Energy subsidies in the European Union

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2001

WORKING DOCUMENT OF THE EUROPEAN PARLIAMENT'S DG FOR RESEARCH.

NOT YET PUBLISHED BY THE EUROPEAN PARLIAMENT.

ENERGY SUBSIDIES IN THE EUROPEAN UNION

Final Report

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July 2001

ACKNOWLEDGEMENT

This study on energy subsidies in the EU was commissioned by the European Parliament, Directorate General for Research. The author would like to thank all those who provided valuable suggestions and comments on earlier drafts of this report.

CONTENTS

SUMMARY

Many European governments as well as the EU itself provide financial support to various sources of energy. Such subsidies have been introduced for a variety of reasons, including economic, social, political, technological and environmental ones. However, energy subsidies also imply market distortions, leading to inefficiencies in the functioning of energy markets, and they may have unwanted side effects, such as reducing the attractiveness of energy conservation and renewable energy.

The present study contains a survey of energy subsidies existing in the EU and the Accession Countries by the end of the 20th century. Lacking any 'objective' definition of what constitutes a subsidy, and lacking any 'objective' baseline against which the size of a subsidy can be measured, some pragmatic and sometimes arbitrary choices had to be made. Furthermore, the information needed to quantify the amounts of subsidy involved was not always available.

When only looking at money transfers and tax reliefs (see Table S.1), it can be concluded that the total amount of subsidy that the EU and its Member States give to renewable energy is substantially lower than the amount of subsidy to fossil fuels, and probably in the same order of magnitude of the subsidies to nuclear alone.

A major part of the identified subsidies relates to tax exemptions and reductions. There are two major groups: those which have been introduced for social reasons (usually reduced VAT rates for households) and those intended to protect industry against the loss of international competitiveness. The latter are often accompanying the introduction of specific energy and/or CO_2 taxes. Renewable energy is subsidised directly as well as by means of various fiscal arrangements. R&D subsidies play a particularly important role in the case of nuclear energy.

Direct subsidies to coal production are declining throughout Europe, although the German coal subsidies remain one of the largest single subsidy items. Tax reductions and exemptions are an important component of the subsidies to oil, gas and electricity and they tend to increase as more countries are introducing energy tax schemes. Support for renewables is also increasing, whereas subsidies to nuclear energy do not show a clear trend.

In the accession countries, especially the former centrally planned economies, subsidies are generally decreasing. In particular, cross subsidies from industry to households are gradually being phased out.

In addition to these direct and indirect subsidies, there are three important factors favouring certain types of energy over others. Firstly, energy producers and users often do not pay for the (full) external costs and damage (such as pollution, accidents and risks). In some cases (oil spills, nuclear accidents), international conventions provide for limited liability of the perpetrators. Secondly, 'traditional' energy continues to benefit from support that it has received in the past, e.g. in the form of below-commercial rates of return on investments. Finally, legal arrangements provide for preferential treatment of specific types of energy (especially renewables). Although these kinds of support are much harder to translate into money terms, some attempts to do so have been made. A comparison with the amounts involved in money transfers and tax reliefs is given in Table S.2. This shows that the bias in favour of 'traditional' sources of energy is even stronger if these factors are taken into account.

A more precise and reliable estimate of the bias against renewable energy might be achieved by means of a study to answer the question: "If energy producers and users were fully liable

for the damage and risks caused by their activities, and if this liability had to be (and could be) covered by insurance, how much would the insurance premium be?".

Table S.1. Amounts of energy subsidies in EU and Member States (millions of Euros per year) (money transfers and tax reliefs)

	solid fuels	**oil and gas**	**nuclear**	**renewables**
EU	60	260	380	180
Austria	> 15	> 95	2	> 150
Belgium	8	1	> 40	5
Denmark	600	1,000	2	> 180
Finland	> 25	30	45	240
France	500	> 30	> 600	> 300
Germany	9,500	1,000	> 700	> 300
Greece	> 1	> 250	< 1	> 35
Ireland	40	> 50	-	> 10
Italy	> 75	> 1,500	100	> 300
Luxembourg	-	> 7	-	> 10
The Netherlands	> 250	> 4,500	65	> 250
Portugal	40	45	< 1	70
Spain	765	> 5	150	> 50
Sweden	70	180	90	> 130
United Kingdom	650	> 1,900	450	250
EU + Member States	**> 12,000**	**> 10,000**	**> 2,600**	**> 2,400**

Note: Subsidies for electricity have been attributed to primary energy sources using shares in electricity production as weights.

Table S.2. Tentative estimates of subsidies and other kinds of support in the EU (mln EUR per year)

	fossil fuels	**nuclear**	**renewables**
money transfers and tax reliefs	> 22,000	> 2,600	> 2,400
uninternalised external costs	± 50,000	> 700 – > 20,000	± 600
inheritance of past subsidies	P.M.	± 8,500	P.M.
preferential treatment			± 1,000
total	**> 70,000**	**> 10,000**	**> 4,000**

INTRODUCTION

Subsidies and other types of financial support to various sources of energy are quite common throughout the European Union, as well as in the countries that have applied for membership (the accession countries). These subsidies have been introduced for various reasons, such as:

- 'traditional' energy policy considerations (security of supply, diversification, development of domestic energy resources, competitiveness);
- social and regional policy considerations (e.g. to maintain income and employment in mining regions or to make heating fuels affordable for low-income households);
- technology policy considerations (e.g. to build up a strong international position in nuclear know-how);
- environmental policy considerations (e.g. to stimulate renewable energy).

In a liberalising European energy market, the need for a 'level playing field' implies the need for a critical assessment of the distortions created by existing energy subsidies. Furthermore, financial support to conventional energy sources may be barriers to achieve the EU's policy objectives on CO_2 reduction and a higher share of renewables.

Against this background, the European Parliament has commissioned the present study, which presents a survey of existing energy subsidies in the EU, its member states and the accession countries.

The report is structured as follows. In Chapter 1, some methodological aspects and general considerations are discussed. Chapter 2 presents a review of energy subsidies in the EU and its 15 member states. The situation in the 13 accession countries is described in Chapter 3, whereas Chapter 4 contains the conclusions.

1. METHODOLOGICAL ISSUES AND GENERAL CONSIDERATIONS

1.1 DEFINING AND QUANTIFYING ENERGY SUBSIDIES

The fact that many governments provide substantial amounts of financial support to the production and consumption of energy has led to a considerable research activity in recent years. An important reason for the interest in energy subsidies is the possible negative impact on the environment that they could have, by providing 'perverse' incentives – i.e., by increasing the demand for energy in general and for polluting types of energy in particular. Another major concern, mainly expressed by economists, are the market distortions that energy subsidies generate, thus impeding the market mechanism to function properly, leading to a sub-optimal allocation and restricting social welfare. Several studies have been published on environmentally adverse subsidies, including energy subsidies (e.g. Roodman, 1996; De Moor and Calamai, 1997; Greenpeace, 1997; Myers and Kent, 1998; OECD, 1996, 1999b).

When trying to identify and quantify energy subsidies, one will unavoidably be confronted with a number of methodological and definition problems. Two of the main problems are:

1. The fact that there is no fundamental difference between energy subsidies in a narrow sense (i.e., direct payments from the public budget benefiting the supply or use of energy) and other kinds of support. Thus, all policies favouring the production or consumption of (specific kinds of) energy can in principle be seen as 'subsidies'. Looking only at actual cash flows would lead to a limited and distorted result. However, including all policies that affect the supply of and demand for energy would imply an unmanageable task. Somehow, a compromise between the two extremes has to be found. The emphasis in this report is on subsidies involving actual money transfers (including tax relief), but attention is also paid to other kinds of support (see Sections 1.2, 1.3 and 1.4).
2. The fact that there is no such thing as an 'objective baseline', i.e. an 'ideal' situation that provides a reference against which the size of a subsidy can be measured. For example, the fact that fuels are taxed more heavily when they are used for transport than when they are used for heating could be regarded as a subsidy for the heating fuels. However, the higher tax for the transport fuel can also be seen as a payment for the use of infrastructure and for 'external costs' (such as congestion and accidents). Determining whether a subsidy exists (either on the transport or the heating fuel) and what its size is would require a full assessment of these external costs, which is obviously not feasible.

The present study takes a pragmatic approach in dealing with these complexities. Rather than starting from a definition of energy subsidies, the demarcation line has been drawn by describing types of support that have remained beyond the scope of the study. Thus, the following arrangements are *not* included as energy subsidies[1]:

- differences in mineral oil tax rates between road traffic and other types of use of the same fuel;
- differentiations and exemptions in excise taxes on mineral oil products for road transport (e.g., reduced rates for unleaded petrol or low-sulphur diesel);
- exemptions from taxes for fuels which are used for non-energy purposes (e.g. as a chemical feedstock);
- exemptions from taxes for fuels which are used for electricity generation (if electricity is taxed);
- public money for investments that only have an indirect relationship with energy use (e.g., in road infrastructure);

[1] In some cases, they may be mentioned in the text, but they are not counted as subsidies when estimating the order of magnitude of subsidies for particular types of energy.

- public money for programs related to the termination of energy production activities, in as far as these expenditures are not part of the normal costs that should have been borne by the operator of the activity (e.g. losses incurred due to a politically motivated early closure of nuclear plants; social programs to alleviate the consequences of coal mine closures);
- differentiations in the conditions under which energy companies can operate (lacking any 'baseline' for these conditions), except when these conditions relate to provisions which also apply to other industries (thus, a lower corporate tax rate for oil and gas producing companies than for other companies is included as a subsidy, but differences in the state's share in mining profits or royalties are not);
- subsidy schemes which are not exclusively related to energy and for which the part related to energy could not be identified separately;
- 'cross-subsidies', i.e. subsidies entirely financed by other users of the same kind of energy;
- financial compensation, given in reaction to energy price increases (such as those given by several governments to the transport, agriculture and fisheries sectors, following protests in autumn 2000);
- subsidies for energy conservation (including subsidies for combined heat and power[2]);
- general energy subsidies which could not be allotted to a particular fuel or type of energy;
- general public provisions that can be related to energy (e.g. military expenditures to safeguard oil supplies from the Middle East, or the cost of police forces protecting nuclear transports).

Furthermore, the present report does not refer to subsidies to energy projects and investments outside the EU or the accession countries. Subsidies amounting to less than EUR 1 million per year are also excluded. The emphasis is on subsidies provided by central governments, although subsidies by regional governments are included where they play an important role in energy policies.

Having drawn these pragmatic demarcation lines, an overview of the various energy subsidy schemes in the EU and the accession countries will be presented in the next chapters. Before doing so, three types of government support will be discussed that do not involve actual money transfers, but which can be important factors favouring particular types of energy: the non-internalisation of external costs, the lasting impact of subsidies that have been provided in the past; and the existence of legal arrangements giving preferential treatment to certain kinds of energy.

1.2 EXTERNAL COSTS AND UNCOMPENSATED DAMAGE

An important, but largely hidden type of support to energy is the fact that energy producers and consumers often do not pay the full social cost of energy. In economic terms: the external cost of energy remains to a large extent uninternalised. Examples of such costs are the environmental damage caused by oil spills or by air pollution from burning fossil fuels, the costs of accidents (e.g. in coal mining), and the risks associated with nuclear power. Obviously, some internalisation occurs if regulations are in place which oblige the energy producer or user to take preventive measures or to compensate the damage. However, the costs of the uncompensated damage and risks that remain are largely borne by society as a whole rather than by the firms or individuals bringing them about. Such shifts of (potential) costs from the private to the public domain can be seen as subsidies.

[2] Although subsidies to combined heat and power (CHP) are intended to be instruments of energy conservation, they can also be regarded as subsidies favouring the fuel that is being used. However, even if one takes that vision, the subsidy could not be attributed to one particular kind of energy, because CHP can involve several types of fuels (though in practice the majority is fossil).

The external costs of electricity production have been estimated in the EU funded 'ExternE' project. Although the estimates should be treated with caution, it can be concluded from one of the project's reports that the sum of these external costs for the EU amounted in the early 1990s to more than EUR 60 billion per year (excluding the former GDR, Austria and Luxembourg). Fossil fuels accounted for the bulk of these costs (see Table 1.1).

Table 1.1 Aggregated external costs of electricity production in the EU (MECU/year)

Fossil fuels	63,342 – 88,539
Nuclear energy	734 – 1,355
Renewables	562 – 564
Total	**64,638 – 90,458**

Source: EC (1999g), Table 19.14.

Note: Figures do not include the former GDR, Austria and Luxembourg. Figures for nuclear do not include Finland. Figures for renewables do not include Belgium, Germany, Italy and The Netherlands. In the ExternE project, on which these figures are based, reliable values for nuclear accidents, high level nuclear waste impacts, nuclear proliferation and impacts of terrorism have not been developed. These omissions might well be significant (EC, 1999f, p. 497).

Energy taxes in the EU amounted in 1997 to some EUR 130 billion[3]. However, in OECD countries more than 90 percent of energy tax revenues is from excise taxes on motor fuels (OECD, 1999c). It is therefore safe to say that only a small part of the external costs of electricity generation in the EU is internalised by means of energy taxes, and the uninternalised external cost of electricity production from fossil fuels can be roughly estimated at some EUR 50 billion per year.

Oil spills are another case in point. The maximum total amounts of compensation that can be paid per event by the 1971 and 1992 International Oil Pollution Compensation Funds (IOPC Funds) are SDR 135 mln (EUR 175 mln) and SDR 60 mln (EUR 78 mln), respectively, including the shipowner's share. The shipowner's liability is limited to a maximum of SDR 59.7 mln (EUR 78 mln) and SDR 14 mln (EUR 18 mln), respectively. Moreover, claims for damage to ecosystems are not accepted (IOPC Funds, 2001). As the IOPC Funds are mainly financed by the oil companies, the payments by the Funds can not be regarded as subsidies, but the uncompensated damage clearly is an implicit subsidy for oil.

Likewise, the liability for damage due to nuclear accidents is limited by the Conventions of Paris (1960) and Vienna (1963) and the Joint Protocol linking these two (1988). Under these Conventions, the liability for the operator of a nuclear plant can be capped at SDR 5 mln (EUR 6.5 mln), whereas the total liability (including the compensation paid from public funds) can be limited to an amount of SDR 300 mln (EUR 390 mln)[4]. This is only a fraction of the damage that could occur in the case of a severe accident. In the "ExternE" project, the maximum amount of external costs in case of a nuclear accident (worst case scenario: a core melt accident, followed by a massive containment breach) was estimated at more than EUR 83 billion (Dreicer *et al.*, 1994). However, due to the extremely low probability of such an accident and as a result of using discount rates (leading to low present values for future damage), the external cost per year calculated on the basis of the ExternE methodology is still quite low: around EUR 1 bln for the EU as a whole (see Table 1.1). Other studies arrive at much higher values. For instance, Ewers and Rennings (1994) estimated the total damage of a reactor meltdown in Germany alone at DEM 10,697 billion (EUR 5,469 billion), or (given a probability of 1 meltdown per 33,000 reactor years) DEM 0.043 (EUR 0.022) per kWh. Total nuclear power generation in the EU amounted to 854 TWh in 1998 (Eurostat, 2000a), implying, when applying the Ewers and Rennings figures to the EU as a whole, a total

[3] Calculated on the basis of Eurostat (2000 a and b).

[4] Under the 1997 Convention on Supplementary Compensation for Nuclear Damage, this amount is increased according to a formula which takes into account the installed nuclear capacity in a country.

external cost from nuclear accident risks for the EU of almost EUR 20 billion per year. Including the external cost of other parts of the nuclear cycle would imply still (much) higher figures. Allowing nuclear plant operators to leave this damage largely uninsured implies an implicit subsidy (by way of unpaid insurance premiums) in the same orders of magnitude.

It can be concluded that the size of uninternalised external costs of energy is considerable, even though the estimates are largely uncertain (especially in the case of nuclear). In order to arrive at more precise figures of the implicit subsidy involved, it might be interesting to launch a study to answer the question: "If energy producers and users were fully liable for the damage and risks caused by their activities, and if this liability had to be (and could be) covered by insurance, how much would the insurance premium be?".

1.3 THE INHERITANCE OF PAST SUBSIDIES

Before the process of liberalisation and privatisation started in the EU, energy supply was widely regarded as a 'public service'. Energy companies were in many cases state owned and heavily regulated so as to contribute to the political objectives of governments. Although the invisible subsidies implied in these arrangements have been substantially reduced, they have not disappeared. Moreover, the impact of past subsidies can remain a beneficial factor for particular types of energy for a long time, especially in case of long term investments.

For example, countries like The Netherlands and Denmark have devoted large amounts of money to the creation of natural gas networks. Although the role of direct government subsidies was limited, tariff regulations and fiscal facilities have played an important role. Present users of natural gas are still benefiting from these investments by paying lower prices than would have been the case if the infrastructure had been financed on commercial terms.

Similarly, investments in nuclear power plants have been facilitated by requiring financial rates of return well below commercial rates. Michaelis (1997) argues that, if a 10%-11% required rate of return (RRR) is taken as the benchmark for the market rate, the 5% RRR required by the British government in the early 1980s reduced the apparent cost of nuclear-generated electricity by approximately 1.6 pence per kWh (nearly 40%). Investment in nuclear power plants has also benefited from direct subsidies. For instance, the European Community has contributed EUR 2.9 billion to investments in nuclear power plants since the start of the Euratom Treaty in 1957 (EC, 2000r). Current nuclear power production still benefits from these capital subsidies. Assuming that for all existing nuclear capacity in the EU government investment support has led to an average cost reduction of EUR 0.01 per kWh, the effective annual subsidy (given the above mentioned nuclear power generation of 854 TWh) amounts to some EUR 8.5 billion.

