



INTERNATIONAL ENERGY AGENCY

# Energy Policies of IEA Countries

## LUXEMBOURG 2000 REVIEW

Energy  
Policies  
of IEA  
Countries

**LUXEMBOURG  
2000 REVIEW**

## INTERNATIONAL ENERGY AGENCY

9, rue de la Fédération,  
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The International Energy Agency (IEA) is an autonomous body which was established in November 1974 within the framework of the Organisation for Economic Co-operation and Development (OECD) to implement an international energy programme.

It carries out a comprehensive programme of energy co-operation among twenty-four\* of the OECD's twenty-nine Member countries. The basic aims of the IEA are:

- To maintain and improve systems for coping with oil supply disruptions;
- To promote rational energy policies in a global context through co-operative relations with non-member countries, industry and international organisations;
- To operate a permanent information system on the international oil market;
- To improve the world's energy supply and demand structure by developing alternative energy sources and increasing the efficiency of energy use;
- To assist in the integration of environmental and energy policies.

*\* IEA Member countries: Australia, Austria, Belgium, Canada, Denmark, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Japan, Luxembourg, the Netherlands, New Zealand, Norway, Portugal, Spain, Sweden, Switzerland, Turkey, the United Kingdom, the United States. The European Commission also takes part in the work of the IEA.*

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- To contribute to sound economic expansion in Member as well as non-member countries in the process of economic development; and
- To contribute to the expansion of world trade on a multilateral, non-discriminatory basis in accordance with international obligations.

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# INTRODUCTION

An IEA review team visited Luxembourg in January 2000 to review the country's energy policies. This report was drafted on the basis of information received during and prior to the visit, including views expressed by various parties during the visit.

The team greatly appreciated the co-operation and the openness demonstrated by the participants during this policy review process.

Members of the team were:

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**Mr. Pierre-Marie Cussagnet** (IEA Secretariat)

Pierre-Marie Cussagnet managed the review and drafted the report, in consultation with the team. Monica Petit prepared the figures. Bertrand Sadin prepared the maps.

The team held discussions with representatives from the following organisations:

- Ministry of Economic Affairs, Department of Energy;
- Ministry of Environment;
- Agence de l'Énergie;
- Compagnie Grand-Ducale de l'Électricité (CEGEDEL);
- Société de Transport de l'Électricité (SOTEL) and representatives from distribution companies;
- Société Électrique de l'Our (SEO);



- TWINerg;
- Société de Transport de Gaz (SOTEG);
- ARBED;
- Fédération des Industriels Luxembourgeois (FEDIL);
- Groupement Pétrolier Luxembourgeois.

# SUMMARY AND RECOMMENDATIONS

## SUMMARY

---

Luxembourg is the smallest IEA country, but its population of 430,000 inhabitants in 1998 is the richest of all IEA countries. Energy consumption per inhabitant is high because of the country's iron and steel industry, the large sales of transport fuel and the overall wealth of the country. Domestic energy resources are limited to renewable energies. Therefore, Luxembourg has the highest dependence on imported energy (more than 99% of total energy in 1998) of all IEA countries. Also, because of its small size and lack of indigenous sources, Luxembourg's energy market is greatly influenced by the energy policies and energy markets in surrounding countries.

Since the last in-depth review, progress has been achieved in Luxembourg's energy policies. The government rightly regards market liberalisation in the whole of Europe as an opportunity for enterprises and domestic consumers in Luxembourg, as it will allow them to benefit from reduced energy prices.

Although decreasing, state and municipal ownership in energy companies remains significant in Luxembourg. According to the government, there is no interference in companies' strategic decisions. Some municipalities are directly engaged in electricity and natural gas distribution activities. To ensure that all companies compete on a level playing field, as a first step, these activities should be separated from municipal/communal administration.

Energy taxes are low in Luxembourg, particularly on automotive fuels. Low automotive fuel prices have induced foreign drivers to refuel in Luxembourg. Better internalisation of the full cost of using energy would reduce this market distortion. It is therefore welcome that the government plans to introduce an energy tax.

95% of the electricity consumed in Luxembourg is imported. However, the commissioning of a combined cycle gas turbine in 2001 will reduce electricity imports. In May 2000, Parliament voted a law to implement the European Directive on the Internal Electricity Market. Owing to the small size of Luxembourg, eligible consumers will have a large choice among suppliers in and outside the country. Therefore, the proper functioning of competition will also depend on regulations outside the country, e.g. for use of the grid.

Electricity generation from renewable energy and co-generation has expanded rapidly because of the generous buy-back tariffs and direct subsidies. The government should ensure that support for renewable energy does not put too heavy a burden on electricity consumers. This could be achieved by improving the cost-effectiveness of support schemes. The best way to ensure that energy production from renewable forms of energy is sustainable in the long term is to ensure that their cost decreases to a level which makes them competitive. The

government should also consider phasing out subsidies for co-generation, as this technology is now mature.

Luxembourg is totally dependent on natural gas imports, which have increased rapidly. However, imports have been diversified, increasing Luxembourg's security of energy supply. The gas pipeline being built from Germany, in particular, will further diversify supplies. Luxembourg expects to pass a law implementing the European Directive on the Internal Natural Gas Market before the end of 2000. Large consumers are expected to benefit from this liberalisation.

