Decision No 3632/93/ECSC pursuant to Article 95 of the ECSC Treaty, have not managed to produce

(2) tce= tonne coal equivalent.

an economic solution to the structural crisis affecting the European coal industry. Indeed, what progress has been made in terms of productivity has not been enough to cope with the prices prevailing on the international markets.

With the exception of a certain amount of potential in the United Kingdom, the objective of a competitive Community coal industry on international markets is completely out of the question despite the efforts made by production companies, both technologically and organisationally, to improve productivity. This is explained primarily by increasingly unfavourable geological conditions through the gradual exhaustion of the most readily accessible deposits and the relatively low level of the price of coal on international markets.

2.3. Assessment and prospects by producer country

- *France*

Under the National Coal Pact agreed between the two sides of industry in 1995 coal extraction is gradually being phased out and will stop completely in 2005. All mines therefore form part of a closure plan and receive aid to reduce activities for the exclusive coverage of operating losses.

Because of the severity of social and regional problems, the French Government has not been able to keep to the 2002 deadline provided for by Decision No 3632/93/ECSC. Given the extremely difficult operating conditions, however, coal-mining could well stop before the end of 2005. There has been a constant increase in production costs which in 2000 should reach EUR 170/tonne (compared with the price of imported coal of EUR 35 - 40/tonne).

- *Spain*

Spain has adopted a restructuring plan for the period 1998-2002 which provides for an annual decrease in production, which should be no more than 12.7 million tonnes in 2002. Even though this plan provides for a gradual reduction in aid to current production of the order of 4% per year, coal-mining in Spain has very little prospect of being competitive. Production costs are currently at a level of EUR 130-140/tonnes.

In recent years the Spanish Government has granted annual aid of the order of EUR 1 billion, a significant proportion of which (70%) is in the form of aid to current production. While several mines are already covered by a closure plan, and thus receive aid to reduce activity, a large proportion of production still receives operating aid. This category of aid is set aside in principle for production units that can improve their economic viability by reducing production costs.

- *Germany*

The restructuring plan adopted by Germany in 1997 provides for a reduction in coal production to 26 million tonnes in 2005. Coal-mining in Germany has no prospect of competing with imported coal in the long term. Production costs, due to increasingly difficult geological conditions, have decreased very little since 1994 and are currently running at EUR 130-140/tonne.

In 1999 the German Government granted aid totalling EUR 4.6 billion, of which more than 4 billion were to current production. Under the 1997 restructuring plan the global aid package should be gradually reduced to EUR 2.8 billion in 2005.

- *United Kingdom*

As a result of concentrating activities in the most productive mines and sustained efforts to improve viability, the United Kingdom is the only Community country where the coal industry has received no State aid since 1995. That said, a number of factors, including the sudden fall in prices on the international markets in 1999, have compelled the British authorities to consider granting aid, albeit on a very modest scale, of around UKL 110 million over the period 2000-2002.

The aim of the assistance plan in the United Kingdom is to provide temporary support - until the expiry of the ECSC Treaty - to production units that are economically and financially viable in the long term but which are experiencing certain temporary problems that could result in their closure.

3. What future for Community coal?

When the ECSC Treaty expires, in the absence of any financial support measures, the large majority of the European coal industry would be condemned to disappear in the very short term. Such an evolution would only increase the uncertainties which are likely to remain regarding the long term energy supply of the European Union.

The orientations for a future support regime for Community coal when the ECSC Treaty expires could incorporate the two fundamental objectives which have emerged since the Treaty was signed, mentioned at point (1) above. Coal could thus play a part in the security of energy supply in the European Community while taking account of the environmental dimension.

If the intention is to guarantee the long term availability of some European coal production capacity in order to cover possible risks which could affect the energy market, a future for Community coal can only be envisaged if it is accompanied by a mechanism of intervention by public authorities.

Such a regime would make it possible to guarantee the maintenance of access to reserves. For that purpose, a minimum quantity of subsidised coal should be produced, not for production as such, but to keep the equipment in an operating condition and to retain the professional qualifications of a nucleus of miners and technological expertise. This base would thus contribute to strengthening the security of supply of the long-term Community.

It would include coal, but also possibly other energy resources such as renewable energy. In addition to the aim of security of supply, this renewable energy would contribute directly to the promotion of environmental objectives, in particular under the Kyoto protocol.

4. Enlargement of the European Union

Any reflection on the future framework for Community coal should also consider the situation in the countries that have applied for accession to the European Union. This issue is particularly relevant for the two principal producers of coal in central and Eastern Europe, namely, Poland and the Czech Republic, especially as Poland alone currently accounts for production levels equivalent to the four producer countries in the Community.

In 1999 Poland produced 112 million tonnes of coal, as against 14 million tonnes in the Czech Republic. Other central and eastern European countries also produce coal, albeit in practically

negligible quantities. These are Bulgaria, Hungary and Romania, which each produce 2 to 3 million tonnes of coal per year. In addition to coal they also produce 186 million tonnes of lignite (equivalent of 55 million tce).

Following an initial phase of restructuring in 1993, accompanied by a significant wave of privatisation, the Czech Republic is currently in the process of a second restructuring phase of its coal industry.

Poland adopted a restructuring plan for the period 1998-2002, providing for a lowering of production to 100 million tonnes in 2002 (as against 148 million tonnes in 1990) and a reduction in jobs to 128 000 miners (as against 391 100 in 1990). In the middle of the 1980s Poland was the fourth biggest exporter of coal to the European Union. After losing market share at the end of the 1980s/beginning of the 1990s, coal exports have gradually increased to around 12% (approximately 20 million tonnes) of coal imports into the European Union.

Production costs, especially wages, have gradually exerted more and more pressure on coal-mining companies. The current restructuring plan, which provides for a significant lowering of production, ought to allow the situation to stabilise. Efforts should nonetheless be kept up beyond 2002, with further reductions in national production targeting mines with the largest deficits.

The Polish coal industry is in a very similar position to the German coal industry, the geological conditions often being very similar. A significant proportion of Polish coal can thus no longer compete with coal from non-European countries (China, United States and South Africa). The Polish coal industry will thus depend increasingly on aid granted by the public authorities.

5. Conclusion

By giving room for manoeuvre to Member States that have committed themselves to a process of restructuring their coal industry, financing based on a system of primary energy would also make it possible to promote renewable energy which will help to reinforce environmental policies.

As for the share reserved for Community coal, the establishment of such a regime to succeed the ECSC should in no way divert Member States from the obligation to streamline this sector. Restructuring measures embarked upon within the ECSC Treaty have to be continued. While security of supply is clearly a priority, this priority can in no way provide an excuse for keeping coal production at levels that defy economic logic.