Renewable energy also benefits from past public investments (e.g. in large scale hydropower), but to a much lesser extent.

Another example of subsidy legacies from the past are the 'stranded costs' involved in projects that would have been too risky for a commercial firm, but could be done thanks to the 'soft budget constraints' of state owned or monopolistic enterprises. Examples are the fast breeder reactors that have been closed down in Germany and France and an expensive coal gasification project in The Netherlands. With the liberalisation of the energy markets, these costs and the huge subsidies they imply are becoming visible.

1.4 PREFERENTIAL TREATMENT OF PARTICULAR TYPES OF ENERGY

Several EU governments have introduced arrangements requiring energy companies to purchase specific kinds of electricity (in particular renewables based) from independent power producers at a fixed price. The best known example of such an arrangement is the German ‘Stromeinspeisungsgesetz’. Comparable arrangements exist in Austria, Greece, Italy and Spain. In March 2001, the European Court of Justice has ruled that this type of support does not constitute state aid under the EU Treaty (ENDS, 2001). Nevertheless, an implicit subsidy element is involved. In 1997, electricity production from renewables in the five countries mentioned (excluding large scale hydro, which usually does not qualify for such ‘feed in’ arrangements) amounted to 33 TWh (calculated on the basis of EC (2000v) and Eurostat, (2000a)). Assuming an average price premium of EUR 0.03 per kWh, the implicit annual subsidy can be estimated to be in the order of magnitude of EUR 1 billion.

2. ENERGY SUBSIDIES IN THE EUROPEAN UNION

This Chapter provides information on the energy subsidies provided by the EU and its fifteen member states. They are classified by category of energy: solid fuels (coal, lignite and peat); oil and gas; nuclear energy; renewables; and electricity. The most recent available information has been used, generally relating to the late 1990s or the year 2000.

To the extent possible, attempts have been made to quantify the amounts of subsidies involved[5]. As a reasonably precise quantification of subsidies is not always possible, the amounts mentioned should be treated with caution and mainly be regarded as indicators of the orders of magnitude. The (rounded) total amounts of quantifiable subsidies by type of energy are mentioned in the tables at the end of each section. Subsidies to electricity have been 'translated' into subsidies for primary energy sources by distributing them according to the share of each energy type in total gross electricity generation in 1998.

[5] Quantifiable subsidy amounts have been expressed in Euros per year (printed bold and in italics). Exchange rates used are those of December 31st, 1999. Incidentally, the value of the Euro and the US Dollar were almost exactly the same by that date. In case of subsidy amounts showing large differences between different years, averages of several years have been calculated to the extent possible.

General

Many EU energy subsidy schemes and funding programmes cover energy in general and can therefore not always be attributed (completely) to a particular type of energy. The main 'general' support schemes that are relevant for energy include:

- The Thematic Programme 'Energy' within the 5th framework programme for research, technological development and demonstration (1999-2002). The budget is EUR 1,042 mln, of which 1,026 mln for 'key actions'. Part of this amount could be attributed to specific types of energy (see Table 2.1.1)[6];
- Parts of the Structural Funds (which include the Regional Development Fund (ERDF), the Social Fund and the Guidance section of the European Agricultural Guidance and Guarantee Fund). Under Objective I, an amount of EUR 2,496 mln was budgeted for energy projects in the period 1994-1999. Energy projects have been financed under national programmes as well as under various Community Initiatives, such as Interreg II, FEDER, Urban, EMS, Leader and Regis II;
- Parts of Phare (mainly within the sectors 'environment and nuclear safety' and 'infrastructure', for which in the period 1990-1998 EUR 447 mln and EUR 958 mln has been disbursed, respectively - EC, 2000s);
- ALURE: a programme for economic co-operation in the energy sector between the EU and Latin America (budget: EUR 25 mln for the period 1998-2002);
- Synergy: a programme for co-operation with non-member countries in the area of energy. It has a budget of EUR 15 mln for the period 1998-2002;
- ETAP: a programme for analysis and forecast at the EU level, and other related work in the energy sector (budget: EUR 5 mln for the period 1998-2002)

Table 2.1.1. Subdivision of RTD subsidies for energy in the 5th Framework Programme

	Key action: Cleaner energy systems, including renewables		Key action: Economic and efficient energy for a competitive Europe		Total (mln €)
	percentage	amount (mln €)	percentage	amount (mln €)	
coal	1.6	7.7	0.3	2.0	**9.7**
oil and gas	2.6	12.7	25.7	140.7	**153.4**
renewables	50.3	240.7	27.6	151.2	**391.9**
electricity	22.9	109.7	5.9	32.0	**141.7**
other/not attributable	22.6	108.3	40.4	221.1	**329.4**
TOTAL	**100**	**479**	**100**	**547**	**1,026**

Solid fuels

The CARNOT programme was devised in order to promote European technology relating to the clean and efficient use of solid fuels. It covers the years 1998-2002 and has a budget of EUR 3 mln (somewhat less than ***EUR 1 mln*** per year).

Within the framework of the ECSC, a coal research programme has been running for more than 40 years. The current annual budget is about ***EUR 25 mln***.

[6] This has been done by attaching to each RTD project that has been funded up to now a weight consisting of the product of its duration and number of participating institutions.

The share of coal in the 5th RTD programme's budget was estimated at EUR 9.7 mln (cf. Table 2.1.1) or ***EUR 2 mln*** per year.

Under a 1994-1999 Structural Funds programme, financial support for the use of peat in Ireland has been provided (EC, 2001). The amount involved was about IEP 20 mln (IEA, 1999c) or ***EUR 4 mln*** per year.

Under the Phare programme, support for coal related projects amounted to a total of EUR 26.75 mln (***EUR 3.3 mln*** per year) over the period 1990-1997 (calculated after ERM, 1999).

Oil and gas

Table 2.1.2 lists the main contributions from the Structural Funds for oil and natural gas projects under the 1994-1999 operational programmes. The total amount is EUR 1,187 mln, implying an annual average of ***EUR 198 mln***.

Table 2.1.2. Contributions from Structural Funds for oil and gas, 1994-1999

country	operational programme	EC contribution (mln EUR)
Greece	Introduction of natural gas	354.6
Greece	Athens : gas-fuelled bus and natural gas station	37.4
Italy	"Energia: Metanizzazione"	60.0
Portugal	Infrastructure to support development: sub-programme for energy (*)	322.0
Portugal/Spain	Interreg II: gas infrastructure	220.0
Spain	LNG plant, Huelva	7.3
Spain	Gibraltar-Cordoba gas pipeline	99.0
Spain	Valencia-Cartagena gas pipeline (1st phase)	23.8
Spain	Cartagena-Puertollano oil pipeline	62.9
Total		**1,187.0**

(*) Includes some funding for renewables and conservation; amount may thus be slightly overestimated.
Source: EC (2001).

The share of oil and gas in the 5th RTD programme's budget was estimated at EUR 153.4 mln (cf. Table 2.1.1), or ***EUR 38 mln*** per year.

Under the Phare programme, support for oil and natural gas related projects amounted to a total of EUR 17.4 mln (***EUR 2 mln*** per year) over the period 1990-1997 (calculated after ERM, 1999).

Nuclear energy

The Euratom R&D budget for the period 1999-2002 amounts to EUR 1,260 mln, or ***EUR 315 mln*** per year.

The Euratom 'nuclear safeguards' budget for 2000 amounted to ***EUR 16.7 mln***.

Euratom loans are presently only provided for modernisation of nuclear installations in Accession Countries.

Under the Phare programme, support is provided for nuclear safety improvements in Bulgaria and Lithuania. In the period 1991-1999, the European Commission has committed EUR 192

mln (on average ***EUR 21 mln*** per year) for nuclear safety under the Phare programme (EC, 2000u).

Renewables

Financial support for renewable energy is mainly coming from the Structural Funds. The amount spent on renewable energy in the period 1994-1999 is estimated at EUR 300 mln (***EUR 50 mln*** per year). Projects have been supported in Greece, Spain, France, Ireland, Italy, Portugal, Austria and the United Kingdom, featuring notably wind, solar and biomass (EC, 1999c).

The share of renewables in the 5th RTD programme's budget was estimated at EUR 391.9 mln (cf. Table 2.1.1) or ***EUR 98 mln*** per year.

A source of funding dedicated specifically to renewable energy is the Altener programme. The budget for Altener II (1998-2002) is EUR 77 mln or ***EUR 15 mln*** per year.

Under the Phare programme, support for renewables related projects amounted to a total of EUR 14.3 mln (***EUR 1.8 mln*** per year) over the period 1990-1997 (calculated after ERM, 1999).

Electricity

The share of electricity in the 5th RTD programme's budget was estimated at EUR 141.7 mln (cf. Table 2.1.1) or ***EUR 35 mln*** per year.

Table 2.1.3 lists the main contributions from the Structural Funds for electricity projects under the 1994-1999 operational programmes. The total amount was EUR 325.7 mln, or ***EUR 56 mln*** per year.

Table 2.1.3. Contributions from Structural Funds for electricity, 1994-1999

country	operational programme	EC contribution (mln EUR)
Greece	energy (electricity production)	140.0
Greece/Italy	Interreg II: interconnection of electricity networks	75.8
Italy	"Energia"	109.9
Total		**325.7**

Source: EC (2001).

Under the Phare programme, support for electricity related projects amounted to a total of EUR 32.6 mln (***EUR 4.1 mln*** per year) over the period 1990-1997 (calculated after ERM, 1999).

Table 2.1.4. European Union: Summary Table

Final energy consumption (1998): 945.5 Mtoe **Gross electricity generation (1998):** 2,490 TWh					
	coal	**oil & gas**	**nuclear**	**renewables**	**electricity**
share in gross electricity generation (1998)	27%	23%	34%	15%	
quantifiable subsidies (mln EUR per year)	35	240	350	165	95
quantifiable subsidies, incl. attributed electricity subsidies (mln EUR per year)	60	260	380	180	

Source: Energy statistics: Eurostat (2000a); other figures: this section.

2.2 AUSTRIA

Solid fuels

The importance of coal in Austria's energy market has greatly diminished over the past two decades. Out of about 20 coal mines operating in the 1960s, only one still operates. The government's financial support to the coal industry in 1996 was estimated to have been around ATS 75 million (EUR 5.5 mln). This support was mainly used for social programmes in connection with mine closures (which is not an energy subsidy in terms of this report), and for exploration (IEA, 1998b).

Coal and coal products are not subject to the energy tax. If coal were taxed at the same rate per GJ as natural gas (ATS 0.6 per m^3 or ATS 1.8 per GJ), the 66.6 PJ final use of coal and coal products in 1998 (Statistik Österreich, 2000) would have been subject to a total tax amount of ATS 119.9 mln or ***EUR 8.7 mln***.

In the years 1995-1998, the Austrian government spent less than EUR 1 mln per year on coal related R&D (IEA, 1999f).

Oil and gas

Natural gas and electricity are subject to an energy tax of ATS 0.60 per m^3 and ATS 0.2 per kWh, respectively. Until June 2000, the rate for electricity was ATS 0.1 per kWh. For energy intensive enterprises there is a ceiling on the total tax burden of the energy tax. Total final gas consumption amounted to 161.7 PJ or 4.49 bln m^3 in 1998 and total final electricity consumption to 179.8 PJ or 49.9 TWh (Statistik Österreich, 2000). If all final consumption were taxed, the revenues would have been ATS 2.7 billion and ATS 5.0 billion, respectively, or ATS 7.7 billion in sum. Total revenues from the energy tax were ATS 5.5 billion in 1997 (EC, 2000b). Assuming (somewhat arbitrarily) an equal distribution of this implicit subsidy between gas and electricity, both received ATS 1.1 billion or ***EUR 80 mln***.

In 1998, the Austrian government spent less than ***EUR 1 mln*** per year on oil and gas related R&D (IEA, 1999f).

Land-locked Austria is not a member of an International Oil Pollution Compensation Fund.

Nuclear energy

Austria has no nuclear power plants.

In 1995-1998, the Austrian government spent on average ***EUR 2.0 mln*** per year on nuclear related R&D (IEA, 1999f). This budget was mainly for nuclear fusion.

Renewables

IEA (1998a) reports the following subsidies for renewable energy in Austria:
- federal subsidies for biomass-based district heating: ATS 192 million (***EUR 14 million***) in 1996;
- capital subsidies of 8 to 25% for investments in small hydropower plants (no amounts specified);
- subsidies administered by the Ministry of Agriculture and Forests for biomass and small hydropower projects: ATS 190 million (***EUR 14 million***) in 1996;
- provincial support for solar, biomass and heatpumps: ATS 500 million (***EUR 36 million***) in 1996;
- guaranteed minimum prices for electricity from renewables that is traded between provinces, ranging from ATS 0.421 to ATS 0.9 (EUR 0.03 to EUR 0.07) per kWh (no amounts specified).

In 1997, an investment fund was created providing subsidies of ATS 80 million (***EUR 5.8 million***) per year for investments in power plants based on renewable sources (Novem, 2001).

There are also a number of renewable energy subsidy schemes running at the level of the *Länder*.

For electricity from renewables, there is no exemption from the energy tax. However, the final use of renewable energy is not taxed. If renewables were taxed at the same rate per GJ as natural gas (ATS 0.6 per m^3 or ATS 1.8 per GJ), the 104.7 PJ final use of renewable energy in 1998 (Statistik Österreich, 2000) would have been subject to a total tax amount of ATS 188.5 mln or ***EUR 13.7 mln***.

Furthermore, firewood, straw and wood by-products are subject to a reduced VAT rate of 10% (the standard rate is 20%) (EC, 2000b). Total final use of firewood amounted to 80.9 PJ in 1998 (Statistik Österreich, 2000). Tentatively assuming a price of EUR 5 per GJ, and assuming that 50% of the firewood use can profit from the VAT reduction (the other half remaining outside formal markets or being used by firms), the implicit subsidy can be roughly estimated at ***EUR 20 mln***.

In 1995-1998, the Austrian government spent on average ***EUR 8.9 mln*** per year on renewables related R&D (IEA, 1999f).

Electricity

Energy intensive industries do not have to pay the full amount of energy tax on electricity. The implicit annual subsidy was estimated above at ***EUR 80 mln***.

There are some cross-subsidies for electricity at the provincial and municipal level. For example, special low prices are often charged to the public transport sector (IEA, 1998b).

In 1995-1998, the Austrian government spent on average ***EUR 3.4 mln*** per year on electricity related R&D (IEA, 1999f).

Table 2.2.1. Austria: Summary Table

Final energy consumption (1998): 22.8 Mtoe **Gross electricity generation (1998):** 57.5 TWh					
	coal	**oil & gas**	**nuclear**	**renewables**	**electricity**
share in gross electricity generation (1998)	7%	22%	0%	70%	
quantifiable subsidies (mln EUR per year)	10	80	2	> 100	> 80
quantifiable subsidies, incl. attributed electricity subsidies (mln EUR per year)	> 15	> 95	2	> 150	

Source: Energy statistics: Eurostat (2000a); other figures: this section.

Solid fuels

Solid fuels (coal, coke and lignite) are subject to a reduced VAT rate of 12%, whereas other fuels are subject to the general rate of 21%. Assuming a price of EUR 300 per tonne, and assuming that half of the 307 kilotonnes of coal consumption in the services & households sector in 1998 (Eurostat, 2000a) could benefit from the VAT reduction, the implicit subsidy can be estimated at some ***EUR 4 mln*** per year. In its recent plan on sustainable development (Federal Government of Belgium, 2000) the federal government has mentioned the abolition of this tax reduction as a possible policy measure.

Coal is also exempted from the energy tax. While this does not constitute a subsidy for industrial users (other industrial fuels remain untaxed as well), it creates a tax advantage for the household use of coal. If we take the energy tax rate for natural gas (BEF 0.433 per m^3) as a reference, the corresponding tax rate for coal should be about BEF 0.400 per kg (based on energy content only). Again assuming that households account for some 150 ktonnes of coal use, the implicit subsidy is BEF 60 mln or ***EUR 1.5 mln***.

In 1995-1997, the Belgian government spent on average ***EUR 1.8 mln*** per year on coal related R&D (IEA, 1999f).

Oil and gas

In 1995-1997, the Belgian government spent on average less than ***EUR 1 mln*** per year on oil and gas related R&D (IEA, 1999f).

Belgium is a member of the 1992 International Oil Pollution Compensation Fund. This implies a maximum compensation for oil spills of EUR 175 mln.

Nuclear energy

More than 50% of the Belgian electricity supply is provided by nuclear power plants. Nuclear power is to be phased out by 2030. Funds for decommissioning the nuclear power plants are collected through a levy on all electricity. The amount of implicit subsidy involved is unknown.

A fund has been set up by the government and the utilities to deal with radioactive waste from the defunct EUROCHEMIC installation (a reprocessing plant), the Waste Department of CEN/SCK (a nuclear research institution) and the dismantling of a reactor in Mol, because no financial provisions for managing these materials had been made (EC, 1999d). The government's contribution to this fund is unknown.