Luxembourg is totally dependent on oil products imports. Its oil sector is strictly retail. The government sets price ceilings on the most important oil products to avoid inflation. This system may also prevent abuses of dominant position if competition does not work properly. Since effective competition encourages companies to decrease costs of supply, allowing them to reduce sale prices, the government should rely on market forces to keep oil product prices low.

Energy efficiency policy in Luxembourg received a welcome boost in 1993, when a new framework law on energy efficiency was adopted. Several Grand Ducal regulations (decrees) have been issued to implement this law and the government needs to start assessing their cost-effectiveness. Implementation of the energy tax will also encourage energy savings.

The restructuring of the iron and steel industry led to a sharp reduction in CO<sub>2</sub> emissions and other pollutant emissions in Luxembourg. However, after the end of this restructuring process, CO<sub>2</sub> emissions are expected to increase. Therefore, the Kyoto target of a 28% reduction in greenhouse gas (GHG) emissions will be difficult to reach. The 1998 National Plan, which rightly recommends adopting a programme to meet this target, needs to be implemented with effective measures.

The *Agence de l'Énergie* has done valuable work in advising municipalities on energy efficiency and renewable energy and through studies on the feasibility of projects. Its activity should therefore be encouraged.

## RECOMMENDATIONS

The Government of Luxembourg should:

### Energy Policy and Market Trends

- ☐ Continue to introduce competition in the gas and electricity sectors. Set up a regulatory body with responsibility for both electricity and gas.

- ☐ Ensure that entities with government or municipal shareholding are free in their strategic decision-making and daily management to allow them to compete on a level playing field.
- ☐ Continue to work towards close and effective co-operation among all the ministries involved in energy policy.
- ☐ Continue to co-operate with neighbouring countries on energy issues, e.g. electricity and natural gas liberalisation and inter-state transport.
- ☐ Address automotive tax distortion by implementing the proposed measure in the National Plan for Sustainable Development to levy an energy tax to better reflect the cost of energy use.

## Energy Efficiency and Environment Policy

- ☐ Assess the cost-benefits of support for energy efficiency measures. In particular, the government should put in place a framework to measure the outcome of the programme to improve energy efficiency in existing buildings.
- ☐ Encourage the *Fédération des Industriels Luxembourgeois* (FEDIL) to continue the voluntary agreement with industry and to extend the agreement to other economic sectors and improve the monitoring system.
- ☐ Develop and implement a comprehensive climate change mitigation plan with concrete measures in order to start getting current GHG levels on track towards meeting Kyoto commitments.
- ☐ Continue to seek solutions at a regional level, i.e. with neighbouring countries, to reduce energy consumption in the transport sector.

## Oil

- ☐ Address automotive fuel tax distortion by better internalising the external cost of using oil products in taxes.
- ☐ Remove price ceilings on gasoline, diesel, heating oil and liquefied petroleum gas (LPG) and ensure that competition authorities have enough power to track down those guilty of anti-competitive practices.

## Natural Gas

- ☐ Implement competition in the gas market as soon as possible.
- ☐ Maintain an arm's-length relationship with companies having public ownership.

- ☐ When introducing competition, corporatise the small municipal entities and require the separation of accounts for all activities of gas suppliers.
- ☐ Set up a regulator with adequate powers, duties and resources to supervise and control the prices charged to final consumers and to deal with customers' complaints.
- ☐ Co-operate with neighbouring countries for the introduction of effective competition in the natural gas sector at regional level.

## Electricity and Renewable Energy

### Electricity

- ☐ Maintain an arm's-length relationship with the companies having state ownership in the electricity sector so that they have the same freedom to operate in the market as any other businesses.
- ☐ Corporatise the small municipal entities and require the separation of accounts for all their activities.
- ☐ Co-operate with neighbouring countries for the introduction of effective competition in the electricity sector at regional level.
- ☐ Ensure that the regulator is given adequate powers, duties and resources to supervise and control the prices charged to final consumers, to deal with customers' complaints and to ensure that there is no discrimination between the users of the grid.
- ☐ Encourage companies to explore further the cost-benefits of closer co-operation between the two grids.

### Renewable Sources of Energy

- ☐ Ensure that the measures used to promote renewable energies put downward pressure on their costs by introducing competition among them and ensure that these measures do not put too heavy a burden on final consumers.
- ☐ Encourage the activities of the *Agence de l'Énergie*, i.e. carrying out studies on renewable sources and energy efficiency and advising municipalities.

### Co-generation

- ☐ Consider phasing out subsidies to co-generation, as this is a mature technology.
- ☐ Give adequate powers to a competent body to supervise and control heating prices.

# ENERGY POLICY AND MARKET TRENDS

## BACKGROUND

---

Luxembourg is the smallest IEA country. In 1998, its population was around 430,000, for a total surface area of 2,586 km<sup>2</sup>. The maximum distance between the North and the South is 82 km and the maximum distance between the West and the East is 57 km. Agricultural and wooded areas account for 89.1% of the land, built-up areas 7%, roads, railways and watercourses 3.9%. The country is divided into three districts and 12 cantons (Figure 1).

