

CHAPTER 2.

OVERVIEW OF THE ENERGY SITUATION IN THE EU

2.1. Energy production and self-sufficiency

The European Union is a major energy consumer, being singularly responsible for 16% of the energy consumed in the world in 1998. Petroleum is the most widely used energy resource, representing over 45% of its energy consumption, followed by natural gas, which represents around 22%.

Only 0.7% of petroleum reserves are found in the EU, and about 2.2% of natural gas reserves. However, European coal deposits account for 7.4% of the world figure. In addition, the EU has 16% of the world's petroleum refining capacity and 17% of the sources for the generation of electric energy. In 1998, the EU produced 5% of the world's petroleum, 10% of the world's natural gas and 7% of the world's coal.

With regard to the energy production of EU countries, in 1998, total production reached 759.19 million equivalent oil tons (Mtoe), which represented 20% of the OCDE total. Within Europe, there are four important producers who account for 78.2% of the total. In first place is the UK, which produces 36.1% of the European total, followed by Germany (17.3%), France (16.5%), then Holland (8.2%). In general terms it can be said that European energy production is based on gas and petroleum deposits in the North Sea, which belong to the UK and Holland, while German potential is based on coal deposits and France on its nuclear production.

Table 2.1.

Total energy production: 1998		
	Mtoe:	%
Germany	131,46	17,32
Austria	9,00	1,19
Belgium	12,81	1,69
Denmark	20,18	2,66
Spain	31,94	4,21
Finland	13,61	1,79
France	125,53	16,53
Greece	9,89	1,30
Holland	62,50	8,23
Ireland	2,47	0,33
Italy	29,05	3,83
Luxembourg	0,05	0,01
Portugal	2,32	0,31
United Kingdom	274,23	36,12
Sweden	34,15	4,50
Total EU	759,19	100,00
Hungary	11,85	
Poland	87,45	
Czech Rep.	30,79	

Mtoe: millions of equivalent oil tons

Source: Elaborated by our research team based on information from the International Energy Agency.

The production of other EU countries is very limited, mainly because of the general shortage of energy resources across Europe. If we include the Eastern European countries, Poland stands out for its production (87 Mtoe) which is superior to Holland, while The Czech Republic, with 30.7 Mtoe has a level of production on par with Spain and Italy, and Hungary, with its 11.8 Mtoe is not far behind Belgian or Finnish levels. (Table 2.1.).

Because of this scarcity of primary energy sources, mainly petroleum and gas, the EU is forced to import heavily. In 1998, 729.5 Mtoe was imported, a figure almost on par with total European production, which was estimated to be in the region of 759.1 Mtoe. What that effectively means is that European countries, together, consume 16% of the world's energy, and produce only 8% of it. A further implication of this is that the EU is a net importer of coal, natural gas and petroleum, that in 1998 it produced 7% of the world's coal but consumed 9% of it, that it produced 10% of the world's natural gas

while it consumed 17% of it. For petroleum the figure is even higher: it produced 5% while it consumed 19%¹. (1)

Table 2.2

Net energy imports. 1998		
	Mtoe	%
Germany	214,69	29,43
Austria	20,04	2,75
Belgium	51,74	7,09
Denmark	1,59	0,22
Spain	88,64	12,15
Finland	18,30	2,51
France	131,95	18,09
Greece	21,41	2,93
Holland	23,58	3,23
Ireland	10,86	1,49
Italy	141,29	19,37
Luxembourg	3,31	0,45
Portugal	19,72	2,70
United Kingdom	-38,07	-5,22
Sweden	20,46	2,80
Total EU	729,51	100,00
Hungary	14,15	
Poland	9,22	
Czech Rep.	10,55	

Source: Elaborated by our research team based on information from the International Energy Agency.

On a country by country basis, Member States are net importers of energy. The only exception is the UK, which is a net exporter to the EU. The major importers are characterised by a high level of economic development, which favours the demand for energy, coupled with the shortage of energy resources, which is a feature of most European countries. Germany, Italy, France and Spain head the list of energy buying countries. Together they purchase a total of 79% of European imports. The smaller countries, generally of lesser economic weight, import less. Finally, in the case of Eastern countries, their energy purchases from outside are quite low, some way below the level of the average EU country. (Table 2.2).

The total supply of primary energy is in the region of 1447.4 Mtoe, which is the result of adding energy imports to national production, taking away exports and taking

¹ Information provided by the Energy Information Administration of the United States of America.

into account other elements such as variations in national stocks (Table 2.3). The relation between energy production and primary energy supply allows us to assess the level of self-sufficiency of the respective national economies. In the EU, self-sufficiency is in the region of 52.4%, meaning that national production only covers half of European energy needs. (Table 2.4).

Table 2.3

Total supply of primary energy. 1998		
	Mtoe	%
Germany	344,51	23,80
Austria	28,81	1,99
Belgium	58,35	4,03
Denmark	20,80	1,44
Spain	112,78	7,79
Finland	33,46	2,31
France	255,67	17,66
Greece	26,98	1,86
Holland	74,41	5,14
Ireland	13,25	0,92
Italy	167,93	11,60
Luxembourg	3,32	0,23
Portugal	21,85	1,51
UK	232,88	16,09
Sweden	52,47	3,62
Total EU	1447,47	100,00
Hungary	25,26	
Poland	96,44	
Czech Rep.	41,03	

Source: Elaborated by our research team based on information from the International Energy Agency (IEA).

The implications of the type of energy policy that leads to a low level of self-sufficiency are very many, given the crucial importance of energy to national economies. It can be said that one of the features of the European energy sector is, apart from the high level of consumption, a dependence on external energy sources. Only in the UK is domestic production higher than energy supply, attaining a level of self-sufficiency of 117.7%. Denmark and Holland have attained levels close to 100%, 96.9 and 83.9% respectively.

On the other hand, with the exception of Sweden, (65%), the other EU countries are characterised by a level of self-sufficiency which is inferior to the European average

of 52.4%. Some of them are worthy of mention, such as Germany, which covers a mere 38.1% of its needs in spite of its significant mining resources; France, which has been able to raise its level of self-sufficiency to 49.1% thanks to its development of nuclear energy, and Spain, which has hardly any energy resources, but whose figure stands at 28.3%, thanks to the development of its hydro-electric and nuclear potential.

Table 2.4

Self-sufficiency in energy. 1998 (energy production in Mtoe)	
	%
Germany	38,16
Austria	31,23
Belgium	21,95
Denmark	96,98
Spain	28,32
Finland	40,68
France	49,10
Greece	36,67
Holland	83,99
Ireland	18,60
Italy	17,30
Luxembourg	1,36
Portugal	10,60
UK	117,76
Sweden	65,09
Total EU	52,45
Hungary	46,92
Poland	90,67
Czech Rep.	75,03

Source: Elaborated by our research team based on information from the IEA.