In 1995-1998, the Belgian government spent on average ***EUR 38.9 mln*** per year on nuclear related R&D (IEA, 1999f).

Renewables

Since 1995, electricity generated from renewables is supported with a subsidy of BEF 1 (EUR 0.025) per kWh. The measure was estimated to cost BEF 30 million (EUR 0.7 million) per year (IEA, 1998a). In July 1998 the amount of support was increased to BEF 2 (EUR 0.05) per kWh for hydro and wind power installations with a maximum capacity of 10 MW (Federaal Planbureau, 1999). Therefore, the order of magnitude of the subsidy is now likely to be some ***EUR 1 mln***.

In all three administrative regions (Flanders, Wallonia and Brussels Capital) investments in renewable energy are eligible to a subsidy of 15%. In the case of photovoltaic energy in Flanders there is an investment subsidy of 50%. Furthermore, 14% of investments in renewable energy can be deducted from company profits (IEA, 1998a). Subsidies for renewable energy are also available in the Walloon region, but information on budgets is generally lacking (Novem, 2001).

In 1995-1997, the Belgian government spent on average ***EUR 3.5 mln*** per year on renewables related R&D (IEA, 1999f).

Electricity

Over the past decade, the 'social electricity tariff', intended to protect low-income households, has involved an average amount of cross-subsidy of BEF 500 mln or EUR 12 mln per year (IEA, 1997b). As this is a transfer between electricity users and does not discriminate between fuels, it is excluded from our quantification.

In 1995-1997, the Belgian government spent on average ***EUR 4.2 mln*** per year on electricity related R&D (IEA, 1999f).

Table 2.3.1. Belgium: Summary Table

Final energy consumption (1998): 37.4 Mtoe **Gross electricity generation (1998):** 83.2 TWh					
	coal	**oil & gas**	**nuclear**	**renewables**	**electricity**
share in gross electricity generation (1998)	17%	24%	55%	2%	
quantifiable subsidies (mln EUR per year)	7	< 1	> 40	5	4
quantifiable subsidies, incl. attributed electricity subsidies (mln EUR per year)	8	1	> 40	5	

Source: Energy statistics: Eurostat (2000a); other figures: this section.

2.4 DENMARK

Solid fuels

The Danish energy and CO_2 taxes have a 'standard' rate of about DKK 600 per tonne of CO_2. For enterprises, especially the energy intensive ones and those that are exposed to international competition, substantially lower rates apply. The lowest rate, which is only DKK 3 per tonne of CO_2, applies to energy intensive industries who have entered into a voluntary agreement on energy efficiency with the Danish Energy Agency. The amount of implicit subsidy can be calculated roughly as follows. The 'theoretical' revenue if all fossil fuel use were taxed at DKK 600 per tonne CO_2 would have been about DKK 27 billion in 1998 (see Table 2.4.1). The actual revenue was almost DKK 18 bln (EC, 2000b)[7]. We will assume (somewhat arbitrarily) that half of the implicit subsidy (the difference of DKK 9 mln) went to coal (i.e. DKK 4.5 bln or ***EUR 600 mln***) and the other half to oil and gas together (see below).

Table 2.4.1. 'Theoretical' energy and CO_2 tax revenues in Denmark in 1998 (with uniform tax rate of DKK 600 per tonne CO_2)

energy product	**CO_2 emissions * (mln tonnes)**	**theoretical revenue (bln DKK)**
coal	21.8	13.1
oil (products) (excluding transport)	13.4	8.0
natural gas	9.9	5.9
total	**45.1**	**27.0**

* Source: IEA (2000g)

In 1995-1998, the Danish government spent on average less than EUR 1 mln per year on coal related R&D (IEA, 1999f).

Oil and gas

The implicit subsidy for oil and gas, resulting from energy and CO_2 tax reductions, was estimated above at ***EUR 600 mln*** per year.

The CO_2 tax on electricity is partially refunded to the producers of electricity from natural gas. This is done because the CO_2 tax rate for electricity is based upon the emissions from coal based electricity. Therefore, it should not be seen as a subsidy.

After the oil crises, large investments in a gas transmission and distribution infrastructure have been done, for which capital was raised by loans. The gas distribution companies are now heavily in debt. The government has financed the debts through price regulations and tax exemptions, which provided an effective annual subsidy of almost DKK 3 billion (***EUR 400 mln***) in 1996 (IEA, 1998c).

[7] The revenues for the CO_2 tax are the expected amounts for 1999.

Royalty payments on oil and gas production have been abolished in the most recent licensing rounds (IEA, 1998c).

In 1995-1998, the Danish government spent on average ***EUR 2.8 mln*** per year on oil and gas related R&D (IEA, 1999f).

Denmark is a member of the 1992 International Oil Pollution Compensation Fund. This implies a maximum compensation for oil spills of EUR 175 mln.

Nuclear energy

Denmark has no nuclear power plants.

In 1995-1998, the Danish government spent on average ***EUR 1.7 mln*** per year on nuclear related R&D (IEA, 1999f).

Renewables

Electricity from renewables is exempted from the energy and CO_2 taxes on electricity. In the case of the CO_2 tax this exemption is achieved by granting a refund of DKK 0.1 per kWh to the producers of electricity from renewables. This is equal to the CO_2 tax rate for electricity, which is based upon coal based electricity. Therefore, it should not be seen as a subsidy. The exemption from the energy tax, however, can be seen as a subsidy. The amount involved can be estimated as follows. In 1998, the total revenues of the energy tax on electricity amounted to DKK 7.0 billion (EC, 2000b). Final consumption of electricity was 32.0 TWh (Eurostat, 2000a), implying an effective tax rate of DKK 0.22 per kWh. Given a gross electricity production from renewables of 4.3 TWh (Eurostat, 2000a), the total amount of subsidy involved can be estimated at DKK 937 mln or ***EUR 126 mln***.

By 2002, the direct financial support of electricity from renewables will be replaced by a system of 'green certificates'. This system has recently been approved by the European Commission.

In the period 1995-1999 the Danish Energy Agency paid an amount of DKK 329.7 mln (on average ***EUR 8.9 mln*** per year) in subsidies for investments in renewable energy installations (Energistyrelsen, 2000b).

A subsidy scheme for investments in solar cells was started in 1998. An amount of DKK 1 billion was reserved for a period of five years (***EUR 27 mln*** per year) (ENDS, 1998a).

Shareholders in private wind turbine cooperatives can opt for a model of income taxation in which the first DKK 3000 (EUR 400) of income from the sale of wind power is tax free (Energistyrelsen, 1999). As the extent to which this scheme is used is unknown, the amount of subsidy involved cannot be calculated.

In 1995-1998, the Danish government spent on average ***EUR 17.2 mln*** per year on renewables related R&D (IEA, 1999f).

Electricity

In 1995-1998, the Danish government spent on average ***EUR 4 mln*** per year on renewables related R&D (IEA, 1999f).

Table 2.4.2. Denmark: Summary Table

Final energy consumption (1998): 15.1 Mtoe
Gross electricity generation (1998): 41.1 TWh

	coal	**oil & gas**	**nuclear**	**renewables**	**electricity**
share in gross electricity generation (1998)	58%	32%	0%	10%	
quantifiable subsidies (mln EUR per year)	600	1,000	2	> 180	4
quantifiable subsidies, incl. attributed electricity subsidies (mln EUR per year)	600	1,000	2	> 180	

Source: Energy statistics: Eurostat (2000a); other figures: this section.

2.5 FINLAND

Solid fuels

Since 1996, investment aid for electricity and heat generation from peat has ceased, but it still exists for cogeneration and district heating plants using mixtures of peat and wood as a fuel (IEA, 1999b) (see below under renewables). Furthermore, small scale peat power is included in the refund scheme for the tax on electricity (see below under renewables). The implicit subsidies cannot be calculated due to lack of data.

In 1995-1997, the Finnish government spent on average ***EUR 3.6 mln*** per year on coal related R&D (IEA, 1999f).

Oil and gas

In the past, the use of natural gas has been stimulated by subsidies and a reduced VAT rate. Following Finland's accession to the EU, these arrangements have been terminated. Presently, natural gas benefits from a reduced CO_2 tax rate: FIM 51 instead of FIM 102 per tonne of CO_2. This tax reduction is not relevant for gas used for electricity generation, because since 1997 fuel inputs for electricity are exempt from the CO_2 tax (instead, the electricity itself is taxed). Gas use for other purposes than electricity production in Finland amounted to 1.2 Mtoe in 1997 (calculated after EC, 1999a), or 900 mln m^3. Given an emission of 1.96 kg CO_2 per m^3, the total CO_2 emissions from this gas use are some 1.76 mln tonnes, which means that the tax reduction implies a subsidy of FIM 90 mln (***EUR 15 mln***) per year for natural gas.

In 1995-1997, the Finnish government spent on average less than EUR 1 mln per year on oil and gas related R&D (IEA, 1999f).

Finland is a member of the 1992 International Oil Pollution Compensation Fund. This implies a maximum compensation for oil spills of EUR 175 mln.

Nuclear energy

Radioactive waste producers have full responsibility for managing their radioactive waste and for covering all related expenses. In order to cover expected expenses for radioactive waste management and decommissioning of the nuclear plants, the operators of the plants pay annual fees to a government-controlled fund, which are tax-exempted (EC, 1999d).

In 1995-1997, the Finnish government spent on average ***EUR 8.4 mln*** per year on nuclear related R&D (IEA, 1999f).

Renewables

Since 1997, when the Finnish CO_2 tax was transformed into a general tax on electricity, a tax refund equal to the electricity tax is available for electricity from renewables (IEA, 1998a). The revenues from the electricity tax were estimated at FIM 2 billion in 1999 (EC, 2000b). As renewables account for about 30% of Finnish electricity production, the subsidy implied can be estimated at FIM 857 million or ***EUR 144 million*** per year.

Investment subsidies for new and renewable energy technologies are available to a maximum of 30% of the investment cost. In 1998, the amount of available subsidies was FIM 130 million (***EUR 22 million***) (IEA, 1999b). It should be noted that these subsidies are partly accruing to non-renewable energy (e.g. subsidies to combined heat and power / district heating plants using a mixture of wood and peat as a fuel).

Subsidies are also granted for the management of young forests and the harvesting of wood for energy. These subsidies amount to between FIM 12 and 15 per MWh (IEA, 1999b). Given a biomass input for power generation of 1.32 Mtoe (15.35 TWh) in 1997 (EC, 1999a), and assuming that all of this biomass input benefited from the support scheme, the total amount of subsidy can be estimated at FIM 184 mln (***EUR 31 mln***) per year.

In 1995-1998, the Finnish government spent on average ***EUR 4.5 mln*** per year on renewables related R&D (IEA, 1999f).

Electricity

The tax on electricity is levied at a reduced rate for industry and greenhouse horticulture: FIM 0.025 instead of FIM 0.041 per kWh. Industrial electricity use amounted to 39.6 TWh in 1997 (calculated after EC, 1999a), so the tax reduction implies a subsidy of FIM 633 mln (***EUR 106 mln***) to industry. The subsidy to greenhouse horticulture cannot be calculated due to lack of data.

In 1995-1997, the Finnish government spent on average ***EUR 15.7 mln*** per year on electricity related R&D (IEA, 1999f).

Table 2.5.1. Finland: Summary Table

Final energy consumption (1998): 23.6 Mtoe
Gross electricity generation (1998): 70.2 TWh

	coal	**oil & gas**	**nuclear**	**renewables**	**electricity**
share in gross electricity generation (1998)	19%	15%	31%	32%	
quantifiable subsidies (mln EUR per year)	> 4	15	8	200	120
quantifiable subsidies, incl. attributed electricity subsidies (mln EUR per year)	> 25	30	45	240	

Source: Energy statistics: Eurostat (2000a); other figures: this section.

2.6 FRANCE

Solid fuels

According to the European Commission (2000a), state aid to coal mining in France amounted to an average EUR 72 million per year in the period 1995-1996. IEA (2000d) estimated the PSE (Producer Subsidy Equivalent) at FRF 2,578 mln or ***EUR 393 million*** in 1998. This amount includes aid to current production only. Total subsidies for the French coal mining industry (including social programmes related to mine closure) are much higher: Bonduelle *et al.* (1998) mention an annual amount of FRF 4.5 billion (EUR 686 million) and according to IEA (2000d) the total support (PSE + assistance not benefiting current production) amounted to FRF 6.6 billion (EUR 1 billion) in 1998.

Indirect types of support to coal include (Bonduelle *et al.*, 1998):
- compulsory purchases of coal-generated electricity (implicit subsidy estimated at FRF 600 mln or ***EUR 91 mln*** per year);
- the rehabilitation of old mine areas;
- uninternalised external costs (uncompensated environmental damage) from coal-fired power plants.

In 1995-1998, the French government spent on average ***EUR 5.4 mln*** per year on coal related R&D (IEA, 1999f).

The use of coal is not taxed in France (apart from VAT). However, as there is not (yet) a general energy tax scheme, this cannot be regarded as a subsidy.

Indigenous coal production in France is to be progressively reduced and will cease completely by 2005 (IEA, 2000d).

Oil and gas

The Institut Français du Pétrole (IFP) receives a certain percentage of the revenues of the tax on oil products and invests it in R&D. In 1996, the R&D funds financed in this way amounted to FRF 871 mln for oil and FRF 235 mln for gas (Bonduelle *et al.*, 1998); together FRF 1,106 mln (EUR 169 mln). As this is financed solely by a tax on oil products, it is not to be considered a subsidy. The oil support fund FSH receives an annual budget in the order of FRF 240 mln (EUR 37 mln) per year from the government (IEA, 2000d). The R&D budget of Gaz de France (GDF) amounted to FRF 634 mln (EUR 97 mln) in 1999 (IEA, 2000d). As in the case of EDF (see below), this should not be regarded as a subsidy. According to IEA (1999f), the average government budget for oil and gas related R&D amounted to ***EUR 32.5 mln*** per year on average in the period 1995-1998.

In response to protests against high prices of oil products, the French government decided in September 2000 to reduce diesel excise tax rates in case of sharp price increases of crude oil. While this measure is not a subsidy, it has the effect of stabilising the price of diesel, thus making its use more attractive. Taxes on diesel have been traditionally low in France, compared to taxes on other motor fuels.

France has informed the European Commission that it intends to apply a reduced diesel excise tax rate for short distance public passenger transport, starting in 2001.

Since the early 1990s, the government has maintained a support policy for small retailers of automotive fuels. The aim of this policy is to maintain petrol supply in remote areas. The policy is financed by a tax that yielded a total revenue of FRF 53 mln in 1997. The tax was raised in December 1999 to yield a total revenue of FRF 73 mln. The government intends to maintain this higher level of support in 2001 (IEA, 2000d). As the tax is (presumably) levied on oil products, the support can be considered to be a cross-subsidy.

Indirect subsidies to the oil industry include (Bonduelle *et al.*, 1998):
- uninternalised external costs of the use of oil products, in particular by motor vehicles;
- military expenditures to protect the interests in oil producing areas, such as the Persian Gulf.

France is a member of the 1992 International Oil Pollution Compensation Fund. This implies a maximum compensation for oil spills of EUR 175 mln. The 'Erika' oil spill (December 1999) has caused considerable damage on the French coast. Although Fina Elf, which had hired the Erika, promised to pay at least USD 85 million compensation, it is likely that a substantial amount of implicit subsidy by way of uncompensated damage will be involved. By December 2000, some 2,950 claims had been received by the 1992 IOPC Fund for clean-up operations, property damage and loss of earnings in the fishery and tourism sectors. Some 1,770 claims had been assessed. Of these, 1,460 claims totalling FRF 113 million had been approved for FRF 84 million. Payments had been made totalling FRF 42 million, i.e. 50% of the amounts approved (IOPC Funds, 2001).

Nuclear energy

The main part of public spending on nuclear R&D in France takes place through the Commissariat à l'énergie atomique (CEA). Nuclear R&D expenses by CEA amounted to FRF 4,638 mln in 1996. Another large publicly financed nuclear research institute is the department IN2P3 of the Centre national de recherche scientifique (CNRS), whose nuclear budget amounted to FRF 1,234 mln in 1995 (Bonduelle *et al.*, 1998). In our view, the R&D budget of electricity company EDF (FRF 594 mln in 1995, according to Bonduelle *et al.*, 1998; FRF 3.1 billion in 1999, according to IEA, 2000d) should not be considered as a subsidy, but as 'normal' R&D expenses of an enterprise (although it is state-owned). The same is true for the FRF 1,251 mln spent on nuclear R&D by Cogéma (IEA, 2000d). The total annual amount of nuclear R&D subsidy could thus be estimated at about FRF 7 bln or slightly above EUR 1 bln. According to IEA (1999f), the average annual government budget for nuclear R&D in the period 1995-1998 was ***EUR 515.8 mln***, which can be used as a conservative estimate.

The annual budget of the Direction de la Sûreté des Installations Nucléaires (DSIN), which is charged with safeguarding the security of nuclear installations, can be regarded as a subsidy to nuclear energy. This budget amounts to FRF 650 mln (***EUR 99 mln***) (Bonduelle *et al.*, 1998). Government proposals seeking greater independence for the safety authorities have recently been rejected by the National Assembly (IEA, 2000d).