GDP increased more than 5.5% per year between 1990 and 1998. It increased 5% in 1998 to US\$ 18.3 billion<sup>1</sup>, i.e. US\$ 42,500 per capita. At current exchange rates and in Purchasing Power Parity (PPP), GDP per capita was the highest of all OECD countries. Provisional data indicate a 5.5% increase in GDP in 1999.

## ENERGY TRENDS

---

### Energy Supply and Demand

Total Primary Energy Supply in 1998 was 3.3 Mtoe, 27% below the level of 1973 (4.5 Mtoe) (Figure 2). The reduction was caused by the restructuring of the iron and steel industry, whose production declined from its maximum level of 6.4 Mt in 1974 to 2.5 Mt in 1998. Owing to this reduction in production and to energy efficiency gains, energy consumption by the iron and steel industry dropped from 1.8 Mtoe (equivalent to 86% of energy use in industry) in 1974 to 0.43 Mtoe (48%) in 1997. In addition, between 1993 and 1997, ARBED (see box) replaced its three blast furnaces with electric arc furnaces<sup>2</sup> and ceased using coal.

The blast furnaces were producing gas which was used directly by industry and to generate electricity. Gas from blast furnaces amounted to 0.7 Mtoe in 1974 and disappeared in 1998 after electric arc furnaces replaced all blast furnaces (Figure 3). As a consequence, electricity generation decreased and electricity consumption replaced gas from blast furnaces in industry.

Overall energy consumption in the industrial sector decreased 40% (Figure 4) from its maximum in 1978 (2 Mtoe) to 1983 (1.2 Mtoe), and 30.8% from 1993 (1.3 Mtoe) to 1998 (0.9 Mtoe).

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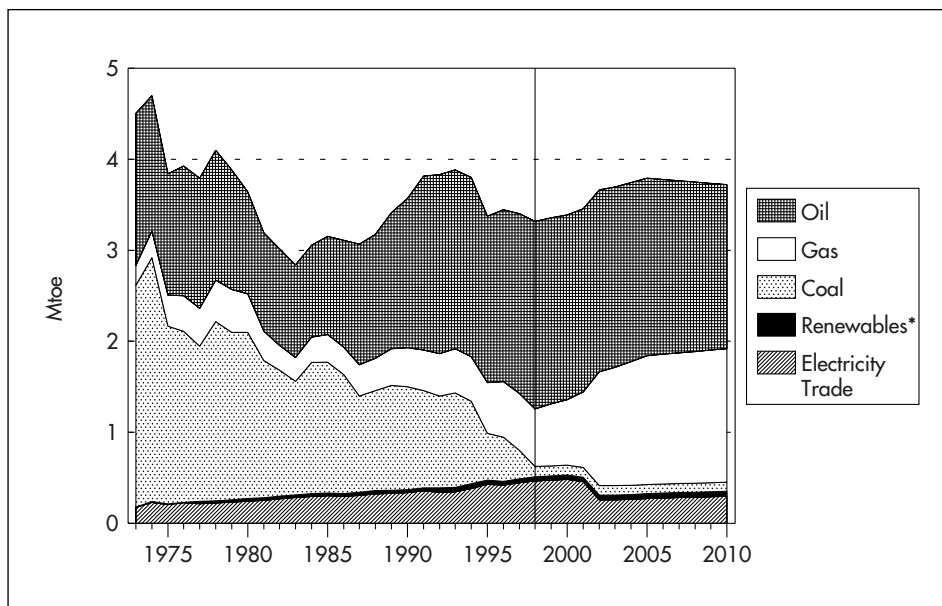
1. In 1999 LUF 1 = US\$ 0.027; LUF 1 = € 0.0248.

2. 1993: Schifange (furnace of ARES), 1994: Differdange (furnace of ProfilARBED); 1997: Esch-Beval (furnace of ProfilARBED).

*Figure 1*  
**Map of Luxembourg**



*Figure 2*  
**Energy Supply by Fuel, 1973-2010**



\* includes hydro.

Note: Government's forecasts (see Annex A). IEA estimates between 1998 and 2004.

Sources: *Energy Balances of OECD Countries*, IEA/OECD Paris, 1999, and country submission.