The Eastern economies have a high level of self-sufficiency. Poland is the most outstanding case, with 90.6%, due mainly to its important coal deposits, while The Czech Republic has reached 75%. The worst case is Hungary which doesn't even cover 50% of its demand, (46.9%).

2.2. Energy production according to energy sources

One of the features of the EU is that it is a very big energy consumer, mainly combustible fossil fuels (petroleum, gas and coal). Another feature of the European energy sector that must always be borne in mind is the shortage of its own energy resources, which forces the sector to import heavily and develop research and development programmes aimed at using potential renewable energy. In this sense, it is worth pointing out that there are important differences among EU countries in terms of resources and energy production, hence the need to take a brief look at this question. The aim is to distinguish between those countries that have energy resources and those that don't. We shall therefore analyse the production of coal, petroleum, petroleum products, natural gas, nuclear and hydraulic energy, renewable energy sources and energy derived from the use of waste and residue.

To deal, first of all, with coal production in the EU, it rose to 112.9 Mtoe in 1998. The biggest producer is Germany, responsible for 56.7% of total production. It is followed by the UK, 22.7%, and Spain, in third position, with 8.1% of total production. A major feature of the eastern countries is their enormous coal production, especially Poland, with 79.3 Mtoe, more than Germany. The Czech Republic production is far inferior to Poland's, though above the UK's. A fact worthy of mention is that the total production level of those three East European countries is almost the equivalent of the full volume of the entire EU production level.

Regarding the production of crude oil and natural gas liquids, the figure is just about 166.7 Mtoe, of which the UK produces 83.3. Only Denmark and Italy, (6.9 and 3.5% respectively) produce anything like a significant level of crude. Holland, with 1.6 % is another of the small European producers. The eastern European countries, like the EU countries, do not possess petroleum deposits and their production is insignificant.

The production of petroleum products is very important in the EU as a whole due to the amount of refineries on European soil. Production reached 694.7 Mtoe in 1998. The four most important countries are: Germany, responsible for 17.4% of production, Italy (14.7%), France and the UK, 13.9%. Holland and Spain follow, with 11.9 and 9% respectively.

With respect to natural gas, European production is 181.4 Mtoe. The biggest producer is the UK, accounting for 44.7%, followed by Holland, 31.7%. On a smaller scale, Germany and Italy are among the natural-gas extracting countries. The remaining countries, including the Eastern countries, hardly produce any natural gas at all.

There is a significant level of nuclear production in the EU, with several countries developing important nuclear programmes. Among them France, which accounts for 45.4% of European nuclear production. Germany, 18.9% and the UK, 11.7% are also high on the list, and Sweden and Spain can also be considered important nuclear production countries. Among the Eastern countries, Hungary, and The Czech Republic have important nuclear plants, though their level of production is relatively low.

Hydraulic production is very important in some countries, which have favourable hydraulic conditions as well as considerable fluvial facilities. Sweden stands out in this respect, and accounts for 24.4% of European hydraulic production, followed by France, with 20.4%. Italy, (13.5%), Austria (12.2%) and Spain (11.1%) are also among those countries that have great hydraulic potential and facilities. In the remaining European countries, including the Eastern countries, the level of hydraulic production is very low.

The production of renewable energy in the EU as a whole is very low, only 1.3 Mtoe. This type of energy source includes solar, wind and tidal energy. The countries with the highest production of clean energy are Germany, which contributes 30.7% of the total of the EU's renewable energy, Denmark, with 19.2% and Spain, which has important solar and wind energy potential, (10.7%).

Energy production derived from bio-masses, mainly through the use of waste and solid urban residue, is up to 44.7 Mtoe, a very significant figure, higher even than the hydraulic production figure. The countries that most contribute to the EU total are France (25.2%) and Sweden (17.6%), both of which, traditionally, are strong users of this type of energy. Finland, Germany and Spain complete the list of countries with a high level of bio-mass production within the EU. In the east, Poland is the biggest producer, with a level of production similar to Germany.

In this sense, the contribution of renewable energy and bio-mass production to the total supply of primary energy is becoming more and more significant with the gradual exhaustion of combustible fossils, and dependence on petroleum has led to economic

instability, subject to the international price determined on crude markets. The reduction of this external dependence has become one of the objectives of energy policy, which has been oriented towards intervention in order to increase the production of these sources of renewable energy. In the EU as a whole, the contribution of renewable energy and the production of energy from wastes account for 5.24% of total supply, and it must also be pointed out that the production of renewable sources has pushed that figure upwards, since it accounts for 4.6%, with the contribution of energy derived from wastes and residue falling to 0.5%.

In some countries these percentages are even higher, Sweden, Austria, and Finland, for instance, where the production of renewable sources of energy (mainly hydro-electricity) is over 20%. Sweden stands out in this respect, with a figure of 27%. With respect to the production of energy derived from wastes, Denmark stands out, accounting for 3.1% of production. Other countries, namely Sweden and Holland, account for 1% each.

2.3. Energy consumption

With regard to the consumption of final energy, by which we mean the distribution of energy consumption through the different economic sectors, the data reflect that the EU is one of the world's biggest consumers, reaching some 1027 Mtoe in 1998, 29.6% of the total consumption of OCDE countries.

There are important differences within the EU in terms of consumption. We may talk of two different blocks of countries. The first made up by countries which are big energy consumers, such as Germany, which consumed some 243.1 Mtoe in 1998, 23.6% of the total, followed by France (16.2%), the UK (15.4%) Italy (12.5%) and Spain (7.8%). These five countries alone account for three quarters of the energy consumed across the EU (75.8%). The remaining countries, together, barely consume a quarter of the total. Holland, Belgium and Sweden consume 54% of the energy consumed by this block of countries which, together, account for 13% of total EU consumption.

And if we extend the analysis to the three Eastern European countries that are on the verge of EU membership, we will see that Poland is the biggest consumer, with 63.5 Mtoe, which is close to the European average of 68 Mtoe. In Hungary and The Czech Republic consumption is lower though quite similar to some other European countries such as Portugal, Greece, Finland and Austria. (Table 2.5).