According to EDF, the owner of all nuclear power plants in France, the cost of decommissioning the existing plants will amount to FRF 102 billion. This amount is based upon an average decommissioning cost that is fixed by the Ministry of Industry, amounting to FRF 1,698 per kW installed by the end of 1998. The cumulated provisions amounted to FRF

44.5 billion in 1998. Given an average age of 13 years and a lifetime of 30 years, EDF concludes that these provisions are sufficient to cover all decommissioning costs (EDF, 1999). However, doubts have been expressed whether the budget for decommissioning (15% of the investment costs) will be sufficient (Bonduelle *et al.*, 1998). Moreover, if the economic life of the reactors is reduced (e.g. due to increasing maintenance costs) the necessary provisions for decommissioning will not be realised.

Other forms of indirect support to the nuclear industry include (Bonduelle *et al.*, 1998):
- nuclear overcapacity, leading to exports of electricity at prices below the level of full cost coverage;
- investments in new nuclear plants at times of overcapacity, the main purpose of the investment being support to nuclear plant builder Framatome;
- the mandatory reprocessing of spent nuclear fuel (intended to support reprocessing firm Cogema);
- limited liability for damage due to a nuclear accident (to FRF 600 mln or EUR 91 mln);
- impacts of the nuclear cycle on health (estimated using the 'ExternE' methodology at FRF 120 mln to 5940 mln, or EUR 18 mln to 905 mln per year).

Renewables

In 1996, the government initiated 'EOLE', a plan to promote grid-connected wind electricity. It is run in a similar fashion to the UK's NFFO, whereby the government (in co-operation with EDF and ADEME) launches a competitive bid process for a certain amount of capacity. Successful bids are chosen on cost grounds: the average in 1997 was FRF 0.337 per kWh. EOLE aims to drive costs down to (a competitive) FRF 0.25 per kWh by 2005. A market for power from the successful bids is guaranteed, and will be bought for the rate determined at the time of bidding for 15 years (IEA, 1998a). So far, the amount of capacity that was accepted following the bidding rounds has exceeded expectations: a total of 124 MW was accepted (IEA, 2000d). Assuming a load factor of 0.2, the energy generated by the 124 MW wind turbine capacity could be 217 GWh per year. With a premium of FRF 0.087 per kWh, the implied subsidy amounts to FRF 18.9 mln or ***EUR 2.9 mln*** per year.

In 1998, a biogas programme was started, designed to equip waste dumps with combustion facilities for the use of methane from waste fermentation. Like the 'EOLE' programme, it is based on calls for tender. The first tendering round for 10 MW of electricity generating capacity was successfully concluded in May 1999 (IEA, 2000d). Given this relatively small capacity, the amount of subsidy involved probably does not (yet) exceed EUR 1 mln.

The 'HELIOS 2006' programme, established in May 1999 and carried out by ADEME, provides investment subsidies for households equipping themselves with solar water heaters (IEA, 2000d). Total funding is FRF 30 mln or (assuming the programme's duration is 7 years) less than EUR 1 mln per year.

Promotion of wood energy for heating is being strengthened via a 'Wood Energy Plan'. The total budget for the plan, which ran between 1995 and 1998, was FRF 215 mln, of which FRF 74.5 mln came from the national government, and the remainder from regional, local or EU funds (IEA, 1998a). On 1 January 1999, FRF 120 mln of subsidies had been spent (of which FRF 47 mln were from ADEME). This programme was extended to comprise the 'Wood Wastes Plan', announced in February 1998. Under this plan, viability studies relating to the use of wood wastes as well as investment costs of installations using wood wastes are subsidised. At present, ADEME spends FRF 65 mln (***EUR 10 mln***) per annum on these programmes (IEA, 2000d).

Firewood is subject to a reduced VAT rate of 5.5%, whereas other energy products are charged with 19.6% VAT (EC, 2000c). The use of wood for heating houses in France was estimated at 7.1 Mtoe in 1996 (IEA, 1998a). It is not known to what extent this wood was purchased in transactions involving VAT (a significant part of the firewood used in France remains outside formal markets). Tentatively, one could assume that 50% of the firewood was formally traded, at an average price of FRF 500 per toe (including 5.5% VAT), implying a subsidy of FRF 237 mln or ***EUR 36 mln*** per year.

The Amortisation of Electrification Costs Fund (FACE) includes a source of finance for investments in renewables and demand-side management in rural areas. The annual budget for this part of FACE is FRF 100 mln (***EUR 15 mln***). The majority of funds are spent on photovoltaic systems in rural areas, and aim to reduce either grid extensions or grid strengthening, via reducing peak demand or increasing stand-alone generation capacity (IEA, 1998a).

EDF is obliged to purchase renewables-based electricity from independent power producers on the basis of 'avoided cost'. In March 2001, the European Court of Justice has ruled that this type of support does not constitute state aid under the EU Treaty (ENDS, 2001).

Biofuels benefit from excise tax exemption of up to FRF 2.3 per litre for RME and FRF 3.29 per litre for ethanol (FRF 1.46 for ethanol-derived ETBE). The Government estimates that this subsidy will cost FRF 1.5 billion (***EUR 230 mln***) per year in lost tax receipts. This programme is followed for agricultural reasons, as it is not cost-effective in terms of CO_2 reduction alone (IEA, 1998a). In a recent judgement (case T-184/97), the European Court of Justice ruled that the French tax exemptions for biofuels are incompatible with EC legislation on mineral oil excise taxation (ECJ, 2000).

Tax credits are available for investments in renewable energy technologies in overseas departments for small hydro, wind, biomass photovoltaic and solar thermal power schemes, whereby renewable energy investments by a company can be deducted against taxable profits (IEA, 1998a). Bonduelle *et al.* (1998) mention a general tax deduction for investments in renewable energy equipment amounting to 25% of the total investment. The amount of subsidy (tax foregone) is unknown.

According to IEA (1998a), national government expenditure on renewables R&D accounted for 1% of total energy R&D budget in 1996 (EUR 5.8 mln). This was the lowest reported proportion of any OECD country's energy R&D budget that is spent on renewable energy. The majority is spent on biomass, photovoltaics and geothermal. On average, the government budget for renewables related R&D amounted to ***EUR 4.5 mln*** per year in the period 1995-1998 (IEA, 1999f). ADEME is the main organisation involved, its R&D budget amounting to some FRF 20 mln (EUR 3 mln) per year (Bonduelle *et al.*, 1998). In 1999, ADEME's spending on renewable R&D had increased to FRF 82 mln (EUR 12.5 mln) (IEA, 2000d).

Electricity

Reinforcement and extension of the electricity grid in rural areas is financed with contributions from the FACE (see above). In recent years, these amounted to FRF 2.2 bln (EUR 335 mln) per year (Bonduelle *et al.*, 1998). As FACE is financed by a levy on electricity use, its expenses can only be regarded as cross-subsidies.

EDF runs a programme 'Vivrélec', aiming at promoting the use of electricity for domestic space heating. It is estimated that in 1997 an amount of FRF 234 to 546 mln (EUR 36 to 83 mln) was spent under this programme. However, as this money comes from EDF's own funds, it should not be regarded as a subsidy in our definition.

Similarly, the money transfers resulting from the principle of 'péréquation tarifaire' should not be regarded as subsidies. This principle implies that all consumers in France (including the overseas territories), regardless where they live, should face the same tariff structure and rates. It is obvious, however, that large amounts of 'cross subsidy' are involved. IEA (2000d) estimates that it constitutes a transfer of wealth from metropolitan France to other areas (including the overseas departments) in the order of FRF 2 billion (EUR 300 million) per year.

Apart from nuclear R&D, no specific government subsidies for electricity related R&D is reported.

Table 2.6.1. France: Summary Table

Final energy consumption (1998): 150.3 Mtoe **Gross electricity generation (1998):** 510.8 TWh					
	coal	**oil & gas**	**nuclear**	**renewables**	**electricity**
share in gross electricity generation (1998)	7%	4%	76%	13%	
quantifiable subsidies (mln EUR per year)	500	> 30	> 600	> 300	
quantifiable subsidies, incl. attributed electricity subsidies (mln EUR per year)	500	> 30	> 600	> 300	

Source: Energy statistics: Eurostat (2000a); other figures: this section.

2.7 GERMANY

Solid fuels

According to the European Commission (2000a), state aid to coal production in Germany amounted to an average ***EUR 4.8 billion*** per year in the period 1995-1998. This amount includes aid to current production only. Since 1996, these subsidies are financed directly from the federal budget. Before that time, they were financed by the 'Kohlepfennig', a surcharge on the electricity bills. The German Ministry of Finance foresees a decrease of German coal subsidies from DEM 9.25 billion (EUR 4.8 billion) in 1998 to DEM 5.3 billion (EUR 2.7 billion) in 2005 (Bundesfinanzministerium, 2000a).

In the new Bundesländer, subsidies have been provided in the past by some Länder governments for lignite fired power plants. Until 2005, access to the grid in this part of Germany can be denied if it endangers lignite based power generation (IEA, 1998d).

In contrast with other fossil fuels and electricity, coal remains untaxed under the 'ecological tax reform' which was introduced in 1999. If we take natural gas as a reference, which is taxed (in 2000) at 6.8 DEM per MWh, then, given a coal consumption of 86.7 Mtoe (= 1028 TWh) in 1997 (EC, 1999a), tax revenues would have been almost DEM 7 billion (***EUR 3.6 billion***).

In 1995-1998, the German government spent on average ***EUR 5.1 mln*** per year on coal related R&D (IEA, 1999f). These spendings have been decreasing substantially over the past 15 years (in 1987, they amounted to more than EUR 150 mln).

Oil and gas

Gas and oil used in combined heat and power (CHP) installations with an operating time of 70% or more, and power plants achieving an electrical efficiency of at least 57.5% are exempted from the mineral oil tax. Furthermore, the *increases* in the mineral oil tax that are introduced under the ecological tax reform are reduced by 80 to 100% for industry and agriculture. The loss of tax income for the federal government in the year 2000 was estimated at DEM 1 billion (***EUR 511 million***) (Subventionsbericht, 1999).

Individual enterprises can get a tax refund if the additional tax burden brought about by the ecological tax reform (i.e. the introduction of the electricity tax and the increase in the tax rates for oil products and gas) exceeds the reduction in social security and pension contributions (which was included in the tax reform as a compensatory measure) by a factor of 1.2 or more. The amount of implicit subsidy involved is unknown, but it is probably already included in the above mentioned amount.

Natural gas or liquid petrol gas used as a propellant in public transport vehicles is taxed at a reduced rate. The subsidy involved amounted to DEM 4 million in 1998 and was expected to increase to DEM 30 million (***EUR 15 mln***) in 1999 (Subventionsbericht, 1999).

As in other countries, the own use of oil products by manufacturers of these products is exempted from the mineral oil tax. The implicit subsidy is estimated at DEM 310 mln (***EUR 159 mln***) in 1999 (Subventionsbericht, 1999).

Since 1974, the federal government has built a crude oil reserve in salt caverns near Wilhelmshaven. This reserve (amounting to 7.3 Megatonnes) is financed and controlled by the federal government (IEA, 1998d). The amount of public money involved is unknown. Tentatively, it could be estimated by assuming that the value of the reserve is at least EUR 1 billion and that the annual costs in terms of storage and interest amount to 10% of this value, i.e. ***EUR 100 mln***. In 1997, it was decided to sell the total amount of the reserve (IEA, 1998d).

In 1995-1998, the German government spent less than EUR 1 mln per year on oil and gas related R&D (IEA, 1999f).

Germany is a member of the 1992 International Oil Pollution Compensation Fund. This implies a maximum compensation for oil spills of EUR 175 mln.

Nuclear energy

Reserves set aside by the Association of German Utilities (VDEW) for future reactor closures and nuclear waste disposal costs amounted to DEM 54 billion at the end of 1996. These reserves are tax exempt (IEA, 1998d). The amount of implicit subsidy is unknown. The federal government is considering setting up a tax on a portion of the reserves to finance future end-storage facility operating costs (IEA, 1998d).

The federal government's budget for R&D in the area of nuclear energy (fission and fusion) in the period 1996-2000 amounted to an average of DEM 390 mln (***EUR 200 mln***) per year (IEA, 1998d).

Renewables

Since 1991, electricity from renewables can be fed into the grid at a guaranteed price under the 'Stromeinspeisungsgesetz'. These prices are set at a percentage of final user prices, depending on the type of renewable: wind and solar electricity are paid 90% of the average consumer end price, small hydro facilities and biomass/waste are paid 80%, and large hydro schemes are paid 65% (IEA, 1998a). The cost of this scheme was estimated at DEM 780 mln (EUR 400 mln) in 1996 (EC, 2000b). The system is currently under revision. Future support will depend on the type of renewable and location. The total costs of the new system are estimated to be in the range of DEM 1.5 billion (EUR 770 million) in the first year, increasing to DEM 4 billion (EUR 2.05 billion) in 2005 (ENDS, 1999c). In March 2001, the European Court of Justice has ruled that this type of support does not constitute state aid under the EU Treaty (ENDS, 2001).

Electricity from renewables that is fed into the public grid is not exempted from the new tax on electricity that was introduced in 1999. However, as a compensatory measure the government has increased the direct subsidies for renewables (ENDS, 1999a,b; Bundesfinanzministerium, 2000b). In 1999, they amounted to DEM 230.8 mln (***EUR 118 mln***) per year (Subventionsbericht, 1999).

The Deutsche Ausgleichsbank, a public bank, grants low-interest loans to specified renewable energy projects. About DEM 4 billion of loans was granted between 1990 and 1997 (IEA, 1998a). A quantification of the subsidy involved in the interest rebate is lacking.

The German Government promotes use of liquid biofuels for use in motor vehicles through tax exemptions amounting to DEM 1.5 per litre for rapeseed methyl ester (RME) (IEA, 1998a). The total amount of subsidy involved is unknown.

Expenditure on renewable energy R&D amounted to EUR 103 mln in 1996, almost 30% of the government's total energy R&D budget. The majority of funds are devoted to solar applications, particularly PV, although significant expenditure is also allocated to wind energy. Biomass and geothermal energy receive a much lower level of funding (IEA, 1998a). The average government budget for renewables related R&D in the period 1995-1998 amounted to ***EUR 85.8 mln*** per year (IEA, 1999f).

Subsidies for renewable energy also exist at the Länder level. Some examples which have recently been approved by the European Commission include[8]:
- Niedersachsen: investment support for renewables of some ***EUR 7.5 mln*** per year;
- Niedersachsen: aid for innovative pilot projects for the use of solar energy (***EUR 1 mln*** per year);
- Thüringen: subsidies for renewable energy and energy conservation amounting to ***EUR 7 mln*** per year;
- Rheinland-Pfalz: a program for investment support covering various types of renewables, with a budget of ***EUR 1.7 mln*** per year.

Electricity

The electricity tax (normal rate in 1999: DEM 20 per MWh) is levied at reduced rates of:
- 50% for nighttime heat storage systems (installed before 1 April 1999) and railway operations;
- 20% for industry and agriculture, to the extent that the payable tax exceeds DEM 1000 per year.

The latter tax reduction is estimated to lead to a loss of tax income for the German federal government of DEM 3.5 billion (***EUR 1.8 billion***) in the year 2000 (Subventionsbericht, 1999).

Furthermore (as stated above under 'oil and gas'), individual enterprises can get a tax refund if the additional tax burden brought about by the ecological tax reform (i.e. the introduction of the electricity tax and the increase in the tax rates for oil products and gas) exceeds the reduction in social security and pension contributions (which was included in the tax reform as a compensatory measure) by a factor of 1.2 or more. The amount of implicit subsidy involved is unknown.

In 1995-1998, the German government spent on average ***EUR 16.3 mln*** per year on electricity related R&D (IEA, 1999f).

[8] State aid cases N531/99, N533/99, N709/99 and N759/99, respectively.

Table 2.7.1. Germany: Summary Table

Final energy consumption (1998): 223.6 Mtoe **Gross electricity generation (1998):** 556.7 TWh					
	coal	**oil & gas**	**nuclear**	**renewables**	**electricity**
share in gross electricity generation (1998)	53%	12%	29%	6%	
quantifiable subsidies (mln EUR per year)	8,500	800	200	> 200	1,800
quantifiable subsidies, incl. attributed electricity subsidies (mln EUR per year)	9,500	1,000	> 700	> 300	

Source: Energy statistics: Eurostat (2000a); other figures: this section.

2.8 GREECE

Solid fuels

Lignite is an important domestic fuel in Greece. It is mainly produced by the state power company PPC and therefore it is impossible to identify any implicit subsidies.

In 1995-1997, the Greek government spent on average ***EUR 1.2 mln*** per year on coal related R&D (IEA, 1999f).

Oil and gas

In order to encourage the development of small oil and gas fields and to improve the economics of fields located in deep waters, Greece introduced a new hydrocarbons exploration law in 1995. The law contains, among others, a number of tax incentives (IEA, 1998c):

- 40% income tax;
- no other taxes;
- exemption from customs duties;
- 50% of exploration expenses from a different concession area are creditible against production.

The amounts of implicit subsidy involved are unknown.

Greece is currently expanding its natural gas grid. The total cost involved is estimated at EUR 2 billion, largely to be financed by the European Investment Bank (Government of Greece, 1997).