## ARBED Group

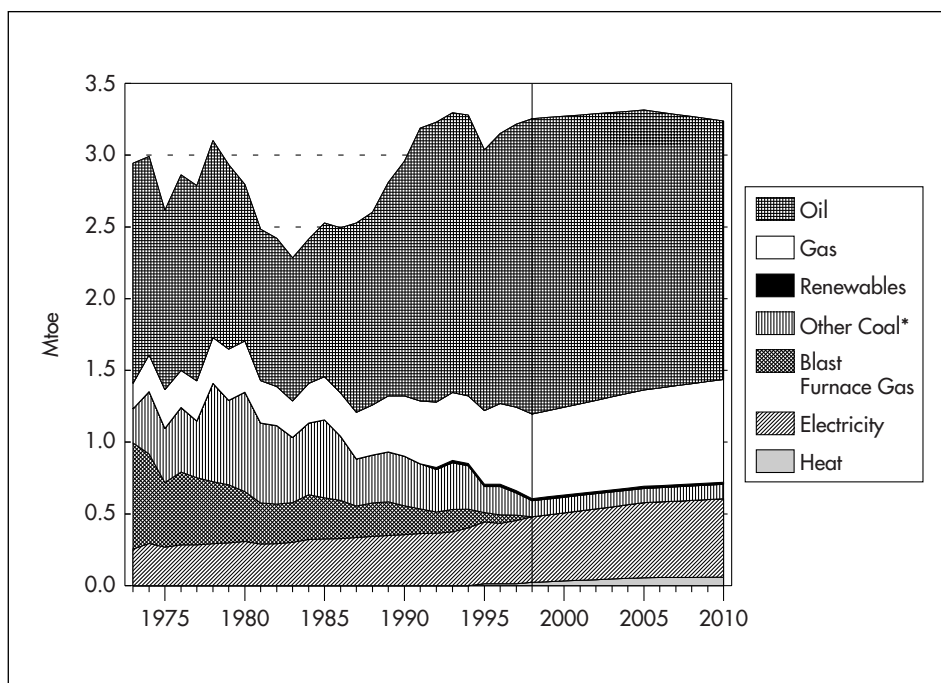
ARBED S.A. is one of Europe's leading steel producers, with its historical roots and headquarters in Luxembourg. Although decreasing, its production accounted for around one-third of the country's industrial output in 1998 and more than 13% of final energy consumption in 1997. The company generated a profit of LUF 1.36 billion in 1998. It contributed around 10% of Luxembourg's GDP. In 1999, the workforce amounted to 9,000 persons.

At the end of 1999, the state had a 29.69% share in ARBED, followed by Aceralia 9.38%; the Société Générale Group 9.35%; the Banque Générale du Luxembourg 4.35% and others 47.23%.

ARBED is an international company. The ARBED Group comprised 301 companies in 1998. It is the seventh largest steel company in the world and the third largest in Europe. It manufactures, transforms and distributes long steel products, flat steels, stainless steel products and wire drawn products. Its annual production of crude steel worldwide is more than 20 million tonnes.



*Figure 3*  
**Total Final Consumption by Fuel, 1973-2010**



\* includes hard coal, coke oven coke and lignite briquettes (BKB).

Sources: *Energy Balances of OECD Countries*, IEA/OECD Paris, 1999, and country submission.

Natural gas supply multiplied threefold during the same period from 0.2 Mtoe to 0.6 Mtoe, replacing oil in industry and in the residential/commercial sector. Oil supply increased 23.5% from 1.7 Mtoe in 1973 to 2.1 Mtoe in 1998. Oil consumption increased rapidly in the transport sector, from 0.3 Mtoe in 1973 to 1.6 Mtoe in 1998 (Figure 5). Four major trends can be discerned:

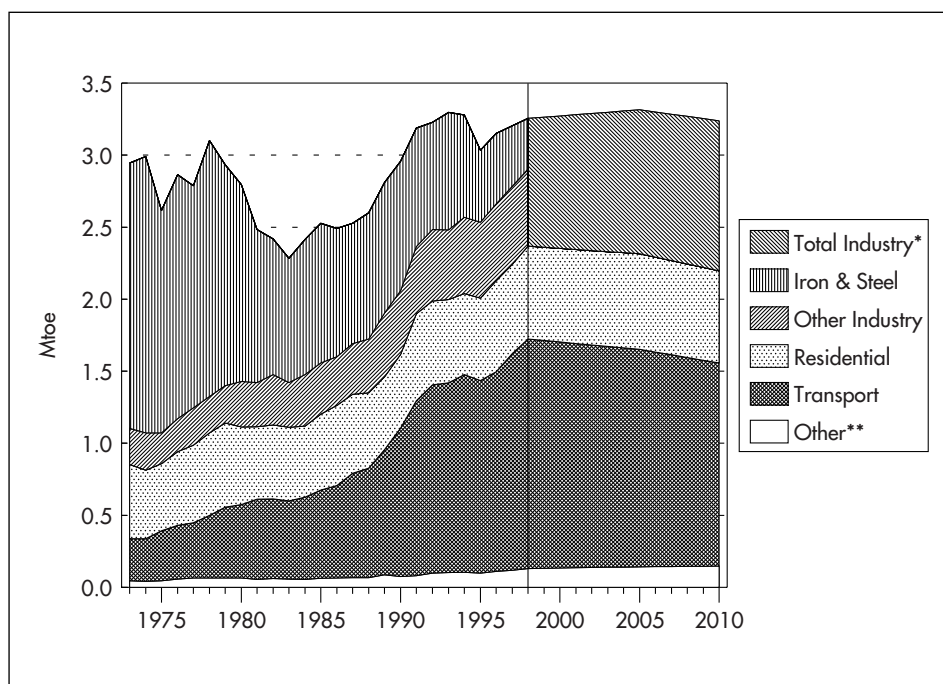
- Because of the tax differential on gasoline, automotive diesel and LPG (in the latter case the quantities involved are much smaller) between Luxembourg and its neighbours, Belgium, France and Germany (see below the section on taxation), a large number of drivers refuel in Luxembourg. The Ministry of Environment estimates that more than two-thirds of automotive fuels sold in Luxembourg are consumed outside the country (see Chapter 4).
- Around 280,000 vehicles per day cross the border (around 390,000 persons) and 9,500 persons by train. These include trips made by non-resident workers employed in Luxembourg. Non-resident workers were estimated to number 70,800 in 1998 (37,400 from France, 20,400 from Belgium and 13,000 from Germany). Rail freight has also developed rapidly. In 1997, rail freight amounted to 0.6 billion tonnes-km, road freight 0.4 billion tonnes-km for inland traffic and

3.1 billion tonnes-km for international traffic. Water freight was 0.3 billion tonnes-km. Only 3% of the trips by car and 10% of the trips by train are for transit.