Table 2.5

Total consumption of final energy: 1998		
	Mtoe	%
Germany	243,19	23,68
Austria	24,15	2,35
Belgium	41,09	4,00
Denmark	15,71	1,53
Spain	80,51	7,84
Finland	25,02	2,44
France	166,86	16,25
Greece	19,08	1,86
Holland	57,95	5,64
Ireland	9,96	0,97
Italy	128,89	12,55
Luxembourg	3,25	0,32
Portugal	17,17	1,67
UK	158,97	15,48
Sweden	35,33	3,44
Total EU	1027,13	100,00
Hungary	17,23	
Poland	63,50	
Czech Rep.	25,04	

Source: Elaborated by our research team based on information from the IEA.

In terms of the distribution of final energy consumption according to sectors, the industrial sector is generally the sector in which most energy is consumed, though the demand in the transport sector is also very high, representing about 30% in the entire EU, a figure similar to industry. “Other sectors” (agriculture, services and domestic consumption) represent about 36.9%. Finally, the “non energy use” sector, which includes the consumption of other products derived from petroleum and the non-energy use of coal, represents 3.1% in the EU (Table 2.6).

Portugal, Sweden and Belgium are countries in which industry consumption is far superior to other sectors. The figures for those countries are 38.8, 37.9 and 37.2% respectively. But there are also countries in which the transport sector is above industry, namely Greece, Ireland, Luxembourg and the UK. Such differences between countries are attributable to many factors, such as the type of industry, which has a direct bearing on energy consumption, plus efficiency during the production process, energy saving and the organisation and structure of production.

Table 2.6

Total energy consumption by sectors. 1998					
	Industry	Transport	Other sectors	Non-energy use	Total
	%	%	%	%	Mtoe
Germany	29,25	27,23	40,80	2,73	243,19
Austria	29,03	28,45	39,42	3,11	24,15
Belgium	37,20	23,86	35,98	2,97	41,08
Denmark	19,41	31,13	46,91	2,55	15,71
Spain	32,47	38,73	23,20	5,59	80,50
Finland	45,86	17,63	33,87	2,64	25,01
France	28,07	29,82	39,26	2,85	166,85
Greece	24,21	39,05	34,38	2,36	19,08
Holland	32,75	24,07	38,86	4,31	57,95
Ireland	24,80	33,84	39,46	1,91	9,96
Italy	31,71	32,43	32,45	3,41	128,89
Luxembourg	26,69	48,77	23,93	0,61	3,26
Portugal	38,85	34,01	22,13	5,01	17,17
UK	25,79	32,17	39,51	2,54	158,96
Sweden	37,92	22,50	37,41	2,18	35,34
Total EU	30,16	29,81	36,90	3,13	1027,10
Hungary	27,20	18,21	50,81	3,77	17,24
Poland	35,84	15,10	46,69	2,38	63,51
Czech Rep.	45,33	15,69	34,62	4,35	25,04

Source: Elaborated by our research team based on information from the IEA.

If we take a closer look at consumption according to sectors and establish comparisons between EU countries, once again we see that there are higher levels of consumption in the more developed countries, and that the greatest volume of demand is concentrated in a small group of countries headed by Germany. (Table 2.7).

In all three cases, Germany is the country with the highest level of consumption in all of the EU. EU industry consumed a total of 309.7 Mtoe in 1998, of which Germany

accounted for 22.9%, while French industry absorbed 15.1%, and Italy and the UK consumed 13.1 and 13.2% respectively. At the other extreme we find countries with very low industrial consumption, which is hardly, if at all representative in the EU. It is the case of countries such as Luxembourg, Denmark, Ireland, Greece and Portugal, which, together account for only 5.7% of the European total.

The pattern is similar when we attempt to explain the differences in consumption in the transport sector. Once again, the German transport sector accounts for 21.6% of the total, followed by the English transport sector, (16.7%), and the French transport sector (16.2%). Italy and Spain are also among the countries with the highest levels. A feature of those countries with lower levels of consumption is their relatively small size, in geographical terms (Austria, Belgium, Luxembourg and Holland), population terms (Finland, Sweden and Denmark), or in terms of a lower level of economic development (Portugal, Greece and Ireland).

Table 2.7.

Energy consumption by sectors Percentage of the EU total. 1998			
	Industry	Transport	Other sectors
Germany	22,96	21,62	26,18
Austria	2,26	2,24	2,51
Belgium	4,93	3,20	3,90
Denmark	0,98	1,60	1,94
Spain	8,44	10,18	4,93
Finland	3,70	1,44	2,24
France	15,12	16,25	17,28
Greece	1,49	2,43	1,73
Holland	6,13	4,56	5,94
Ireland	0,80	1,10	1,04
Italy	13,19	13,65	11,04
Luxembourg	0,28	0,52	0,21
Portugal	2,15	1,91	1,00
UK	13,23	16,70	16,57
Sweden	4,33	2,60	3,49
Total EU	100,00	100,00	100,00
EU (Mtoe)	309,79	306,21	378,96

Source: Elaborated by our research team based on information from the IEA.

2.4. Energy indicators

Another way to look at the European energy sector and to analyse similarities and differences from country to country is via the use of certain energy indicators, such as energy supply in relation to GDP or energy supply per capita.

Energy supply measured in relation to GDP gives us an idea of the energy intensity of the country, or shows the number of equivalent petroleum tons per thousand dollars in constant terms using 1990 as a base year for purchasing power parity. Here, we see that the Eastern countries have a higher level of consumption in comparison to their domestic production, which is far higher than the European average of 0.2%. In Europe as a whole, the countries with the highest index are those that have the lowest level of consumption, such as Finland, Sweden, Belgium and Luxembourg. And among the countries with the lowest index are Portugal, Denmark, Italy and Ireland. Finally, there is also an intermediary group, where the indicator is close to the European average, with countries such as Germany, Spain and France. (Table 2.8).

In terms of energy supply per inhabitant, the EU average is 3.8 toe. Countries such as Luxembourg, Finland, Sweden and Belgium are way above that average. As in the previous analysis, these countries stand out for their high relative energy consumption in terms of GDP and population, due mainly to their small population (especially Luxembourg) and their extreme climatic conditions. In Germany, France and the UK the indicator, which is above the European average, is directly influenced by industrial development, which always requires high levels of energy consumption. Finally, the Mediterranean countries such as Spain, Greece, Portugal and Italy have a level of consumption that is relatively lower than the average, which is directly determined by the more favourable weather conditions, such as a good climate and hours of sunlight, which significantly reduce the amount of energy consumed. (Table 2.9).