The Greek CO_2 abatement Action Plan, which covers the period 1995 through 1999, reports an amount of EUR 184 mln (EUR 37 mln per year) of public expenditure for the conversion to natural gas in electricity generation. However, this money is invested by the Public Power Corporation (PPC) and should probably not be regarded as a subsidy.

Since 1995, 75% of the cost of household appliances using natural gas can be deducted from a person's taxable income. The amount of subsidy (tax foregone) involved is unknown. To assess the order of magnitude it could be assumed that 100,000 households per year spend an average EUR 200 on such appliances. At a marginal tax rate of 45% this would imply a subsidy of ***EUR 6.75 million*** per year.

Natural gas is subject to the standard VAT rate (currently 18%), but is exempted from other taxes up to 31 December 2010 (IEA, 1998e). As Greece does not (yet) apply a general energy tax, this can not be considered as a subsidy.

During the heating season, the excise tax on fuel oil for space heating is reduced from GRD 83 to GRD 42 per litre (EC, 1999b). The use of gas oil in the services and households sector amounted to 3.1 mln tonnes in 1998 (Eurostat, 2000a). Assuming that the main part of this (say, 2 mln tonnes) related to fuel oil for space heating, purchased during the heating season, the implicit subsidy can be estimated at some GRD 80 bln (***EUR 242 mln***).

In 1995-1997, the Greek government spent on average ***EUR 1.4 mln*** per year on oil and gas related R&D (IEA, 1999f).

Greece is a member of the 1992 International Oil Pollution Compensation Fund. This implies a maximum compensation for oil spills of EUR 175 mln.

Nuclear energy

Greece does not have any nuclear power plants.

Public funding for R&D in the area of nuclear energy amounts to less than ***EUR 1 mln*** per year (cf. IEA, 1998e, 1999f).

Renewables

The Public Power Corporation (PPC) is required by law to purchase electricity from small renewable electricity plants at 70 to 90 percent of the retail electricity price. As of March 1998, 37 projects totalling some 100 MW_e had received construction or operating licenses under this law (IEA, 1998e). In March 2001, the European Court of Justice has ruled that this type of support does not constitute state aid under the EU Treaty (ENDS, 2001).

Subsidies of up to 40 per cent, reduced interest rates, accelerated depreciation and tax credits are available for the promotion of investments in renewable energy production. It was estimated that a total amount of GRD 44 billion in public funds would be involved in the period 1995-1999, i.e. about ***EUR 27 mln*** per year (Government of Greece, 1997; IEA, 1998a,e).

75% of the cost of renewable appliances for households, such as solar water heating systems, can be deducted from a person's taxable income (IEA, 1998a). The amount of subsidy (tax foregone) involved is unknown.

The *Operational Energy Programme* of the Ministry of Industry, Energy and Technology, which ran from 1994 through 1999, allocated EUR 20 mln of public funds (almost ***EUR 4 mln*** per year) for the development of renewable energy sources (in addition to EU and private funds) (Government of Greece, 1997; IEA, 1998a).

In 1995-1997, the Greek government spent on average ***EUR 4.3 mln*** per year on renewables related R&D (IEA, 1999f).

In the Greek CO_2 abatement Action Plan, which covers the period 1995 through 1999, the various elements in the available public budget for renewable energy add up to EUR 203.5 mln, or EUR 41 mln per year, including public R&D funding and spending by local governments (Government of Greece, 1997).

Electricity

Electricity pricing is affected by national policies, for social and development reasons. In recent years, the government has tended to restrain price rises as an instrument to control

inflation. Furthermore, there are uniform tariffs throughout Greece, implying substantial cross-subsidies from users of the interconnected systems to users of isolated systems (IEA, 1998e).

In 1995-1997, the Greek government spent less than ***EUR 1 mln*** per year on electricity related R&D (IEA, 1999f).

Table 2.8.1. Greece: Summary Table

Final energy consumption (1998): 18.2 Mtoe **Gross electricity generation (1998):** 46.3 TWh					
	coal	**oil & gas**	**nuclear**	**renewables**	**electricity**
share in gross electricity generation (1998)	70%	21%	0%	9%	
quantifiable subsidies (mln EUR per year)	> 1	> 250	< 1	> 35	> 1
quantifiable subsidies, incl. attributed electricity subsidies (mln EUR per year)	> 1	> 250	< 1	> 35	

Source: Energy statistics: Eurostat (2000a); other figures: this section.

2.9 IRELAND

Solid fuels

Peat production is supported through the use of peat (which is some 50% more expensive than imported coal) in five power plants. IEA (1999c) estimates the Producer Subsidy Equivalent (PSE) for peat production at IEP 15.3 mln (***EUR 19.4 mln***) per year in 1997/98. Furthermore, the EU (q.v.) has provided a subsidy of IEP 20 mln for a new peat fired power plant and the Irish government has given a capital injection of IEP 108 mln to the Irish Peat Board to restructure its debt.

Households pay a reduced VAT rate on coal (12.5% instead of the standard rate of 21%). Given a coal consumption of 847,000 tonnes by services and households in 1998 (Eurostat, 2000a), an average price (excluding VAT) for households of IEP 170.91 per tonne in 1994 (the latest available year – IEA, 1999d), and assuming that half of the given consumption was by households, the implicit subsidy can be estimated at IEP 6.2 mln or ***EUR 7.9 mln***.

Oil and gas

Since 1992, Ireland has had a comprehensive regime of fiscal and non-fiscal measures applicable to hydrocarbon exploration, development and production. The Irish upstream fiscal regime is considered to be one of the most attractive in the world. Corporation tax at 25% applies where production of oil and gas takes place under leases issued before certain specified dates (2003, 2007 or 2013, depending on location) (IEA, 1999c). The standard corporation tax rate is 32% (for company income exceeding IEP 50,000).

Furthermore, taxation allowances of 100% are available for exploration, development and operating expenses with a provision for allowance of unsuccessful exploration expenditure for 25 years. There is also a provision for an allowance with respect to expenditure on the abandonment of fields and dismantling of pipelines. There is no provision for royalty payments or State participation in the current licensing terms. In the case of two gas fields, production is carried out under an earlier agreement and a royalty of 12.5% applies. (IEA, 1999c).

Oil importers are obliged to purchase 20% of their supplies from an Irish refinery at prices determined by the Minister. The cost to consumers of this arrangement is estimated at IEP 5 mln (EUR 6 mln) per year (IEA, 1999c).

Households pay a reduced VAT rate on fuel oil and gas (12.5% instead of the standard rate of 21%). Given an oil products consumption of 1.7 mln tonnes by the ‘services and households’ sector in 1998 (Eurostat, 2000a), an average price (excluding VAT) for households of IEP 207 per tonne in 1998 (IEA, 1999d), and assuming that half of the given consumption was by households, the implicit subsidy for oil can be estimated at IEP 15.0 mln or ***EUR 19.0 mln***. Similarly, given a natural gas consumption of 15.7 PJ by households in 1998 (Eurostat, 2000a) and an average price (excluding VAT) for households of IEP 6.97 per GJ in 1998 (IEA, 1999d), the implicit subsidy for gas can be estimated at IEP 9.3 mln or ***EUR 11.8 mln***.

Ireland is a member of the 1992 International Oil Pollution Compensation Fund. This implies a maximum compensation for oil spills of EUR 175 mln.

Nuclear energy

Ireland does not have any nuclear power plants and no subsidies for nuclear R&D are reported.

Renewables

Government support has concentrated on renewable electricity generation, via the 'Alternative Energy Requirement' (AER): a competitive tendering process whereby electricity from selected renewable energy projects is guaranteed a market. Until 1998, approximately 300 MW of renewable electricity-generating capacity (wind, hydro, waste-to-energy and landfill) had bid successfully for projects under AER. In the first round of AER, an amount of IEP 70 mln was budgeted for 15 years of price support for successful projects (IEA, 1998a); this is equivalent to EUR 5.9 mln per year. Assuming that subsequent rounds have yielded comparable results, it is likely that AER support now exceeds ***EUR 10 mln*** per year.

In 1998, a new tax relief was introduced for private investment in approved wind energy and biomass projects. This relief was to apply to up to 50% of a project's cost (capped at IEP 7.5 mln per project and IEP 10 mln per year per company) (IEA, 1999c).

Public R&D funds for renewables amounted to IEP 87,000 (EUR 0.1 mln) in 1992 (IEA, 1998a). More recent figures on these (and other) energy R&D subsidies are lacking.

Electricity: EUR 45 mln

Households pay a reduced VAT rate on electricity (12.5% instead of the standard rate of 21%). Given an electricity consumption of 5.5 TWh by households in 1998 (Eurostat, 2000a), an average price (excluding VAT) for households of IEP 77 per MWh in 1998 (IEA, 1999d), the implicit subsidy for electricity can be estimated at IEP 36.0 mln or ***EUR 45.7 mln***.

Table 2.9.1. Ireland: Summary Table

Final energy consumption (1998): 9.2 Mtoe
Gross electricity generation (1998): 21.2 TWh

	coal	**oil & gas**	**nuclear**	**renewables**	**electricity**
share in gross electricity generation (1998)	40%	53%	0%	7%	
quantifiable subsidies (mln EUR per year)	25	> 30	0	> 10	45
quantifiable subsidies, incl. attributed electricity subsidies (mln EUR per year)	40	> 50	0	> 10	

Source: Energy statistics: Eurostat (2000a); other figures: this section.

2.10 ITALY

Solid fuels

Coal is subject to a reduced VAT rate of 10%, whereas the standard rate is 20%. Coal use by households in Italy is, however, negligible, so the effective implicit subsidy is close to zero.

Until 1999, when a CO_2 tax was introduced, coal was the only fossil fuel that was exempt from energy taxes.

There are plans to re-open a coal mine on Sardinia, which will supply coal to a gasification plant, which in turn will feed an electricity power plant. Electricity company ENEL will purchase the electricity generated at a preferential price. Total investment is expected to amount to ITL 2,000 billion (EUR 1 billion), part of which will be funded by the European Union (IEA, 1999a). The (national) subsidy for coal implied in this arrangement is unknown.

Oil and gas

Natural gas is subject to a reduced VAT rate of 10%, whereas the standard rate is 20%. In 1998, households used 952.4 PJ of natural gas (Eurostat, 2000a). Given a natural gas price for households (excluding VAT) of ITL 17,863 per GJ, the implicit subsidy can be estimated at ITL 1.7 trillion or ***EUR 879 million***.

Excise tax rates for natural gas differ by category of user, by type of use and by region. It is impossible to calculate the implicit subsidy, but it is obvious that a substantial amount is involved if one takes the highest rate (in 1998: ITL 332 per m^3 for gas used outside industry, in the centre or north of the country, for other purposes than cooking or water heating – IEA, 1999a) as the baseline.

The normal royalty rate on onshore hydrocarbons production and offshore gas is 7%, although there are exemptions for small quantities. Royalties on offshore net oil production are 4% (IEA, 1999a).

Italy is a member of the 1992 International Oil Pollution Compensation Fund. This implies a maximum compensation for oil spills of EUR 175 mln.

Nuclear energy

Italy has abandoned the use of nuclear power for energy production since 1987. Four nuclear power plants were closed and the construction of two others was stopped. Substantial amounts of public money are involved in compensatory payments for the early closure, for decommissioning and for nuclear waste storage. As it is unknown to what extent public money for decommissioning and waste storage would also have been needed if nuclear power production would have continued, it is impossible to say whether any ‘subsidies’ are involved in terms of this report.

In 1995-1998, the Italian government spent on average ***EUR 114.0 mln*** per year on nuclear (fission and fusion) related R&D (IEA, 1999f).

Renewables

Since 1991, renewable energy has been stimulated by allowing certain authorised plants to sell electricity to ENEL at a regulated price. These prices differ by type of renewable and in some cases also by time of delivery (peak hours or off-peak hours). In 1997, the price paid in Italy for renewable energy was estimated by the European Commission at EUR 0.083 per kWh, the second highest (after Germany) among the countries considered (IEA, 1998a, 1999a). In March 2001, the European Court of Justice has ruled that this type of support does not constitute state aid under the EU Treaty (ENDS, 2001).

Another 1991 law provided for investment subsidies for renewables based capacity, but this law has never come into effect (IEA, 1998a).

Limited support for liquid biofuels has been available since 1993. A fixed annual quota of 125 ktons of diester is exempt from excise tax (IEA, 1998a). In 1998, the regulation has been renewed (Barra *et al*., 1999). Assuming that the quotum is completely used to substitute for gas oil (used as propellant), and that 1 kg of diester is equivalent to 1 litre of gas oil, then (given an excise tax rate of ITL 780.731 per litre for gas oil in 1999) the amount of implicit subsidy can be estimated at ITL 97.6 billion or ***EUR 50.4 million***. In addition to this, subsidies of ITL 15 billion (***EUR 7.7 million***) were allocated by the government for the production of diester from set-aside land (IEA, 1998a).

Solar (PV and heating) systems are encouraged by reducing their VAT rate from 20% to 10% (IEA, 1998a; Barra *et al*., 1999). The amount of subsidy involved is unknown.

Of the revenues from the CO_2 tax, which was introduced in 1999, ***EUR 52 million*** is earmarked for renewable energy subsidies. Recently, it was decided to spend another EUR 150 million of these revenues on various projects, including not only renewables but also emission reduction, transport projects and energy saving (ENDS 2000a).

District heating based upon biomass qualifies for a tax rebate of ITL 20 per kWh in specified climatic zones (Barra *et al.*, 1999). The amount of subsidy implied is unknown.

In 1995-1998, the Italian government spent on average ***EUR 39.3 mln*** per year on renewables related R&D (IEA, 1999f).

Electricity

Capital subsidies to the electricity sector (taking the form of equity participation, loans at preferential rates, loan guarantees and debt forgiveness) were estimated at EUR 700 mln in 1994, with a downward trend (Tosato, 1997).

Electricity is subject to a reduced VAT rate of 10%, whereas the standard rate is 20%. Electricity use by Italian households amounted to 59.3 TWh in 1998 (Eurostat, 2000a). Given an average price of ITL 246.7 per kWh (excluding VAT) (IEA, 1999d), the implicit subsidy is about ITL 1,463 billion or ***EUR 756 mln***.

Household consumption of electricity is subject to an excise tax of ITL 9.1 per kWh, but the first 150 kWh per month remains untaxed. Assuming there are some 20 mln households in Italy, and that they use on average 100 kWh of untaxed electricity per month, the annual implicit subsidy can be estimated at ITL 218 billion or ***EUR 113 mln***.

For industry, the electricity tax rate is ITL 4.1 per kWh for the first 200 MWh per month, and ITL 2.45 per kWh for additional consumption. The amount of implicit subsidy cannot be calculated due to lack of adequate data.

In 1995-1998, the Italian government spent on average ***EUR 16.2 mln*** per year on electricity related R&D (IEA, 1999f).

Table 2.10.1. Italy: Summary Table

Final energy consumption (1998): 123.5 Mtoe **Gross electricity generation (1998):** 259.1 TWh					
	coal	**oil & gas**	**nuclear**	**renewables**	**electricity**
share in gross electricity generation (1998)	9%	71%	0%	20%	
quantifiable subsidies (mln EUR per year)	> 0	900	100	> 150	> 850
quantifiable subsidies, incl. attributed electricity subsidies (mln EUR per year)	> 75	> 1,500	100	> 300	

Source: Energy statistics: Eurostat (2000a); other figures: this section.

3.11 LUXEMBOURG

Solid fuels

Coal is subject to a VAT rate of 12%, whereas the standard VAT rate is 15%. However, coal use by households in Luxembourg is negligible, and therefore the effective implicit subsidy is close to zero.

Oil and gas

Gas and oil products for domestic use are subject to VAT rates of 6% and 12% respectively, whereas the standard VAT rate is 15%. Natural gas use by households amounted to 10 PJ in 1998 (Eurostat, 2000a). Given a gas price for households of LUF 265 per GJ (excluding VAT) in 1997 (the latest available year – IEA, 1999d), the implicit subsidy for gas is LUF 238.5 mln or ***EUR 5.9 mln***. The use of oil products by the services & households sector was 356 TJ in 1998, which implies that the implicit subsidy for oil products is negligible (less than EUR 1 mln).

Land-locked Luxembourg is not a member of an International Oil Pollution Compensation Fund.

Nuclear energy

Luxembourg has no nuclear power plants and no subsidies for nuclear R&D are reported.

Renewables

On 1 January 2001, government support for renewable energy was to be expanded considerably. The available subsidies include (Umweltministerium, 2000):

- 50% of investment costs in PV systems in residential and other buildings;
- a premium of up to LUF 25 (EUR 0.62) per kWh for electricity from PV;
- 40% of investment costs in passive solar systems (for water and space heating);
- up to LUF 3,025 (EUR 75) per kW for investments in wind turbines;
- a premium of LUF 4.1 (EUR 0.10) per kWh for electricity from (small scale) wind;
- 25 to 50% of investment costs in biomass and biogas installations;
- a premium of LUF 1 (EUR 0.02) per kWh for electricity from (small scale) hydropower, biomass and biogas.

The amounts involved in the investment subsidies will of course depend upon the actual volume of investment. The amounts involved in the premiums for renewables based electricity can be estimated as follows. If we assume that of the hydro based electricity (1049 GWh in 1998 – Eurostat, 2000a) 20% qualifies for the premiums, and 100% of other renewable electricity (11 GWh wind and 45 GWh biomass - ibidem), the total subsidy is about LUF 300 mln or ***EUR 7.4 mln***.