- Car ownership in Luxembourg has increased rapidly and in 1998 amounted to 58 per 100 inhabitants compared with an average of 45 per 100 in the European Union (Table 1).
- Luxembourg's airport is used by the region of "Palatinat-Sarre-Lorraine-Luxembourg-Province du Luxembourg Belge" and therefore aviation fuel consumption is not representative of Luxembourg's needs alone.

Energy consumption in the residential sector and in the other sectors (which include the commercial, public service and agricultural sectors) increased as a result of the growth in the number and wealth of households and the growth of tertiary activities. In these sectors, natural gas and electricity have increased their share at the expense of coal and oil. Heat consumption has developed since 1995, due to the government's policy (see Chapter 4).

*Figure 4*  
**Total Final Consumption by Sector, 1973-2010**

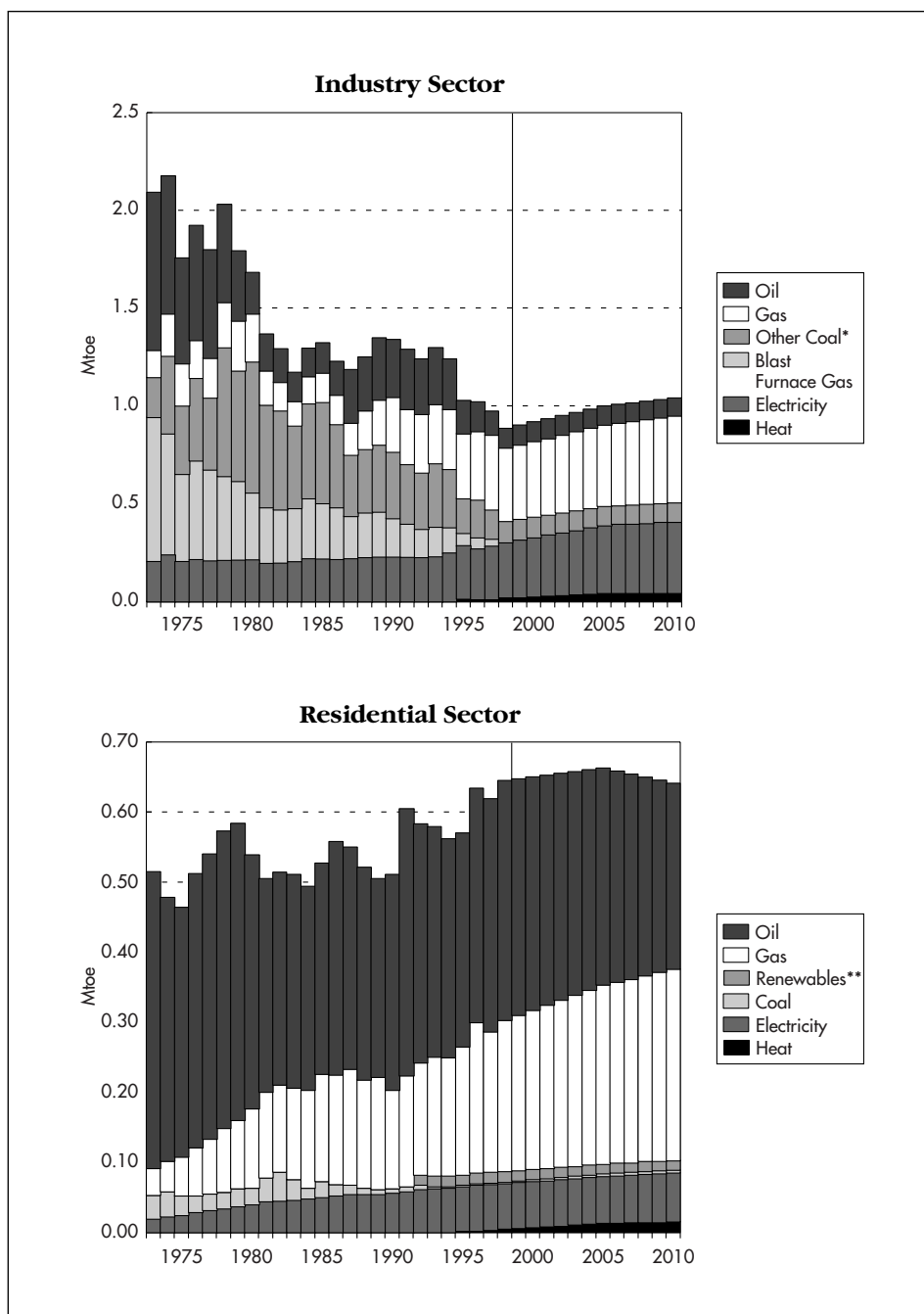


\* only Total Industry is available in the forecasts.

\*\* includes commercial, public service and agricultural sectors.