Table 2.8

Energy supply/GDP. 1998	
	Toe per thousands of 1990 US\$ PPP
Germany	0,2323
Austria	0,1865
Belgium	0,2983
Denmark	0,1769
Spain	0,2022
Finland	0,3611
France	0,2245
Greece	0,2284
Holland	0,2438
Ireland	0,1858
Italy	0,1619
Luxembourg	0,2463
Portugal	0,1681
UK	0,2161
Sweden	0,3193
Total EU	0,2174
Hungary	0,3534
Poland	0,3748
Czech Rep.	0,4449

PPP: purchasing power parity

Source: IEA

The same indicators used can be applied to the electricity sector. The European electricity sector generated, in 1998, a total of 2,468 TWh, which represents 27.2% of the total produced in OCDE countries. Within the EU, the countries with the largest electricity sectors are Germany, which produces 22.3% of the European total, France (20.5%), the UK (14.4%), Italy (10.2%) and Spain (7.8%). In general the level of TWh production is directly linked to the level of economic development as well as the size and population of the country. It depends, to a lesser extent, on other factors, such as climatic conditions and geographical location. (Table 2.10.).

To establish comparisons between EU countries, it is necessary to use indicators such as electricity consumption per capita and average consumption in terms of GDP. In this sense, it must be pointed out that electricity consumption means domestic supply less losses brought about in distribution.

Table 2.9

Toe/population 1998	
	Toe per capita
Germany	4,20
Austria	3,56
Belgium	5,71
Denmark	3,92
Spain	2,86
Finland	6,49
France	4,34
Greece	2,56
Holland	4,73
Ireland	3,57
Italy	2,94
Luxembourg	7,78
Portugal	2,18
UK	3,93
Sweden	5,92
Total EU	3,86
Hungary	2,49
Poland	2,49
Czech Rep.	3,98

Source: IEA

With regard to the consumption of electric energy, there are five major consumers in the fifteen community countries: Germany, France, the UK, Italy, and to a lesser extent, Spain. (Table 2.10).

However, the comparison in terms of GDP consumption reveals that the biggest consumers of electric energy are the Nordic countries, Sweden and Finland. In those countries, extreme climatic conditions and geography, with less hours of sunlight make for a higher level of consumption of electrical energy, above the European average of 0.3 kWh per 1990 dollar. However, in other cases, in Mediterranean countries such as Greece and Portugal, the higher level of consumption has to do with less efficiency in energy consumption, a factor which is also true of the three eastern countries included in our study. (Table 2.11).

In the same way, when per capita consumption is compared we note great differences between Member States. Although the European average is 6.272 kWh per person, the Nordic countries double that figure, with Sweden and Finland having figures

of 15,492 and 14,848 respectively. Luxembourg, with 15,420 kWh per capita heads the list of electricity energy consumers. It must be pointed out that it occupies that position because of its very small population and because much of its industry is electricity intensive.

Table 2.10

Total electricity generation. 1998		
	GWh	%
Germany	552382	22,38
Austria	55885	2,26
Belgium	82133	3,33
Denmark	41083	1,66
Spain	193526	7,84
Finland	70169	2,84
France	506932	20,54
Greece	46180	1,87
Holland	91165	3,69
Ireland	20882	0,85
Italy	253641	10,28
Luxembourg	369	0,01
Portugal	38914	1,58
UK	356622	14,45
Sweden	158226	6,41
Total EU	2468109	100,00
Hungary	37188	
Poland	140771	
Czech Rep.	64624	

Source: Elaborated by our research team based on information from the IEA.

Portugal, Greece, Spain, Italy and Ireland are below the European average. Their lower consumption levels can partly be explained by the better climatic conditions of the Mediterranean, while in Ireland, the lower per capita consumption is attributable to a lower level of economic and industrial development.

Finally, in the Eastern countries, per capita consumption is below the European value of Portugal, with the exception of The Czech Republic, where the value is close to that of the UK. In these cases, of high consumption in relation to GDP and low consumption per capita, the explanation lies partly in electricity intensive industries, plus a lower GDP and a level of energy efficiency of industries which is below the other European countries.

In short, we may say that to use electricity consumption as an indicator requires us to take into account the influence of certain key factors, which affect, to a greater or lesser degree, the level of consumption of electric energy: factors such as climatic conditions, the economic structure of the country, energy consumption habits with regard to certain energy sources, plus efficiency in the use of energy.

Table 2.11

Electricity consumption. 1998			
	Consumption (TWh)	C/GDP (kWh por 90 US\$)	C/Population (kWh per capita)
Germany	531,64	0,28	6482
Austria	53,93	0,28	6677
Belgium	80,74	0,35	7913
Denmark	34,43	0,20	6496
Spain	180,17	0,31	4576
Finland	76,51	0,50	14848
France	422,22	0,31	7175
Greece	44,77	0,46	4261
Holland	99,06	0,28	6310
Ireland	19,31	0,23	5213
Italy	282,01	0,23	4949
Luxembourg	6,57	0,41	15420
Portugal	36,02	0,42	3610
UK	343,58	0,30	5800
Sweden	137,12	0,54	15492
Total EU	2348,08	0,30	6272
Hungary	33,01	0,93	3264
Poland	123,99	1,58	3207
Czech Rep.	57,70	2,18	5605

Source: Elaborated by our research team based on information from the IEA

2.5. An overview of the energy and electricity sectors in each country.

This overview is taken through the total of all the energy sources that supply energy demand, in order to first determine the volume of each source and its contribution to final consumption. Diversification is one of the major objectives of national energy policies, thereby contributing to reduce the dependence on one source of energy and seeking to increase the level of self-supply through the use of one's own resources in order to lessen the vulnerability of energy and the level of dependence on outside sources.

An analysis of the overall picture shows that in the EU as a whole there is a high dependence on petroleum for energy supply, to the tune of 45.2% of the total. Gas, 21.7%, is the second source in terms of consumption. For their part, nuclear energy and coal are also significant, accounting for 15.3 and 15.1% respectively. Fossil fuels therefore continue to constitute the mainstay of European energy supplies, while renewable energy (hydro-electric, geo-thermal, bio-mass and solar based energy) account for no more than 6% of energy needs, in spite of their importance in terms of contributing to greater self-sufficiency and of reducing the dependence on non-renewable sources. (see appendix table A.10.).

With regard to final consumption, petroleum derived sources are, without doubt, the most widely consumed energy products, mainly gas and gas oil. Half of energy consumption (51.6%) is on petroleum derived products, while 21.9% of energy needs are taken care of by gas. The contribution of electricity to final consumption is also important, representing 17.6%.

Mention must also be made of the European electricity sector. In 1998, electricity production was 2,468 TWh. Of that total, electricity of nuclear origin accounted for 34.6%, followed by the thermal production of coal (28.1%). The growing use of gas for electricity generation has increased the participation of gas plants to 14.8%, above hydro-electric production, which is 12.6%. We also note the use of many countries' own resources, such as coal and hydro-electricity, for the generation of electricity, as well as the intense use of nuclear energy. (see appendix table A.11.)