Electricity

Electricity is subject to a reduced VAT rate of 6%, whereas the standard VAT rate is 15%. Electricity consumption by households amounted to 752 GWh in 1998 (Eurostat, 2000a). Given an electricity price for households of LUF 4,179 per MWh (excluding VAT), the implicit subsidy can be estimated at LUF 283 mln or ***EUR 7.0 mln***.

Since 1 January 2001, connections to the public electricity grid are eligible to a subsidy of 50% of the investment costs, up to a maximum of EUR 100,000 (Umweltministerium, 2000). The amount of subsidy involved is unknown.

Table 2.11.1. Luxembourg: Summary Table

Final energy consumption (1998): 3.2 Mtoe **Gross electricity generation (1998):** 1.3 TWh					
	coal	**oil & gas**	**nuclear**	**renewables**	**electricity**
share in gross electricity generation (1998)	0%	16%	0%	84%	
quantifiable subsidies (mln EUR per year)	0	6	0	7	> 7
quantifiable subsidies, incl. attributed electricity subsidies (mln EUR per year)	0	> 7	0	> 10	

Source: Energy statistics: Eurostat (2000a); other figures: this section.

2.12 THE NETHERLANDS

Solid fuels

Coal is taxed under the Dutch fuel tax, but not under the 'regulatory' energy tax (a tax on the final use of energy, introduced in 1996 and intended as an incentive for energy conservation). The final use of coal and coal products amounted to 95 PJ in 1997 (CBS, 2000a). Taking the tax rate for natural gas (in 2000: NLG 0.16 per m^3 or NLG 5.1 per GJ) as a reference, the implicit annual subsidy can be estimated at NLG 485 mln or ***EUR 220 mln***.

In 1995-1997, the Dutch government spent on average ***EUR 3.3 mln*** per year on coal related R&D (IEA, 1999f).

Oil and gas

Since 1997, excise taxes on diesel oil can be partly refunded for heavy trucks (with a maximum allowable weight of 12 tonnes or more). In 1999, the refund amounted to NLG 51.10 (EUR 23.19) per 1000 litres. The total amount refunded is about NLG 120 million (***EUR 54 million***) per year.

The environmental tax on energy has degressive rates, i.e. reduced rates for large energy users. Furthermore, the tax rules allow for a tax-free basic consumption of 800 m^3 of natural gas per household per year. The horticulture sector gets special tariff reductions. A number of other, less substantive exemptions and reductions apply as well. The implicit subsidy can be roughly estimated as follows. The revenues from the energy tax in 1999 were about NLG 2.9 billion (Ministerie van Financiën, 2000b). The final use of energy products that come under the energy tax, the 'standard' tax rates (i.e., the rate for small users, above the tax free base) and the 'theoretical' revenues (i.e. the revenues if the 'standard' rate would apply to all final use) are given in Table 2.12.1.

Table 2.12.1. 'Theoretical' energy tax revenue in The Netherlands without reductions and exemptions

	final use (PJ) (1998)	**tax per GJ (NLG) (1999)**	**theoretical revenue (bln NLG)**
oil (products) (excluding transport)	354	3.00	1.1
natural gas	937	5.1	4.7
electricity	329	13.8	4.5
total	1620		10.3

Source: CBS (2000a); Ministerie van Financiën (2000b). Tax rates for oil and gas are approximations, based on the rates per litre and m^3.

The difference between the 'theoretical' and the actual revenue is thus NLG 7.4 bln. Assuming, somewhat arbitrarily, that this implicit subsidy is distributed among the energy products in proportion to their share in final use, the share of oil (products) and natural gas is NLG 8.2 billion (***EUR 3.7 billion***) and that of electricity NLG 2.1 billion (see below).

The implicit subsidy in the tax on fuels can be estimated in a similar way. The most important element here is the reduced rate for the amount of natural gas used that exceeds 10 mln m^3.

Furthermore, for 'residual' fuels (such as blast furnace gas and refinery gas) that are used in the same plant where they originate, a zero tax rate will apply until 2003. Table 2.12.2 shows the calculation of the 'theoretical' tax revenue if all fuels were taxed at their standard rate. The actual revenue in 1999 amounted to NLG 1,345 mln (Ministerie van Financiën, 2000b). The difference with the actual revenue is about NLG 660 mln or ***EUR 300 mln***. As there are no exemptions or reductions for coal, this implicit subsidy can be completely attributed to oil and gas.

Table 2.12.2. 'Theoretical' revenue from the tax on fuels without reductions and exemptions, 1999

	use (PJ)	**tax per GJ (NLG)**	**theoretical revenue (mln NLG)**
coal	351	0.81	284
oil (products)	1055	0.67	707
natural gas	1452	0.70	1016
total	2858		2007

Source: CBS (2000b); Ministerie van Financiën (2000b). Tax rates are approximations, based on the rates per litre, kg and m^3. Tax rates for different oil products have been averaged.

Investments in oil and gas production on the Dutch part of the Continental Shelf can be freely depreciated. The tax expenditures involved in this arrangement are estimated at NLG 45 mln (***EUR 20 mln***) in 2000 (Ministerie van Financiën, 2000a).

As in other countries, the own use of mineral oil products by refineries is exempted from excise tax. Since 1 January 2000, this exemption also applies to the fuel tax and the energy tax. The amount of implicit subsidy involved is unknown.

The strategic oil reserves are financed by a specific levy on oil products and should therefore not be regarded as being 'subsidised'.

In 1995-1997, the Dutch government spent on average ***EUR 54.3 mln*** per year on oil and gas related R&D (IEA, 1999f).

The Netherlands are a member of the 1992 International Oil Pollution Compensation Fund. This implies a maximum compensation for oil spills of EUR 175 mln.

Nuclear energy

Presently, there is only one nuclear power plant operating in The Netherlands, which is due to be closed in 2004.

All costs of the Central Organisation for Radioactive Waste (COVRA) have to be covered by fees paid for the waste it receives. Funds for the decommissioning of the nuclear power plants are collected by the operators via an internal scheme (EC, 1999d).

The maximum amount for which the operator of a nuclear plant is obliged to have a financial security to cover his legal liability for a nuclear accident is NLG 750 mln (EUR 340 mln).

In 1995-1997, the Dutch government spent on average ***EUR 26.3 mln*** per year on nuclear related R&D (IEA, 1999f).

Renewables

The budget for renewable energy of the Ministry of Economic Affairs contained in 1999 and 2000 an average amount of NLG 168.5 mln (***EUR 76.5 mln***) per year (Ministerie van Economische Zaken, 1999). This includes investment subsidies as well as R&D programmes.

Within the framework of the 'CO_2 reduction plan', which started in 1996, subsidies amounting to more than NLG 900 mln are available for projects contributing to CO_2 emission reduction. In the first four years, about NLG 100 mln (***EUR 11 mln*** per year) has been made available for projects involving renewable energy (Projectbureau CO_2-reductieplan, 2000).

Electricity from renewables is exempted from the energy tax. In 1998, when the European Commission granted approval for this exemption, the amount of subsidy involved was estimated at NLG 30 mln (***EUR 14 mln***) (ENDS, 1998c). Meanwhile, the tax rates as well as the production and use of 'green' electricity have increased considerably. Therefore, the annual subsidy might currently be several times higher.

For specific investments in energy conservation and renewable energy, companies can deduct 40 to 52% of the investment costs from their fiscal profit. The amount of tax expenditure involved is NLG 360 mln in 2000 (Ministerie van Financiën, 2000b). It is unknown which part of this amount is related to renewables. In 1999, the largest investments under this scheme were in various energy conservation measures and in wind turbines (Senter, 2000). Assuming that 50% of the tax expenditure benefits renewables, the implicit subsidy is ***EUR 82 mln***. For non-commercial institutions a comparable scheme applies, with subsidies amounting to NLG 35 mln. per year. Assuming once again that 50% of this relates to renewable energy, this means a subsidy of ***EUR 8 mln*** per year.

Another fiscal facility is the 'VAMIL' scheme, allowing enterprises to determine themselves when they want to depreciate investments in certain environmentally benign investments, which are on a list that is updated annually. In 2000, tax expenditures under VAMIL are estimated to amount to NLG 250 mln (Ministerie van Financiën, 2000b). In 1999, 47% of investments under the VAMIL scheme were related to energy (Ministerie van VROM, 2000). Assuming that half of this (23.5%) relates to renewables, the implied subsidy is ***EUR 27 mln***.

Interest and dividend on "green" investments are tax-exempt. The total tax expenditures under this scheme amounted to NLG 50 mln in 2000 (Ministerie van Financiën, 2000b). The part accruing to renewable energy can be estimated as follows. In the period 1995-1999, 273 projects have been declared eligible for the "Green investment" scheme. The total amount of investment involved was NLG 735 mln. Assuming an average interest/dividend on such investments of 4%, and a marginal income tax rate of 50%, the tax expenditure involved amounts to some NLG 15 mln or ***EUR 7 mln*** per year.

Bio-ethanol for pilot projects is exempted from the excise tax on mineral oils. An annual amount of NLG 13.5 mln (***EUR 6 mln***) is available for this tax expenditure scheme.

Electricity

The energy tax has reduced rates for large electricity users. Furthermore, the energy tax allows for a tax-free basic consumption of 800 kWh of electricity per dwelling per year. Some other, less substantial reductions and exemptions apply as well (including the exemption for electricity from renewables, see above). The amount of implicit subsidy was roughly calculated above (under 'oil and gas' at NLG 2.1 billion (***EUR 1.0 billion***). The share of the exemption for renewables (calculated at some EUR 50 mln above) disappears in the margin of error of this amount.

In 1995-1997, the Dutch government spent on average ***EUR 17.1 mln*** per year on electricity related R&D (IEA, 1999f).

Table 2.12.3. The Netherlands: Summary Table

Final energy consumption (1998): 49.2 Mtoe
Gross electricity generation (1998): 90.9 TWh

	coal	**oil & gas**	**nuclear**	**renewables**	**electricity**
share in gross electricity generation (1998)	27%	64%	4%	4%	
quantifiable subsidies (mln EUR per year)	225	> 4,000	25	> 230	1,000
quantifiable subsidies, incl. attributed electricity subsidies (mln EUR per year)	250	> 4,500	65	> 250	

Source: Energy statistics: Eurostat (2000a); other figures: this section.

2.13 PORTUGAL

Solid fuels

Portugal's coal production and the associated subsidies were terminated in 1994.

Public R&D expenditure for coal amounts to less than ***EUR 1 mln*** per year (IEA, 1999f, 2000c).

Oil and gas

Public R&D expenditure for oil and gas amounts to less than ***EUR 1 mln*** per year (IEA, 1999f, 2000c).

During the period 1994-1999, the Portuguese state has funded a total amount of EUR 6 mln for the promotion of natural gas (***EUR 1 mln*** per year on average) (IEA, 2000c). Substantially higher amounts have been funded by the EU (a total of 194 mln; see Section 2.1) and by public enterprises (EUR 286 mln). The latter, however, cannot be regarded as a subsidy as it may be expected that this investment will be recovered from gas consumers.

Heating oil used to be subject to a reduced VAT rate of 5%, but in 1997 it was raised to the standard rate of 17% whereas at the same time the VAT rate for natural gas was reduced to 5%. Natural gas consumption by households amounted to 358 TJ in 1998 (Eurostat, 2000a), which means that the implicit subsidy is less than ***EUR 1 mln***.

Portugal is a member of the 1971 International Oil Pollution Compensation Fund. This implies a maximum compensation for oil spills of EUR 78 mln.

Nuclear energy

There is no nuclear power production in Portugal.

Public R&D expenditure for nuclear energy amounts to less than EUR 1 mln per year (IEA, 1999f).

Renewables

The 1994 Energy Programme provides, among others, for support to renewable energy. The types of support include capital grants, 'soft' loans and guaranteed prices for electricity from renewables (IEA, 1998a). Public funding for renewables amounted to a total of EUR 159 mln in the period 1995-1999, of which 69 mln came from the EU (see Section 2.1) and EUR 90 mln (***EUR 18 mln*** per year) from national sources (IEA, 2000c). As it is unclear to what extent this funding consists of subsidies, the said amount is an upper limit for the subsidy estimate.

Purchases of renewable energy equipment (such as solar panels for residential use) benefit from the reduced VAT rate of 5% under the 1992 Budget Law. It is also possible to deduct the investment cost in renewable end-use technology from personal taxable income (subject to a ceiling) (IEA, 1998a). The amounts of implicit subsidy involved in these fiscal incentives are unknown.

Public R&D spending on renewable energy amounted to PTE 253 mln or ***EUR 1.3 mln*** in 1999 (IEA, 2000c). In 1995-1997, the annual average was below EUR 1 mln (IEA, 1999f).

Electricity

Electricity is subject to a reduced VAT rate of 5%, whereas the standard rate is 17%. Electricity consumption by households amounted to 8.8 TWh in 1998 (Eurostat, 2000a). Given an average price (excluding VAT) for households of PTE 26.4 per kWh, the implicit subsidy can be calculated at PTE 27.5 billion or ***EUR 137 million***.

Table 2.13.1. Portugal: Summary Table

Final energy consumption (1998): 15.6 Mtoe
Gross electricity generation (1998): 39.0 TWh

	coal	**oil & gas**	**nuclear**	**renewables**	**electricity**
share in gross electricity generation (1998)	31%	33%	0%	37%	
quantifiable subsidies (mln EUR per year)	< 1	< 3	< 1	20	135
quantifiable subsidies, incl. attributed electricity subsidies (mln EUR per year)	40	45	< 1	70	

Source: Energy statistics: Eurostat (2000a); other figures: this section.

2.14 SPAIN

Solid fuels

According to the European Commission (2000a), state aid to coal mining in Spain amounted to an average ***EUR 761 million*** per year in the period 1995-1998. This amount includes aid to current production only. The subsidies are to be phased out by 2002.

In 1995-1998, the Spanish government spent on average ***EUR 4.1 mln*** per year on coal related R&D (IEA, 1999f).

Oil and gas

The VAT rate for bottled gas is 7%, whereas it is 16% for other energy products (EC, 2000c). The amount of implicit subsidy cannot be calculated due to lack of data.

The Spanish government promotes the use of natural gas as a way of diversifying energy supply. In the National Energy Plan 1991-2000, ESP 9.2 billion in government subsidies was budgeted for this substitution (MICyT, 1990), i.e. ***EUR 5.5 mln*** per year.

Members of CORES, an agency empowered to build up strategic oil stocks, enjoy certain fiscal exemptions (IEA, 1996a). Detailed information is lacking.

Spain is a member of the 1992 International Oil Pollution Compensation Fund. This implies a maximum compensation for oil spills of EUR 175 mln.

Nuclear energy

Construction work on a number of nuclear power plants has been terminated since 1984, when Spain announced a nuclear moratorium. The financial obligations relating to these unfinished plants are covered by a fund that is financed from a levy on electricity bills. However, as this fund does not contribute to nuclear power production, it should not be regarded as a subsidy under our definition.

The costs of maintaining a basic stock of uranium and of nuclear waste management are covered by levies on electricity of 0.007% and 0.8%, respectively. Given a final use of electricity of 166 TWh in 1998 (Eurostat, 2000a) and an average price of ESP 13.6 per kWh (mean value for industry and households, excluding taxes; IEA, 1999d) the subsidy for nuclear energy can be estimated at ESP 19.6 billion or ***EUR 118 mln*** per year.

In 1995-1998, the Spanish government spent on average ***EUR 32.6 mln*** per year on nuclear related R&D (IEA, 1999f).

Renewables

The two main thrusts of renewables promotion in Spain are favourable electricity tariffs to autoproducers and capital subsidies under the Energy Conservation and Efficiency Plan 1991-2000 (ECEP). Subsidies under ECEP for renewables amount to ESP 53.4 billion, or ESP 5.3 billion (***EUR 32 million***) per year (Ministry of Industry, Trade and Tourism, 1991).

The obligation for utilities to buy excess electricity from autoproducers at a price set by the Administration only applies to plants with a capacity lower than 100 MW (lower than 10 MW for hydro). Rates are specified for both capacity and output credits (buy-back rates). Capacity credits are highest for waste incineration plants, whereas output credits are highest for wind and solar plants: ESP 11.48 (EUR 0.07) per kWh over a five-year period. Output credits for waste-generated electricity vary, depending on the size of the plant and the relative importance of any co-fired fossil fuel, but are lower than those for wind and solar electricity, and decrease yearly. Buyback rates for such plants are about ESP 9.5 (EUR 0.06) per kWh in the first year - still significantly higher than the estimated average production cost from autoproducers of ESP 8 (EUR 0.05) per kWh. The buyback rate levels are also dependent on continuity of supply to avoid periodic surges in power sold to the grid (IEA, 1998a). In March 2001, the European Court of Justice has ruled that this type of support does not constitute state aid under the EU Treaty (ENDS, 2001).

Renewable energy is also promoted at the regional and local levels, e.g. the Andalusian government launched a 3 year programme for solar heating systems with a budget of ESP 1.2 billion (***EUR 2.4 million*** per year) (IEA, 1998a).