Sources: *Energy Balances of OECD Countries*, IEA/OECD Paris, 1999, and country submission.

*Figure 5*  
**Total Final Consumption by Sector and by Fuel, 1973-2010**

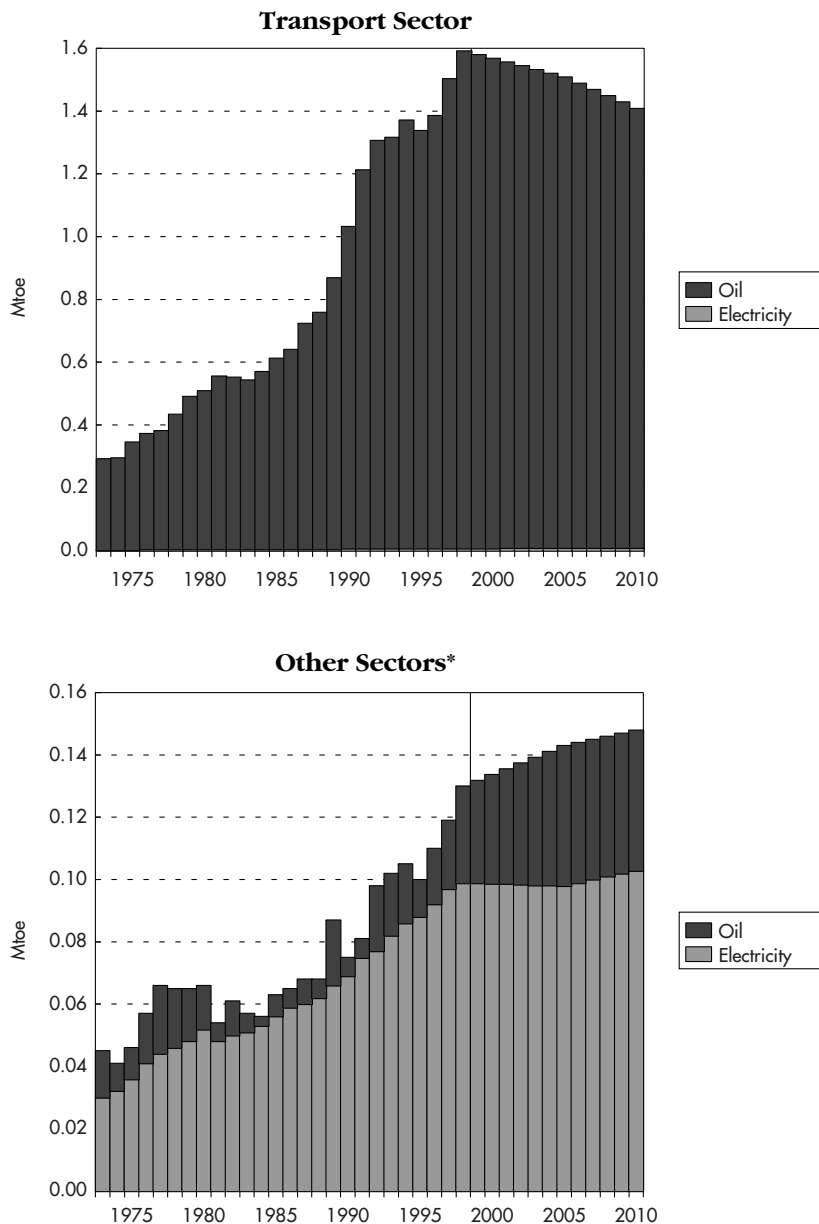


\* includes hard coal, coke oven coke and lignite briquettes.

\*\* data available as from 1992.

Sources: *Energy Balances of OECD Countries*, IEA/OECD Paris, 1999, and country submission.

*Figure 5 (continued)*  
**Total Final Consumption by Sector and by Fuel, 1973-2010**



\* Includes commercial, public service and agricultural sectors.

Sources: *Energy Balances of OECD Countries*, IEA/OECD Paris, 1999, and country submission

*Table 1*  
**Number of Registered Vehicles in Luxembourg, 1970-1998**

	<i>Heavy Trucks</i>	<i>Private and Commercial cars</i>	<i>Others*</i>	<i>Total</i>
1970	3,746	84,816	25,173	113,735
1980	3,991	128,610	23,284	155,885
1990	4,948	183,405	30,940	219,293
1998	4,378	244,129	46,682	295,189