All in all, it would be true to say that the main features of the European electricity sector are its strong dependence on fossil fuels and a shortage of that type of resource in the EU. Such particularities are the major challenges to be tackled by energy policy: greater use of one's own resources and diversification of sources of external supply.

In this sense, the state of the natural gas sector is worrying since the energy dependence is in the order of 45% and it seems very likely that this is only going to get higher, to reach 54% by 2005 and 62% by 2010. And this is happening at a time when reserves in Holland are being exhausted and when production is stagnating in the UK, which makes the need to seek new supplies even more pressing. At present, the EU's main natural gas supplier via gas line is Russia, which provides about 44% of total

imports. Norway and Algeria are in second and third places with 28.8 and 25.4% respectively².

Action being taken for natural gas supply is aimed at increasing the capacity of gas lines, which will allow the entry of new suppliers and increase existing capacities. Projects are currently underway for doubling the capacity of gas lines between Europe and the Maghreb, and to begin natural gas channels, such as those envisaged between Russia and the south of Europe and from Egypt to Europe.

In this overview of the energy sector of each EU country, we must bear in mind that geographical features as well as the social and economic conditions of each country have a direct bearing on the overall picture. Therefore, the structure of that overall picture depends on the energy resources of the country, the organisation and productive structure, as well as the level of experience in the use and exploitation of certain energy sources.

GERMANY

In Germany there is a less significant presence of petroleum, in comparison to the European average; it is in the order of a third of the entire total.

In order of importance, coal is in second place, accounting for 24.3%, and, in this sense, the use of German coal gives it greater weight in the overall picture. Gas is in third place, accounting for 21.1% of the total.

As far as final consumption goes, petroleum derived products constitute over 50% of the energy resources used. Gas and electricity are the secondary energy sources that, quantitatively, come after petroleum derived products, accounting for 21.8% and 16.4% respectively.

The importance of national coal is clear from the use of this fuel for the generation of electric energy. In fact 54.2% of GWh produced come from that source. Nuclear production is also quite significant, since some 30% of electricity needs are met through

² From J. De Quinto (2000): *In Search Of A Competitive natural Gas Market In Spain*.

this kind of energy. To a lesser degree, gas represents 9.8% of the total, slightly below the European average. (see appendix table A.13.)

Significantly low is the use of fuel oil for generation, mainly because of its high cost. Not much use is made of hydraulic resources, which account for only 3.1% of total production.

AUSTRIA

In Austria, petroleum provides 34.9% of primary energy, below the European average of 45.2%. Gas and coal are also significant within the overall energy picture. Hydroelectric energy and bio-mass are also significant, accounting for 11% of the total, and being, together, as important as gas. This is an important example of how the use of the country's own resources has led to greater self-sufficiency, pushing it up to 31.2% in a country that is virtually devoid of energy resources. (see appendix table A.14).

With regard to final consumption, even though petroleum derived products are very important and represent 46% of the total, electricity is significant (17.7%), as is bio-mass, which accounts for 10.5% of the consumption of final energy.

Regarding electricity production, the use of hydroelectricity is quite significant, representing 66.5% of the total, since ample use is made of Austria's water resources. The use of gas in generation plants is no less significant, and it accounts for 15.8% of the total. The relative non-importance of coal production plants (9%) is attributable, mainly, to the absence of that resource and its negative environmental impact.

BELGIUM

Petroleum is very high within the overall picture in Belgium, accounting for 60.3%. Along with gas (21.3%) they contribute to a very polarised energy structure in terms of fossil fuels. Even so, nuclear production is very significant, covering 20.6% of supply. With regard to the supply of gas, since 1998 a gas line has linked Belgium to the

UK, the source of most of its natural gas imports. Distrigaz is the Belgian gas company which also owns part of that linking network, which provides it with a fixed amount of the gas that goes through the network, although, at present, short term contracts are being signed with other suppliers. The network has increased to incorporate Germany and Holland. Coal is less important within the Belgian picture, accounting for close to 15%. The production of renewable energy sources is very insignificant.

With regard to final Belgian consumption, petroleum derived products are still rather important, representing some 54.1%, followed by gas (22.7%). Electricity consumption is also important, accounting for 15.4% of final consumption, though it is slightly below the European figure of 17.6%.

Most of the energy generated in Belgium comes from nuclear plants (56.2%). Coal and gas are also significant within the general picture, accounting for 20.5 and 18.3 % respectively. The other sources of generation are hardly, if at all, representative.

DENMARK

In Denmark, petroleum represents 42.1% of the energy supply, though coal is of some importance, representing 27%. Biomass as renewable energy occupies fourth place, after gas, accounting for 7.3% of the energy picture, some way above the European average of 3.1% (A.18.)

Half of final consumption is accounted for by petroleum derivatives, and electricity plays a significant role, accounting for 17.5% of final consumption that originates in thermal coal plants. It must be underlined that a significant portion of final consumption (14.5%) comes from the use of heat generated in certain industrial processes.

More than half of the electric energy generated in Denmark comes from coal plants (57.5%), a figure which is significantly higher than the average European level (28.1%). After coal, gas and fuel oil are the most widely used combustibles for the generation of electricity. Renewable energy represents a significant 6.8%, most of which is accounted for by wind-based energy. (see appendix table A.19).

SPAIN

Several conclusions can be drawn from a look at the Spanish picture. First of all, that petroleum follows the general pattern observed in almost all of the EU, providing more than half of the energy supply. Secondly, the use of national coal has meant that this source of energy now represents 15.3% of the total, which, along with nuclear production (13.6%) has led to a greater degree of energy self-sufficiency in a country that has hardly any gas or petroleum deposits. (see appendix table A.20.)

Gas has become more and more important in the energy picture in the last few years; at present, it accounts for 10.2% of the total. The main supplier is Algeria, which provides 64.9% of the gas imported. The other countries that supply Spain are Norway, which provides 17.1% of its needs, Libya, (6.8%), The United Arab Emirates (4.6%) and Qatar (3.7%)³

The supply of natural gas has been diversified in recent years and at present five countries supply Spain with gas, as compared to 1993, when only three did so (Algeria, Libya and Norway). The gas from Algeria and Norway arrives via gas lines, while the other sources - Libya, UAE, Qatar and Algeria - supply it via natural gas channels.

In terms of final consumption, there is a heavy dependence on petroleum derivatives, up to 65%, and on gas, which accounts for 11.4%. Electricity, though, is the most representative secondary source, accounting for 17.6% of the total.