In 1995-1998, the Spanish government spent on average ***EUR 14.4 mln*** per year on renewables related R&D (IEA, 1999f).

Electricity

Under Law 54/97 the Spanish electricity sector can receive state aid to cover the costs of transition to competition. The amounts involved are unknown.

In 1995-1998, the Spanish government spent on average less than ***EUR 1 mln*** per year on electricity related R&D (IEA, 1999f).

Table 2.14.1. Spain: Summary Table

Final energy consumption (1998): 71.2 Mtoe **Gross electricity generation (1998):** 195.9 TWh					
	coal	**oil & gas**	**nuclear**	**renewables**	**electricity**
share in gross electricity generation (1998)	31%	18%	30%	20%	
quantifiable subsidies (mln EUR per year)	765	> 5	150	> 50	> 1
quantifiable subsidies, incl. attributed electricity subsidies (mln EUR per year)	765	> 5	150	> 50	

Source: Energy statistics: Eurostat (2000a); other figures: this section.

2.15 SWEDEN

The Swedish CO_2 and energy tax regulations contain a number of exemptions and reductions for several categories of users. For example, industry pays no electricity tax and only 50 per cent of the CO_2 tax, with a maximum limit for energy-intensive plants A rough estimate of the implicit subsidy can be made by calculating the 'theoretical' revenue if all final use of energy were taxed at the standard rate (cf. Table 2.15.1):

Table 2.15.1. "Theoretical" revenue of energy taxes if all energy were taxed at full rate

type of energy	**final use (1998)***	**tax rate (2000)****	**'theoretical' revenue**
coal	2.4 mln tonnes	SEK 1,236 per tonne	SEK 2,966 mln
oil products (transport)	7.3 mln tonnes	SEK 3,000 per tonne ***	SEK 21,900 mln
oil products (other)	4.8 mln tonnes	SEK 1,801 per tonne	SEK 8,645 mln
natural gas	0.5 bln m^3	SEK 1,033 per 1000 m^3	SEK 517 mln
electricity	124 TWh	SEK 162 per MWh	SEK 20,088 mln
total			**SEK 54,116 mln**

* Source: Eurostat (2000a)
** Source: National Tax Board (2000). It has been assumed that 1 tonne of oil (product) equals 1 m^3.
*** Estimated average of various types of oil products

The actual revenue is slightly lower than the calculated 'theoretical' revenue: SEK 50,478 mln (National Tax Board, 2000). Lacking detailed data, we will assume that the implicit subsidy in the difference of SEK 3.6 bln is divided as follows: SEK 1.5 bln for oil/gas and electricity each, and SEK 0.6 bln for coal.

Solid fuels

The implicit subsidy for coal by way of energy/CO_2 tax exemptions and reductions was calculated above at SEK 600 mln or ***EUR 70 mln***.

In 1995-1997, the Swedish government spent on average less than ***EUR 1 mln*** per year on coal related R&D (IEA, 1999f).

Oil and gas

The implicit subsidy for oil and gas by way of energy/CO_2 tax exemptions and reductions was calculated above at SEK 1.5 bln or ***EUR 175 mln***.

Sweden is a member of the 1992 International Oil Pollution Compensation Fund. This implies a maximum compensation for oil spills of EUR 175 mln.

Nuclear energy

Nuclear power, now responsible for half of Sweden's electricity production, is to be phased out by 2010.

All costs for the back-end of the nuclear fuel cycle, including decommissioning, are borne by the reactor operators via fees paid into state funds (EC, 1999d).

In 1995-1997, the Swedish government spent on average ***EUR 6.6 mln*** per year on nuclear related R&D (IEA, 1999f).

Renewables

A government programme set up to encourage increased use of renewables has been running since July 1997. This programme supports renewable energy investments in order to encourage increased production of renewable electricity, particularly from biomass and wind (IEA, 1998a). The programme includes grants of:

- 25% for investments in CHP plants based on biomass (up to SEK 3000 per kW_e), with a 5-year budget of SEK 450 mln;
- 15% for wind turbines over 200 kW, with a 5-year budget of SEK 300 mln;
- 15% for environmentally friendly, small-scale (<1.5 MW) hydro plants, with a 5-year budget of SEK 150 mln.

The annual budget of this programme can be calculated at ***EUR 21 mln***.

In addition to the 1997 investment support programme, the government set up a 5-year technology procurement programme for renewable electricity production from January 1998. Total funds for the procurement programme are SEK 100 mln, or ***EUR 2.3 mln*** per year (IEA, 1998a).

The obligatory purchase of renewable electricity was abolished in November 1999. In 2000, a procurement price for electricity from renewables was established in the range of SEK 0.13-0.14 per kWh (IEA, 2000e). The amount of subsidy involved is unknown. As from 2001, a market-oriented scheme will replace the former support schemes for renewable energy.

Electricity produced by wind power is exempted from the energy tax ('environmental bonus'). The amount of implicit subsidy in the year 2000 was estimated at SEK 91 mln (***EUR 11 mln***)[9].

In 1995-1997, the Swedish government spent on average ***EUR 10.2 mln*** per year on renewables related R&D (IEA, 1999f). Since then, this amount is likely to have increased substantially, as the energy policy programme that has been adopted in 1997 includes, among others, a seven years research, development and demonstration programme of SEK 5.6 billion (EUR 93 mln per year) for renewable energy sources and new energy technology. The main target of the programme is to reduce the costs of the use of renewables so as to make them economically more viable alternatives to nuclear power and fossil fuels (IEA, 2000e).

[9] cf. letter from the European Commission dated 02.12.1999, state aid case NN 143/96.

Electricity

The implicit subsidy for electricity by way of energy/CO_2 tax exemptions and reductions was calculated above at SEK 1.5 bln or ***EUR 175 mln***.

In 1995-1997, the Swedish government spent on average ***EUR 5.5 mln*** per year on electricity related R&D (IEA, 1999f).

Table 2.15.2. Sweden: Summary Table

Final energy consumption (1998): 33.6 Mtoe **Gross electricity generation (1998):** 158.3 TWh					
	coal	**oil & gas**	**nuclear**	**renewables**	**electricity**
share in gross electricity generation (1998)	1%	3%	46%	49%	
quantifiable subsidies (mln EUR per year)	70	175	7	> 45	180
quantifiable subsidies, incl. attributed electricity subsidies (mln EUR per year)	70	180	90	> 130	

Source: Energy statistics: Eurostat (2000a); other figures: this section.

2.16 UNITED KINGDOM

Solid fuels

Government support for coal production in the UK peaked in 1988/89 at more than GBP 4 billion (EUR 6.4 billion) (Michaelis, 1997). According to the European Commission (2000a), state aid to coal production in the UK had ceased by 1995. The IEA (1998f) also concludes that UK coal production had become unsubsidised. However, 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 GBP 110 million over the period 2000-2002 (European Commission, 2000r), i.e. ***EUR 60 mln*** per year.

Domestic use of coal for heating purposes is subject to a reduced VAT rate of 5% instead of the normal rate of 17.5%. In 1998, final coal consumption by households was 2.64 mln tonnes (IEA, 2000a). The average price per tonne for households was GBP 126.30 (excluding VAT) (IEA, 1999d). The implicit subsidy can thus be calculated at GBP 41.7 mln or ***EUR 67 mln***.

In 1995-1998, the British government spent on average ***EUR 6.2 mln*** per year on coal related R&D (IEA, 1999f).

Oil and gas

A special royalty and tax system is applied to petroleum exploitation, incorporating royalty (12.5%), Petroleum Revenue Tax (50%), and corporation tax (30%). Income from fields developed before end March 1982 is subject to all three components, the resulting marginal tax rate being 69.375%. For fields developed in the period April 1982 – March 1993 royalty is not payable and the marginal rate is 65%. For new fields developed since March 1993 only corporation tax is payable (30%). Lacking any objective ‘baseline’ for the royalties and taxes on oil and gas exploitation, the implicit subsidy involved cannot be calculated. It is noteworthy, however, that recent changes in the regulations (such as the abolition of the Petroleum Revenue Tax and the Gas Levy) have provided incentives for investments, especially in smaller and more difficult fields.

Domestic use of oil and gas for heating purposes is subject to a reduced VAT rate of 5% instead of the normal rate of 17.5%. In 1998, households used 2.6 mln toe of oil and 30.6 mln toe of gas (calculated after Eurostat, 2000a). Prices (excluding VAT) were GBP 138.0 and GBP 221.9 per toe, respectively (IEA, 1999d). The implicit subsidy for oil and gas can thus be calculated at GBP 893.6 mln or ***EUR 1.4 billion***.

In 1995-1998, the British government spent on average ***EUR 7.2 mln*** per year on oil and gas related R&D (IEA, 1999f).

The United Kingdom is a member of the 1992 International Oil Pollution Compensation Fund. This implies a maximum compensation for oil spills of EUR 175 mln.

Nuclear energy

Subsidies to nuclear power producers from the Fossil Fuel Levy (introduced in 1990 to enable them to compete on the liberalised electricity market) have been ended in 1996.

BNFL, a state owned company, is responsible for the processing of nuclear waste from nuclear power plants in the UK. The producers and owners of the radioactive waste are responsible for bearing the cost of its management and disposal, including regulatory costs (EC, 1999d).

In 1995-1998, the British government spent on average ***EUR 31.2 mln*** per year on nuclear (fission and fusion) related R&D (IEA, 1999f).

Renewables

The production of electricity from renewable energy is stimulated by means of the 'Non Fossil Fuel Obligation' (NFFO), which requires electricity suppliers to secure specified amounts of renewable energy generation capacity and to provide certain specified amounts of electricity from renewables to their customers. Renewable capacity is contracted under a series of competitive bidding processes, known as 'NFFO Orders'. NFFO orders are financed through the 'fossil fuel levy' on electricity bills. NFFO support for 1997/98 was around GBP 120 mln (***EUR 193 mln***) (IEA, 1998a).

In 1995-1998, the British government spent on average ***EUR 10.1 mln*** per year on renewables related R&D (IEA, 1999f).

Electricity

Domestic use of electricity is subject to a reduced VAT rate of 5% instead of the normal rate of 17.5%. In 1998, households used 9.43 mln toe of electricity (calculated after Eurostat, 2000a). The average price (excluding VAT) was GBP 807.0 per toe (IEA, 1999d). The implicit subsidy for electricity can thus be calculated at GBP 951 mln or ***EUR 1.5 billion***.

In 1995-1998, the British government spent on average ***EUR 2.9 mln*** per year on electricity related R&D (IEA, 1999f).

Table 2.16.1. United Kingdom: Summary Table

Final energy consumption (1998): 148.9 Mtoe
Gross electricity generation (1998): 358.2 TWh

	coal	**oil & gas**	**nuclear**	**renewables**	**electricity**
share in gross electricity generation (1998)	34%	34%	28%	3%	
quantifiable subsidies (mln EUR per year)	130	> 1,400	30	200	1,500
quantifiable subsidies, incl. attributed electricity subsidies (mln EUR per year)	650	> 1,900	450	250	

Source: Energy statistics: Eurostat (2000a); other figures: this section.

3. THE ACCESSION COUNTRIES

The description of energy subsidies in the accession countries is more concise than for the EU member states in the previous chapter. Due to incomplete information, no attempt has been made to attain aggregate quantifications by country and by type of energy.

3.1 BULGARIA

Solid fuels

Prices of domestic coal and briquettes for household consumption are still state controlled (Klarer *et al*., 1999). The amount of subsidy involved is unknown. Production subsidies will be phased out by the end of 2001 (EC, 2000e).

Oil and gas

Cross-subsidies in the gas sector in Bulgaria have been eliminated (EC, 2000e).

Bulgaria is not a member of an International Oil Pollution Compensation Fund.

Nuclear energy

Early closure of the Kozloduy nuclear power plant units 1-4 will be supported from the EU's Phare funds (see Section 2.1).

Since 1999, funds for the management of radioactive waste and for the decommissioning of nuclear power plants are in place. They are financed by the operators of the plant (EC, 1999e).

Electricity

In 1991, electricity subsidies in Bulgaria were estimated to amount to USD 943 million (CNT, 2001). At present, prices of electricity are still state controlled (Klarer *et al*., 1999). The objective is to liberalise electricity prices by the end of 2001 (EC, 2000e).

3.2 CYPRUS

Solid fuels

Cyprus does not have any coal mines and the sector of solid fuels is of no significance (EC, 2000f).

Oil and gas

Cyprus does not yet have legislation in place regarding oil stocks (EC, 2000f), so it can be assumed that also no subsidisation of oil stocks occurs.

Cyprus has no natural gas network.

Cyprus is a member of the 1992 International Oil Pollution Compensation Fund. This implies a maximum compensation for oil spills of EUR 175 mln.

Nuclear energy

Cyprus has no nuclear power plants.

Renewables

A grant scheme for investments in energy efficiency promotion, encouraging the use of energy from renewable sources, became fully operational at the beginning of 2000 (EC, 2000f).

3.3 CZECH REPUBLIC

Solid fuels

Coal is subject to a reduced VAT rate of 5 percent (the standard rate is 22 percent).

Oil and gas

A gradual process of price liberalisation in the gas sector is underway, aiming at eliminating cross subsidies by 2002 (EC, 2000g). Transgas, the state-owned gas utility, stopped subsidising its gas prices in the Czech market in 1999 (EIA, 2001).

Natural gas is subject to a reduced VAT rate of 5 percent (the standard rate is 22 percent).

The Act on Emergency Oil Stocks, which came into force in 1999, aims at reaching the *acquis* level of 90 days of oil stocks in 2005 (EC, 2000g). It is unclear how the stocks will be financed and thus whether they are subsidised or not.

Being land-locked, the Czech Republic is not is a member of an International Oil Pollution Compensation Fund.

Nuclear energy

The controversial Temelin power plant has started operating in October 2000.

Producers of nuclear waste must bear the costs of radioactive waste management, including disposal. The operators of nuclear power plants pay a levy of CZK 50 (EUR 1.4) per MW_e into a fund (EC, 1999e).

Renewables

Biogas, small water and wind turbines (with an output up to 100 and 75 kVA, respectively), and solar facilities are subject to a reduced VAT rate of 5 percent (the standard rate is 22 percent). Furthermore, income generated from the operation of several renewable energy producing facilities are exempt from income tax in the first calendar year of their operation and in the following five years (Klarer *et al.*, 1999). The amounts of implicit subsidy involved are unknown.

Electricity

Electricity is subject to a reduced VAT rate of 5 percent (the standard rate is 22 percent).

A gradual process of price liberalisation in the electricity sector is underway, aiming at eliminating (cross) subsidies by 2002 (EC, 2000g; EIA, 2001).

3.4 ESTONIA

Oil and gas

Estonia is a member of the 1971 International Oil Pollution Compensation Fund. This implies a maximum compensation for oil spills of EUR 78 mln.

Nuclear energy

Although there are no nuclear power plants in Estonia, there is a substantial nuclear legacy from former Soviet military installations. Obviously, no subsidies for nuclear energy are involved in dealing with this legacy.

3.5 HUNGARY

Direct government subsidies to energy consumption in Hungary were terminated in 1991, but natural gas, electricity and heat prices have remained regulated. After several years of price increases, prices are now nearing cost covering levels (IEA, 1999e).

Solid fuels

Some coal mines in regions with high unemployment receive government support, partly through direct subsidies and partly through purchase contracts from the power industry, concluded under government pressure. The direct support amounted to HUF 2.5 billion (EUR 10 million) in 1998. Most of these mines were to be closed by 2000 (IEA, 1999e).

Coal use by households is exempted from VAT since 1995 (the standard VAT rate is 25 percent).

In the corporation tax, an accelerated amortisation rate of 33 percent is in force for fluidised coal-fired equipment (Klarer *et al*., 1999).

Oil and gas

Gas prices are being increased stepwise (in July 2000 by 12%), contributing to the elimination of price distortions (EC, 2000i).

Since 1995, natural gas is subject to a VAT rate of 12 percent, whereas the standard rate is 25 percent. Propane and propane-butane gas are also taxed at 12 percent. The use of light fuel oil by households is exempted from VAT.

Mineral oil used for the production of electricity is exempted from the excise tax.

Oil stocks in Hungary exceed the level of 90 days internal consumption, as required by the *acquis* (EC, 2000i), but it is unclear whether and to what extent they are being subsidised.

Land-locked Hungary is not a member of an International Oil Pollution Compensation Fund.

Nuclear energy

The work of the Hungarian Atomic Energy Authority is partly financed from the central budget (EC, 2000i). The amount of subsidy involved is unknown.

With the 1996 Nuclear Energy Act, nuclear operators were made liable for all damages they caused, and indemnities were fixed in accordance with Hungary’s obligations under the Vienna Convention in this respect. In order to comply with these requirements, the Paks Nuclear Power Plant Company and Hungarian insurers established an insurance pool with the intention of seeking re-insurance in international pools (IEA, 1999e).

The costs of decommissioning and of nuclear waste disposal are covered by a Central Nuclear Financial Fund, which was set up in January 1998. It is financed through a levy on electricity use (EC, 1999e; 2000i).

Renewables

The reduced VAT rate of 12 percent applies to solar cells, wood for heating purposes and wood briquettes. In the corporation tax, an accelerated amortisation rate of 33 percent is in force for solar cells and for boilers burning agricultural by-products. No corporate tax has to be paid for services connected to renewable energy carried out by public utility companies (Klarer *et al*., 1999).