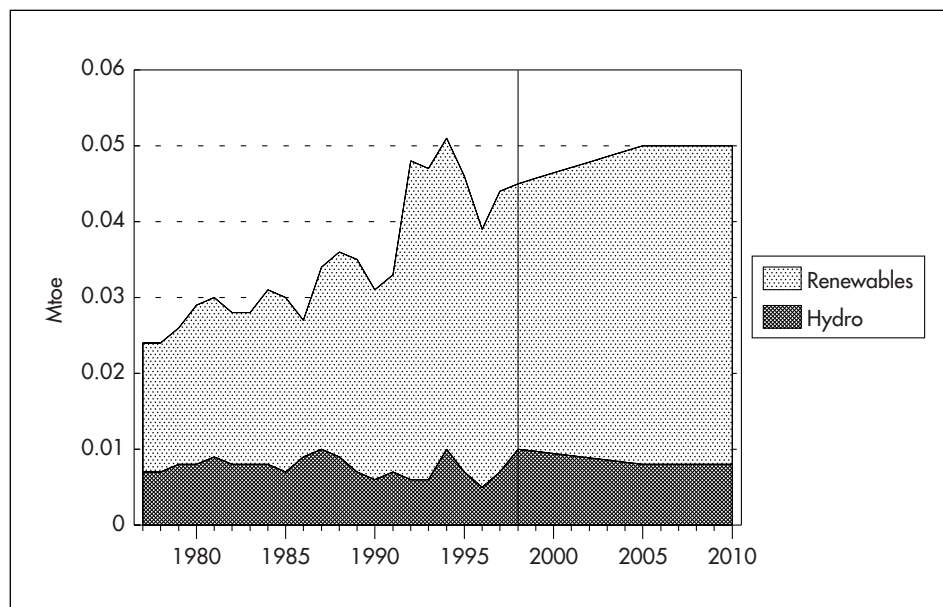
\* motorbikes, buses, lorries and tractors.

Source: *Annuaire Statistique*, 1998.

## Energy Production and Imports

Energy production stems only from renewable sources (Figure 6). Although production is modest (0.045 Mtoe in 1998), it has increased 45% since 1990. Most energy production is from combustible renewables and wastes and a small amount is from hydro.

*Figure 6*  
**Energy Production by Fuel, 1977-2010**



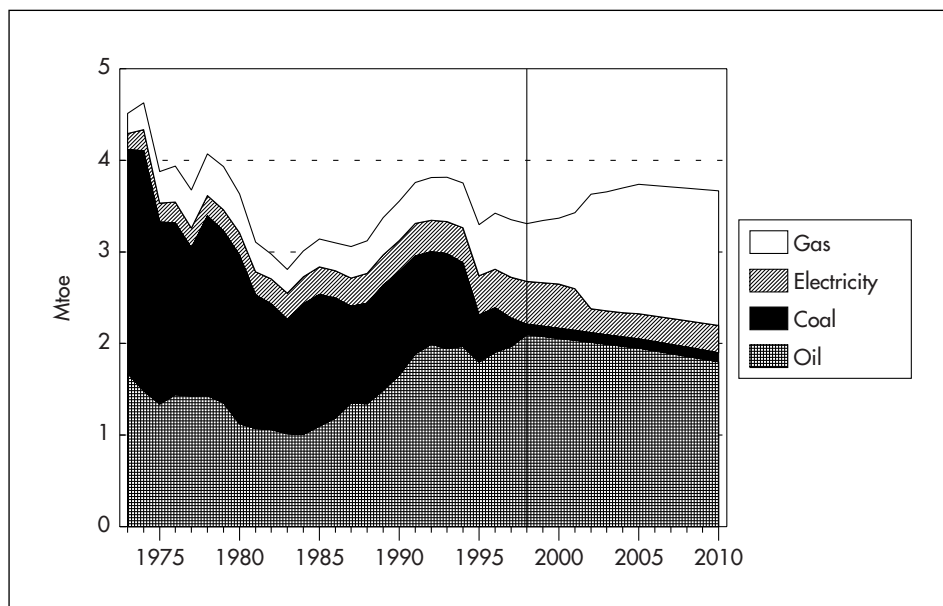
Note: Data on non-hydro renewable energy not available prior to 1977.

Sources: *Energy Balances of OECD Countries*, IEA/OECD Paris, 1999, and country submission.

Electricity generation is modest in comparison with consumption. In 1998 net electricity imports amounted to 94% of consumption.

Because domestic energy production is low, dependence on imports is high. In 1998, net energy imports amounted to 3.3 Mtoe, i.e. more than 99% of total energy supply (Figure 7). Oil is the main imported fuel with 2.1 Mtoe of net imports, followed by natural gas (0.6 Mtoe), electricity (0.5 Mtoe) and coal (0.1 Mtoe).

*Figure 7*  
**Net Energy Imports, 1973-2010**



Note: Government's forecasts. IEA estimates between 1998 and 2004.

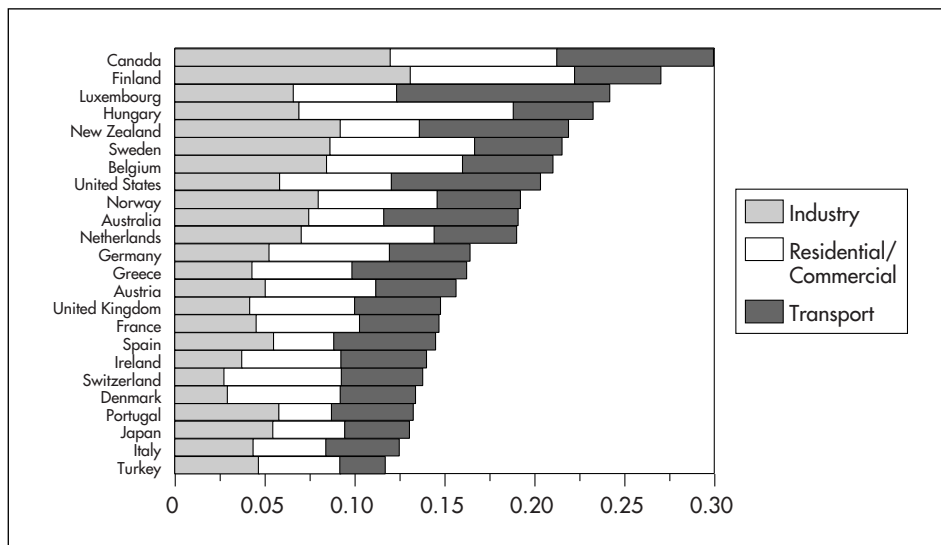
Sources: *Energy Balances of OECD Countries*, IEA/OECD Paris, 1999, and country submission.