The Spanish electricity picture shows clearly the importance of nuclear production, which represents 30.4% of the total. The abundant use of coal for the generation of electricity is justified, to a large extent, by the use of national coal. The use of hydraulic resources has meant that hydroelectricity has risen to account for 17.5% of the total. On the other hand, the increased use of gas for the generation of electricity is taking place at such an alarming rate that it now accounts for 8.3% of all the electricity generated. (see appendix table A.21.)

FINLAND

Petroleum and gas are less important in Finland, accounting for 38 and 9.9% of the picture respectively. Biomass production and nuclear energy are important, accounting, together, for over 35.3% and raising the level of self-sufficiency to 40.6%. (see appendix table A.22.)

With regard to final consumption, the weight of gas and petroleum derivatives is below the EU average, while the weight of electricity is decidedly greater, over 25% of total consumption. Bio-mass is also important to final consumption, accounting for 18.5%. Finally, the use of heat is worthy of mention, accounting for 10.1% of the total.

As far as electricity generation is concerned, nuclear production is important, covering 31.1% of demand. Finnish water resources allow for the generation of 21.4% of national electricity production, which is above the European average as far as use of such resources goes. The use of coal accounts for 19.2% of the total, and gas 12.5%, figures which are just under the community average. Biomass use is also most worthy of mention (Finland has important vegetal resources); it is just about on par with or slightly above gas plant production. (see appendix table A.23.)

FRANCE

Here is an example of increasing self-sufficiency through the development of an ambitious nuclear energy programme initiated back in the fifties. Gas and petroleum account for 36.1% and 13% of supply respectively, below the rest of the EU country figures. Nuclear energy, however, accounts for 29.5% of energy consumption, above petroleum, something which is exceptional in the EU.

In final consumption, petroleum and gas derivatives acquire proportions similar to those that obtain in the rest of the European countries, even though electricity is the second source of secondary energy, accounting for 18.9% of the total.

³ Figures for 1998. J. De Quinto, as in footnote 2.

As far as electricity goes, the most significant fact is the presence of nuclear energy, which provides 76.5% of national electricity production. The contribution of other sources is virtually insignificant, especially when compared to the electricity picture in other Member states. The second energy resource for electricity generation is provided by the use of hydraulic elements (12.2%) followed by the use of thermal coal plants which represent 7.3% of production. The use of gas for electricity generation is still very limited, and at present is not even 1% of the total.

GREECE

There is a very high level of dependence on petroleum in Greece, 72.7% of the energy supply. Coal is being consolidated as a major energy source, contributing 33.1% of the total.

In final consumption, petroleum derivatives still represent a very significant portion (70%), although electricity (17.7%) is also important to the energy bill.

Greek electricity comes from traditional thermal coal and fuel plants. The production of coal derivatives is in the order of 70.2%, while fuel oil plants generate 17.4% of the total. Greece has no nuclear production and does not use bio-mass energy either. Its production is reduced to the use of energy sources of fossil origin.

HOLLAND

Holland is a special case. Along with the UK, it is one of the two countries that have important gas and petroleum deposits. The weight of fossil combustibles is quite significant, and petroleum covers, almost exclusively, the energy supply picture, contributing 88.9%, even if that figure is reduced with the transformation into derived products. Gas also plays a significant role, providing 46.9% of the total.

In terms of final consumption, gas is the most widely used energy resource, accounting for 40.6% of the total, ahead of petroleum derivatives, which represent

39.1%. In third place, is electricity, which provides 13.7% of final consumption, and comes mainly from plants which use gas and coal.

The use of gas deposits is clear in the overall picture of the energy situation, since production from gas plants represents more than half of the electricity generated in the country. Production from coal plants represents almost 30% of the total, and nuclear energy 4.1%. Apart from bio-mass production, electricity generation derived from other energy sources (fuel, hydro-electricity and renewable energy) is very insignificant.

IRELAND

Petroleum derivatives constitute the core of the energy picture in Ireland, though there is quite a balanced division between this source, coal, gas and petroleum. Among the immediate objectives of the energy sector are the exploration and exploitation of Irish petroleum deposits, which would greatly enhance the possibility of a stable supply. In the gas sector, the main obstacle is the limited capacity of the networks linking Ireland and the UK, along with the fall in production of the Kinsale and Bally cotton deposits. The decisions to be taken in the next few years in the energy sector are aimed at assuring the gas supply and solving the problem of network linkage. For this reason medium term decisions are aimed at the development of a new gas works in Corrib and at the establishment of the second link with the gas line network, which will increase security and competition, by bringing the Irish market closer to the European market.

Coal is important to the energy supply but its uses are becoming more and more limited, and Ireland is unlikely to carry on using its own coal for much longer. For environmental and efficiency reasons, plants that use combustible are no longer seen as desirable. Furthermore, it doesn't seem likely that electricity plants of that nature are going to be built in the future, although the Clonbulloge plant, which is being built at present, is going to be used.

As far as final consumption goes, petroleum derivatives are in first place, accounting for 61.6% of the total, followed by electricity, which accounts for 15.2%.

Electricity production is mainly of thermal origin, and coal, gas and fuel oil account for 40.3, 30.7 and 23.2% respectively, of national production. There is no electricity of nuclear origin, and renewable energy is hardly, if at all, significant. Furthermore, hydroelectricity provides only 4.3% of electricity in spite of the existence of important water resources.

ITALY

In Italy, petroleum accounts for 58.8% of the energy supply, a long way ahead of gas, (30.4%), which goes to show the low level of diversification of the combustible-based energy sector in Italy. These figures are some way above the European average. Italy does have petroleum and natural gas deposits and the exploration of and production from these deposits have helped to improve the level of self-sufficiency.

One of the features of the Italian energy sector is the high tax burden on energy products, in comparison to their European neighbours. There are many taxes on gas and electricity, and, what's more, since 1998 there has also been a tax on CO₂ emissions. In this sense the tax burden, apart from pushing up the price also distorts competition between fuels and industry.

As in other countries, natural gas consumption has risen appreciably. The increased dependence on outside sources is leading to diversification of supply, with the State being very vigilant in order not to endanger stability.

Final consumption is made up mainly by petroleum derivatives (51%) and gas (28.8%). The consumption of electric energy is also high, now standing at 17% of the total.

As for electricity, the use of fuel oil for generation is a major element, with production from such plants reaching 42.3%. Gas plants are also important, providing 27.9% of the total amount of electricity generated. Italy is one of the few countries that doesn't use much coal, as can be seen from the fact that only 10.9% of electricity comes from this source. Italy does not use nuclear produced forms of energy. The 1987 referendum decided to put an end to electric energy of nuclear origin, and since then

demand has been serviced by other sources of energy, which has led to a significant increase in imports.