Electricity

Electricity prices are being increased stepwise (in January 2000 by 6%), contributing to the elimination of price distortions (EC, 2000i).

Since 1995, electricity is subject to a VAT rate of 12 percent, whereas the standard rate is 25 percent.

3.6 LATVIA

Oil and gas

Fuel oil for heat production and oil products used in technological and refining processes are exempt from the excise tax on oil products, which was introduced in 1998 (Klarer *et al*., 1999).

In February 2000, a strategy document on the establishment of oil stocks was adopted, confirming that energy supply companies would become responsible for the establishment and maintenance of oil stocks (EC, 2000j). The oil stocks are thus likely to remain unsubsidised.

Latvia is a member of the 1992 International Oil Pollution Compensation Fund. This implies a maximum compensation for oil spills of EUR 175 mln.

Nuclear energy

There are no nuclear plants in Latvia, nor are there plans to build any.

Renewables

Surplus electricity from small hydro power stations (with a capacity up to 2 MW) and wind farms has to be purchased on the national grid at higher tariffs (Klarer *et al*., 1999). The amount of subsidy involved is unknown.

3.7 LITHUANIA

Solid fuels

Lithuania does not produce coal, and the small amounts of coal that it imports are not subsidised.

Under the natural resource tax, peat for domestic use is taxed at LTL 1.1 per tonne, whereas the tax for exported peat is LTL 5.1 per tonne (Klarer *et al*., 1999).

Oil and gas

In 1999, the Mazeikiu Oil Company (one of the largest enterprises in Lithuania) was sold to a private foreign investor. The deal involved a large public cost (the government promised to cover USD 350 mln of capital deficit), leading to the fall of the government. Furthermore, in October 2000 the Constitutional Court ruled that the promise by the government to cover the debt was illegal (EC, 2000k; EIA, 2001).

On 27 June 2001, Lithuania will become a member of the 1992 International Oil Pollution Compensation Fund. This implies a maximum compensation for oil spills of EUR 175 mln.

Nuclear energy

The Ignalina nuclear power plant (the world's largest) will be decommissioned, starting with Unit 1 in 2005. A Decommissioning Support Fund (of about EUR 195 million, mainly from international financing sources) was established in June 2000 and is managed by the EBRD. Unit 2 is subject to a EUR 10 mln modernisation project, guaranteed by the government (EC, 2000k).

A new fund for radioactive waste management will be partly financed by the state budget (EC, 1999e).

3.8 MALTA

Solid fuels

There is no market for solid fuels in Malta.

Oil and gas

Malta does not yet have legislation on minimum oil stocks compatible with the *acquis* (EC, 2000l). It can be assumed that subsidies for such stocks are also absent.

There is no market for natural gas in Malta.

Malta is a member of the 1992 International Oil Pollution Compensation Fund. This implies a maximum compensation for oil spills of EUR 175 mln.

Nuclear energy

Malta has no nuclear power plants.

3.9 POLAND

Solid fuels

The Polish coal mining industry has huge debts (over EUR 5 billion) and is currently in a process of restructuring. In total, 30 of Poland's 53 mines will be closed by the end of the restructuring programme. Government assistance to the industry led the United Kingdom to charge Poland with "dumping" its coal on world markets in violation of World Trade Organization rules, but the British coal producers withdrew their complaint in 2000. In February 2000, the average price of one tonne of coal was for the first time above production costs (EC, 2000m; EIA, 2001).

Oil and gas

Oil stocks in Poland fall considerably short of the *acquis* requirement of 90 days of national consumption. A schedule of increasing oil security stocks that meet EC requirements has been developed (EC, 2000m). Information on the financing of these stocks is lacking, so it is unclear whether subsidies are involved.

Poland is a member of the 1992 International Oil Pollution Compensation Fund. This implies a maximum compensation for oil spills of EUR 175 mln.

Nuclear energy

Poland has no nuclear power plants and does not intend to build any.

Renewables

Income tax allowances are extended to farmers who invest in renewable energy sources (Klarer *et al*., 1999). The amount of subsidy involved is unknown.

3.10 ROMANIA

State subsidies on goods and services (including those for the mining industry) were expected to be totally eliminated by the year 2000 (Klarer *et al*., 1999).

Solid fuels

In recent years, after years of subsidising the coal mining industry, the government has been shutting down unprofitable state-owned companies (EIA, 2001).

Household use of coal is exempted from VAT (Klarer *et al*., 1999). The current standard VAT rate is 19%.

Oil and gas

Household use of oil and gas is exempted from VAT (Klarer *et al*., 1999). The current VAT rate is 19%.

Furthermore, fuels used for household consumption are exempted from the excise tax on mineral oil products.

Cross subsidies between industrial and domestic use of gas have been completely removed (EC, 2000n).

Romania is not a member of an International Oil Pollution Compensation Fund.

Nuclear energy

Romania's only nuclear power plant, at Cernavoda, has started operations in 1996 with the activation of the first reactor. The second reactor is 40% complete, but financing remains a problem. In an effort to complete work on the reactor, the Romanian government has granted the plant profit tax-exempt status until 2010 and has suspended its debts to the Finance Ministry until the plant is commissioned at the end of 2006. Investments and credits are expected from foreign investors and from Euratom (EIA, 2001).

A law for the establishment of a fund for the management of radioactive waste and decommissioning has been drafted (EC, 1999e).

Electricity

Household use of electricity is exempted from VAT (Klarer *et al*., 1999). The current VAT rate is 19%.

Cross subsidies between industrial and domestic use of electricity have been completely removed (EC, 2000n).

3.11 SLOVAKIA

Solid fuels

From 1990 to 1996, state support for the lignite mining sector declined from EUR 54 million to EUR 4.3 million. Indirect subsidies, by way of obligatory lignite purchases by power plants, were estimated to amount to EUR 14 million in 1996 (IEA, 1997c).

Klarer *et al*. (1999) state that the use of solid fuel is still subsidised in Slovakia, but do not give any details.

Oil and gas

In February 2000 the Slovak government approved an increase of gas prices. This measure was taken in the context of an overall policy to ensure cost recovery by energy producers (EC, 2000o). Cross-subsidies (especially from industry households) were considerable in the 1990s. There was also evidence that gas prices for domestic customers (industry, households and other groups) were subsidised by the highly profitable transit business (IEA, 1997c).

Land-locked Slovakia is not a member of an International Oil Pollution Compensation Fund.

Nuclear energy

Production costs of electricity from Slovak nuclear power plants are lower than in Western Europe, due to, among others, asset values that are based on low historic costs (IEA, 1997c).

A fund for the decommissioning of nuclear power stations and the management of radioactive waste is funded by a 10 percent surcharge on the sales price of electricity generated by nuclear power plants. It is estimated that this fund will yield some SKK 30.8 billion (EUR 723 million) by 2010. According to the government this sum will be sufficient (Klarer *et al*., 1999). If that is correct, nuclear energy is not being subsidised in Slovakia by way of insufficient decommissioning and waste management cost coverage.

In April 2000, the government made clear that no state guarantees or any form of state aid will be provided for the completion and operation of units 3 and 4 at the Mochovce nuclear power plant (EC, 2000o).

Renewables

Biogas, fire wood and wood chips are subject to the reduced VAT rate of 6 percent (the normal rate is 23 percent). Operations of small hydropower plants, wind electricity generation, solar equipment, biogas generating equipment and geothermal production facilities are excluded from income tax for the first five years of operation (Klarer *et al*., 1999).

Domestically produced ‘ecological fuel’ is subject to a preferential excise duty rate (EC, 2000o).

Electricity

In February 2000 the Slovak government approved an increase of electricity prices (an average of 40% for households and 5% for businesses). As with gas prices, this measure was taken in the context of an overall policy to ensure cost recovery by energy producers (EC, 2000o). There used to be considerable cross-subsidisation, especially from industry to households (IEA, 1997c).

3.12 SLOVENIA

Solid fuels

Direct budget subsidies for the coal industry were expected to end in 1996 (IEA, 1996b). Nevertheless, state aid to the coal mining sector has grown in recent years, although in 1999 such aid was solely devoted to the closing down of mines and entailed no operating aid (EC, 2000p).

Until 2004, coal for electricity generation will be exempted from the CO_2 tax, which was introduced in 1997. The rate of the tax is SIT 1.00 per kg CO_2 (Klarer *et al*., 1999).

Oil and gas

A recent decree foresees the collection of a special fee on petroleum products aimed at financing the creation of obligatory oil stocks (EC, 2000p). This would mean that no subsidies will be involved.

Slovenia produces small amounts of oil (2,000 toe per year), which remain untaxed (IEA, 1996b).

Slovenia is currently a member of the 1971 International Oil Pollution Compensation Fund, but will move to the 1992 Fund on 19 July 2001. This implies an increase of the maximum compensation for oil spills from EUR 78 mln to EUR 175 mln.

Nuclear energy

The Krško nuclear power plant (which is owned jointly by Slovenia and Croatia) has to pay a levy of SIT 0.61 for every kWh of electricity that it supplies to the Slovenian or Croatian power grid. The recipient of this charge is a fund which is to finance the decommissioning of the plant and the disposal of nuclear waste (Klarer *et al*., 1999). To what extent this funding will be sufficient is unclear. Therefore it is not possible to judge whether and to what extent nuclear energy is being subsidised in Slovenia by way of insufficient decommissioning and waste management cost coverage.

Renewables

From 1990 to 1995, the Slovenian government has provided interest subsidies and grants for renewable energy totalling EUR 8.1 million for 211 projects, mostly small hydro plants (IEA, 1996b).

3.13 TURKEY

Solid fuels

Subsidies to coal production in Turkey amounted to EUR 267 mln in 1995, according to the PSE estimate by the IEA (IEA, 1997a).

In the period 1996-1998, the Turkish government increased its budget for coal related R&D from EUR 0.1 mln to EUR 7.1 mln (IEA, 1999f).

Oil and gas

Natural gas is subject to a VAT rate of 8%, while the standard rate is 15%.

To ensure the penetration of natural gas into the market, natural gas prices are mostly set below the level of competing fuels. In some sectors such as residential, the price of natural gas is too low to reflect the full cost of supply (IEA, 1997a).

Oil stocks amounted to 87-90 days of consumption in 1998. The Directorate General for Petroleum Affairs is responsible for monitoring and controlling these stocks (EC, 2000q). It is unknown whether and to what extent subsidies are involved.

To enhance domestic oil exploration and production, the government was planning (in 1997) to adapt the royalty taxes, which amounted to 12.5% of production in 1996. The new royalty should decrease proportionally with the production and should be lower for smaller fields (IEA, 1997a).

Turkey is not a member of an International Oil Pollution Compensation Fund.

Nuclear energy

There are currently no nuclear power plants in Turkey, and plans to build one have been abandoned in July 2000.

In 1997, the budget of the Turkish Atomic Energy Authority (in charge of nuclear R&D, regulatory issues and control of all nuclear activities) was TRL 1,600 billion (EUR 2.9 million) (IEA, 1997a).

Renewables

The Ministry of Environment promotes the development of geothermal heat and other environmentally-friendly investments via low-interest loans on up to 45% of the capital cost.

Independent electricity producers, including those using renewable energy sources, are given a power purchase guarantee by the Turkish Electricity Generation and Transmission Corporation.

Total expenditure of renewable energy R&D for 1996 was reported to the IEA as EUR 0.15 mln (IEA, 1998a).

Electricity

The selling prices of electricity are too low for the power suppliers to be able to make the necessary investments (IEA, 1997a).

4. CONCLUSIONS

Lacking an internationally agreed definition of the term ‘subsidy’, identifying and quantifying energy subsidies is a delicate operation. A study like this one has to draw certain demarcation lines and unavoidably arbitrary choices have to be made when deciding to label certain arrangements as energy subsidies or not. The problem is that the outcome, especially in quantitative terms, is very dependent upon such choices.

Having said this, it can be concluded that energy subsidies in the European Union and the accession countries are numerous and involve substantial amounts of money. For the EU and its Member States, Table 4.1 indicates the estimated amounts of money transfers and tax reliefs that are benefiting the different types of energy, to the extent that they could be quantified. It can be concluded that the total amount of quantifiable subsidy (in terms of money transfers and tax reliefs) going to renewable energy is substantially lower than the amount of subsidy to fossil fuels, and in the same order of magnitude as nuclear energy subsidies.

A major part of the identified subsidies relates to tax exemptions and reductions. There are two major groups: those which have been introduced for social reasons (usually reduced VAT rates for households) and those intended to protect industry against the loss of international competitiveness. The latter are often accompanying the introduction of specific energy and/or CO_2 taxes. Renewable energy is subsidised directly as well as by means of various fiscal arrangements. R&D subsidies play a particularly important role in the case of nuclear energy.

Direct subsidies to coal production are declining throughout Europe, although the German coal subsidies remain one of the largest single subsidy items. The subsidies to oil, gas and electricity tend to increase as more countries are introducing energy tax schemes with provisions for exemptions and reductions. Support for renewables is also increasing, whereas subsidies to nuclear energy do not show a clear trend.

In the accession countries, especially the former centrally planned economies, subsidies are generally decreasing. In particular, cross subsidies from industry to households are gradually being phased out.

In addition to these direct and indirect subsidies, there are three important factors favouring certain types of energy over others. Firstly, energy producers and users often do not pay for the (full) external costs and damage (such as pollution, accidents and risks). In some cases (oil spills, nuclear accidents), international conventions provide for limited liability of the perpetrators. Secondly, ‘traditional’ energy continues to benefit from support that it has received in the past, e.g. in the form of below-commercial rates of return on investments. Finally, legal arrangements provide for preferential treatment of specific types of energy (especially renewables). Although these kinds of support are much harder to translate into money terms, some attempts to do so have been made in Sections 1.2 through 1.4. A comparison with the amounts involved in money transfers and tax reliefs is given in Table 4.2. This shows that the bias in favour of ‘traditional’ sources of energy is even stronger if these factors are taken into account.

A more precise and reliable estimate of the bias against renewable energy might be achieved by means of a study to answer the question: “If energy producers and users were fully liable for the damage and risks caused by their activities, and if this liability had to be (and could be) covered by insurance, how much would the insurance premium be?”.

Table 4.1. Amounts of energy subsidies in EU and Member States (millions of Euros per year) (money transfers and tax reliefs)

	solid fuels	oil and gas	nuclear	renewables
EU	60	260	380	180
Austria	> 15	> 95	2	> 150
Belgium	8	1	> 40	5
Denmark	600	1,000	2	> 180
Finland	> 25	30	45	240
France	500	> 30	> 600	> 300
Germany	9,500	1,000	> 700	> 300
Greece	> 1	> 250	< 1	> 35
Ireland	40	> 50	-	> 10
Italy	> 75	> 1,500	100	> 300
Luxembourg	-	> 7	-	> 10
The Netherlands	> 250	> 4,500	65	> 250
Portugal	40	45	< 1	70
Spain	765	> 5	150	> 50
Sweden	70	180	90	> 130
United Kingdom	650	> 1,900	450	250
EU + Member States	**> 12,000**	**> 10,000**	**> 2,600**	**> 2,400**

Note: Subsidies for electricity have been attributed to primary energy sources using shares in electricity production as weights.

Table 4.2. Tentative estimates of subsidies and other kinds of support in the EU (mln EUR per year)

	fossil fuels	nuclear	renewables
money transfers and tax reliefs	> 22,000	> 2,600	> 2,400
uninternalised external costs	± 50,000	> 700 – > 20,000	± 600
inheritance of past subsidies	PM	± 8,500	PM
preferential treatment			± 1,000
total	**> 70,000**	**> 10,000**	**> 4,000**

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APPENDIX: ABBREVIATIONS

ADEME	Agence de l'Environnement et de la Maîtrise de l'Energie
ATS	Austrian Schilling
BEF	Belgian Franc/Frank
CEA	Commissariat à l'énergie atomique
CHP	combined heat and power
CO_2	carbon dioxide
DEM	German Mark
DKK	Danish Krone
EC	European Community
EDF	Electricité de France
ERDF	European Regional Development Fund
ETBE	ethyl tertiary butyl ether
ESP	Spanish Peseta
EU	European Union
EUR	Euro
FACE	Fonds d'Amortissement des Charges d'Electrification
FIM	Finnish Markka
FRF	French Franc
GBP	British Pound
GJ	GigaJoule (10^9 Joule)
GRD	Greek Drachme
GW	Gigawatt (10^6 kilowatt)
GWh	Gigawatt hour
IEA	International Energy Agency
IEP	Irish Pound
IOPC Funds	International Oil Pollution Compensation Funds
ITL	Italian Lira
kW	kilowatt
kWh	kilowatt hour
Mtoe	megatonne oil equivalent
MW	Megawatt (1000 kW)
MWh	Megawatt hour
NFFO	Non Fossil Fuel Obligation
NLG	Dutch Gulden
PJ	Petajoule (10^{15} Joule)
PSE	producer subsidy equivalent
PTE	Portuguese Escudo
PV	photo-voltaic (electricity from sunlight)
R&D	Research and Development
RME	rapeseed methyl ester
SDR	Special Drawing Right
SEK	Swedish Krone
TJ	Terajoule (10^{12} Joule)
toe	tonne oil equivalent
TW	Terawatt (10^9 kW)
TWh	Terawatt hour
VAT	value added tax