LUXEMBOURG

Luxembourg is an atypical case: the energy sector is very small and imports are of strategic importance. Petroleum derivatives basically constitute the energy supply (62%). As far as final consumption goes, petroleum derivatives dominate, accounting for 63.3% of the total, even though gas and electricity make up the rest of final energy consumption. Even so, it must be pointed out that energy production is very low indeed and the electricity generated comes mainly from plants that use imported gas.

First of all, it is important to note that national electricity production is very low indeed, and that demand is covered by a significant volume of electricity imports from neighbouring countries. As far as electricity in Luxembourg goes, it is centred around gas and hydroelectricity. Gas plants provide 55.2% of all the electricity generated in the country and hydroelectricity 31.1%. In both cases the figure is way above the European averages. (see appendix table A.35.).

PORTUGAL

Portugal is another case of dependence on petroleum, which is responsible for 66% of the overall energy balance, followed by coal, which provides 14.2%. Biomass and hydroelectricity have contributed to less dependence on external resources, and account for 10.2% of the entire picture.

Final energy consumption is constituted almost entirely by petroleum derivatives (72.9%). A long way off is electricity, which provides 16.9% of final consumption.

Hydroelectric production is also important, providing 33.9% of the total amount generated. Traditional thermal plants (coal and fuel oil) are no less important, and together they account for more than half of the 38,914 GWh produced.

THE UNITED KINGDOM

Though the UK has sufficient gas and petroleum resources the energy scenario is quite diversified, and petroleum and gas account for 42.7 and 34% of the total respectively. Coal is also important to the English energy supply, accounting for 17.4% of it. Nuclear energy is also important, accounting for 11.2.

In final consumption petroleum derivatives stand out against the rest, representing 46.3% of the total, though gas and electricity are also significant. Gas provides 32.3% of final consumption and electricity 17%.

There is little or no diversification, and nuclear generated energy and energy produced from coal and gas plants provide almost all of the energy in almost equal measure, with coal providing a little more than the others. The use of hydraulic sources is not at all significant (1.4%), neither is production from fuel oil plants (1.6%).

SWEDEN

Finally, Sweden is a country in which, in spite of the importance of petroleum (38.3%) that source is followed closely by nuclear energy (36.5%) and bio-mass production (15%). The climate is also conducive to the use of hydroelectricity, which represents 12.1% of the energy supply.

With regard to final consumption, petroleum derivatives represent 41% of the figure. It is no doubt significant that electricity represents 30% of final energy consumption, a very high figure, not reached in any other country.

Half of Swedish energy comes from hydroelectricity, while the other half is almost exclusively of nuclear origin. The level of dependence on external energy sources for electricity production is very low, as can be seen from the very low level of electricity production from thermal coal, gas and fuel oil plants.

THE EASTERN COUNTRIES:

HUNGARY

Finally, we move on now to the Eastern countries. In Hungary petroleum represents about 30.36% of the total, and gas 38.68%. Coal is an important energy resource, which accounts for 16.51% of the total, and nuclear energy also plays a significant role, accounting for 14.41% of the total energy supply, even though there is only one nuclear plant in the entire country.

One of the most striking features of the Hungarian energy sector is the dependence on natural gas from Russia, the only supplier of this energy source. This is dangerous for the energy supply, not only because of the dependence on Russia, but also because gas covers a significant part of the country's energy needs. Since 1996 Hungary has been linked to the Western gas network via Austria, through the Gyor-Baumgarten gas line. Even so, Russian gas is still its cheapest option.

The dependence on Russia is maintained by the Croatian gas line, which is linked through the Adriatic Sea.

With regard to energy consumption, petroleum derivatives and gas are, without doubt, the main energy sources. Electricity occupies third place in terms of importance, accounting for 14.5% of final consumption.

The major source of Hungarian electricity is nuclear in origin, providing 37.5% of the total generated. Coal has become the second most important source of electricity generation (26%) and gas the third, about 20%.

POLAND

In Poland coal is the most important energy source, providing for 66.7% of total needs. Petroleum is a long way behind, (17%) and gas (9.8%), the demand for which is increasing all the time. The other sources, with the exception of biomass, are hardly, if

at all, representative. Another feature of the Polish energy sector is the lack of nuclear energy.

The country has important coal resources of great quality, hence the weight of this energy source within the overall picture. Poland is one of the countries in the world most dependent on coal. It is the biggest Central European producer and part of its production is exported to European countries and the former Soviet Union. About 97% of its production comes from the Silesian basin in southern Poland. In 1998 a programme for the restructuring of the coal industry was announced, in order to reduce losses and make the sector profitable.

Petroleum reserves are very small and about 50% of imports come from the Russian Federation, even though what is supplied by the United Kingdom is also significant. Natural gas reserves are also small, and most of the natural gas used is imported from Russia. In order to reduce the dependence on Russian gas, Poland is planning to build storage plants and to import liquid petroleum gas from Qatar, Nigeria, Norway and Algeria.

Poland has developed important infrastructure for natural gas and petroleum which has allowed it to be linked to Russia. Furthermore, a project for the importation of gas from Russia via Yamal-European Transit Networks is now being developed, to link Poland with western Europe. In its endeavour to diversify the origin of imported gas, The Polish Gas and Petroleum Company has signed an agreement with The Danish Natural Gas Company, which will build a gas line through the Baltic Sea. It has also been connected to the German transport system.

With regard to final consumption, petroleum derivatives are hardly, if at all, important in almost all European countries, providing only 27.4%, slightly below coal (27.5%). Gas, electricity and heat are the three secondary sources of energy in descending order of importance.

The use of Poland's most abundant resource is patently obvious in the overall energy picture, where 96.3% of the electricity generated comes from thermal coal plants. This has reduced the country's level of energy self-sufficiency but has also had a negative effect on the environment. Hydroelectricity and fuel oil production complete the overall picture.

One important factor, in terms of the future development of the electricity sector, is the estimated level of consumption of electrical energy sources. By the year 2010, it is estimated that demand will be between 60 and 90% of the level established in 1993.

With regard to electricity networks, part of the POKOJ (distribution system for Eastern Europe and the Ukraine) and CENTREL (Poland, the Czech Republic, Slovakia and Hungary) have been connected to the UCPTE system. It also maintains its links with the distribution system of the Ukraine and Belorussia.

THE CZECH REPUBLIC

Finally, The Czech Republic, where the overall energy picture is dominated by the significant presence of coal. Ample use is made of the country's own coal reserves. 51.4% of the energy supplied is accounted for by coal, though for economic and environmental reasons it is hoped that coal production will be reduced in the future, to reach, by the year 2020, production levels that do not exceed half of the quantity extracted in 1990.

The overall energy picture also reflects an important presence of gas, which accounts for 18.7% of the total, while petroleum accounts for 17.1% of the total. Nuclear energy is also significant since the country's one nuclear plant is responsible for supplying 8.3% of the total amount of energy.

The dependence on fossil fuels is such that the figure is over 60% and one of the aims of Czech energy policy is to bring this dependence down to about 40% by the year 2005.

The Czech Republic has hardly any natural gas and petroleum resources of its own and therefore has to import heavily. The Russian Federation is practically the only natural gas supplier and its supply comes through the Transgas system which is, as well, the transport route that links the Czech Republic to western Europe. Its strategic importance makes it a bridge between Russia and the west, and it is, along with

Slovakia, the main point of exportation of Russian gas to European countries⁴. In order to ensure a greater degree of stability of supply, The Czech Republic also receives gas from Norway and Germany, though not in very significant quantities. However, since 1997, it has been importing more significant quantities from Norway through companies such as Statoil, Norsk Hydro and Saga.

Petroleum reaches the Czech Republic via the Druzhba oil pipeline, coming from Russia, its main supplier, and from Germany via the Mero oil pipeline. This route allows the country to receive petroleum from the Italian port of Trieste through the Transalpina network (TAL). In recent years, crude imports from Russia have begun to fall, while those from the EU have begun to rise. Other link networks that supply energy to the Republic are the Adria oil pipeline and the Brotherhood gas line.

With regard to final consumption, petroleum derivatives are far less significant than in other countries, representing 30.9%. Gas has been becoming more important in recent years, and now stands at about 24.8% and electricity is in third place, with 16.7%. Even so, coal is also an important secondary source of energy, representing 14.3% of final consumption.

Electricity production coming from thermal coal plants is extremely high, up to 71.6%. Unlike Poland, The Czech Republic does use nuclear production, which represents 20.3% of the total. With the exception of gas and hydroelectricity, the other sources of energy are hardly, if at all, representative in terms of the generation of electricity. (see appendix table A.47.)

With regard to energy infrastructure, the country is linked to the high tension system of all the neighbouring countries. It is a member of CENTREL, along with Slovakia, Poland and Hungary, who are in the process of preparing their linkage to the western electricity system UCPTE⁵.

⁴ Approximately 40% of Russian gas exported to western Europe is transported through the Czech Republic and Slovakia, which is linked to Germany, France, Italy and Austria

⁵ UCTE: Union for the Co-ordination of the Transport of Electric Energy. CENTREL: Central European Electricity Network.

2.6. Linking the energy networks

One of the most important aspects of the European energy sector is the need for a transport network for the circulation of energy products (petroleum, gas and electricity). This is essential and crucial to a domestic energy market where energy products may circulate without any restriction throughout the entire EU. In this respect, emphasis must be placed, first of all, on the effective linking of networks, i.e., all countries must be connected to the European network, and action must be geared towards the peripheral countries, which, geographically, are not within the European network. Secondly, it is absolutely necessary to increase the linkage capacity, especially in areas where bottlenecks and excessive congestion have been observed, which have resulted in limiting traffic across the network. Furthermore, a greater volume of energy exchanges brought about by the creation of a domestic market can also cause serious saturation of the networks. Finally, international co-operation and the diversification of external supply will necessarily lead to an improvement in the European network through greater linkages with third countries and to the building of new communication networks.

To deal more specifically with the gas line networks, the peripheral countries have more problems of connection. A case in point is Greece, which is not linked to the rest of the EU and Finland is linked to the European network through the gas line that runs close to Saint Petersburg and which links Russia with Western Europe through the Eastern countries. However, the peripheral countries in southern Europe, Spain and Italy, have taken advantage of their proximity to the African countries to develop an important gas infrastructure network that transports gas from Algeria and Libya and which are directly linked to the European network.

In other cases, the connection capacity is below demand needs and a major priority is to increase the transport capacity. An example of this is the Ireland-England link.

Furthermore, the EU is a major importer of gas, purchasing over 40% of the natural gas it consumes. The main gas line suppliers are the Russian Federation, which supplies about 41% of the total of gas imports, Algeria (30%) and Norway (27%)⁶.

Figure 2.1



Source: EUROGAS

The entry of the eastern countries does not necessarily imply connection problems, especially as far as The Czech Republic and Hungary are concerned. At present, both are connected to the central European network, while Poland is connected to Denmark and the German system. The diversification of external gas supplies will be enhanced by the incorporation of the Eastern countries. These three countries have always been heavily dependent on Russian gas, which has forced them to develop important infrastructure. In this respect, links with the Russian Federation would be

⁶ Figures are for 1997, DG XVII (1999): *1999 Annual Energy Review*

strengthened, along with gas imports coming through the gas line network that links it to Europe, through Italy and Spain, with the African gas deposits.

Finally, we must mention some of the major investments aimed at strengthening the European transport network. These are the most important projects:

- Linking Bacon (England) with Zeebrugge (Belgium)
- The NorFa network that links Norway directly to France
- The agreement between Norway and The Czech Republic
- Supply from the Norwegian deposit of Froy to Scotland via the St. Georgius gas line, and from there to Ireland
- Several projects are being developed in Germany, the most important being the Trans Europa Naturgas gas line
- In Austria, the country's biggest oil company, OMV, has lined up several options for the introduction of natural gas in the European market, such as the Trans.Austria-Gasline, which will cross Austria from Slovakia and another network that would supply Russian gas to Germany and France.

With regard to the European electricity network, proper linkage is equally important. With the exception of Greece, Finland and Ireland, all the Member States are connected to the European high tension network. The United Kingdom is directly linked to France by undersea cable, as is Sweden with Germany.

At present, the biggest electricity exchanges take place in the centre of Europe, around the north of France and to the west and south of Germany. Virtually all the Central European countries are involved in those electricity exchanges, the most important, volume wise, being France, Germany and Italy. There are less dealings with peripheral countries, mainly because of the low connection capacity. Spain is a case in point, having a very limited exchange capacity with France. This severely restricts business opportunities with the rest of Europe.

Exchange with Eastern countries requires a major technical and economic effort, to bring tension levels into line with each other and to bring new countries up to the required technical levels necessary for their proper linkage with Western Europe. In this

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sense, Poland, Hungary and The Czech Republic are part of CENTREL, which has recently been connected to the European network, UCPTE.