## Energy Intensity

Energy intensity in Luxembourg is among the highest in the IEA, reflecting the importance of the iron and steel industry, the significant amount of refuelling by Luxembourg's neighbouring drivers, and higher energy consumption by households than the IEA Europe average because of the higher per capita income and the lower energy prices (Figure 8). However, energy intensity has decreased rapidly over the past two decades, mostly because of the sharp reduction of energy use by industry (Figure 9). Energy intensity in the residential/commercial sector has also decreased, but in 1998 remained above the IEA Europe average (Figure 10).

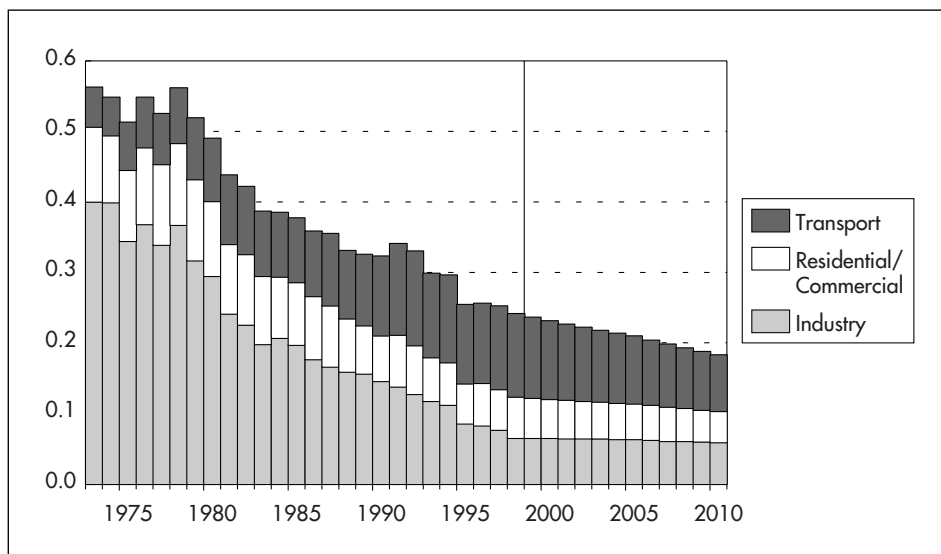
Since the end of the 1970s, electricity consumption increased at a much lower rate than GDP, mostly because of a slow increase in industry (Figure 11). Since 1993, it has stabilised at a higher level than the IEA Europe average.

*Figure 8*  
**Energy Intensity in IEA Countries by Sector in PPP, 1998**  
 (Toe per thousand US\$ at 1990 prices and purchasing power parities)



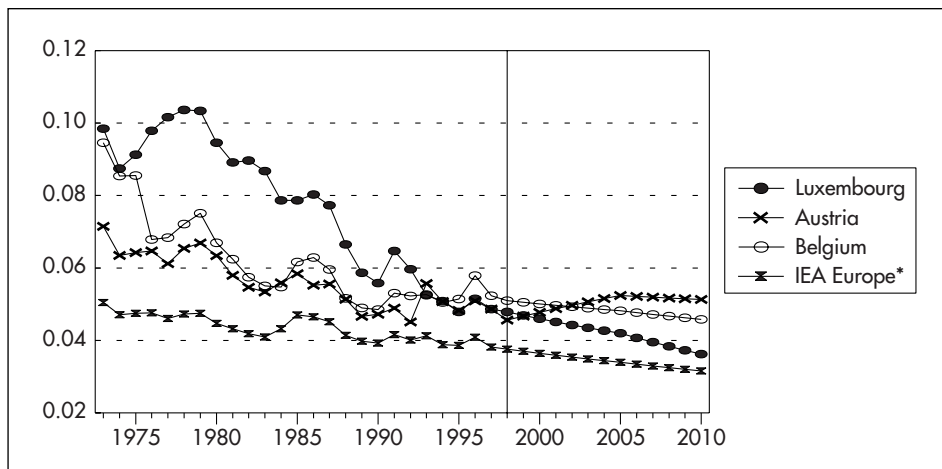
Sources: *Energy Balances of OECD Countries*, IEA/OECD Paris, 1999, and *National Accounts of OECD Countries*, OECD Paris, 1999.

*Figure 9*  
**Energy Intensity by Sector, 1973-2010**  
 (Toe per thousand US\$ at 1990 prices and purchasing power parities)



Sources: *Energy Balances of OECD Countries*, IEA/OECD Paris, 1999; *National Accounts of OECD Countries*, OECD Paris, 1999, and country submission.

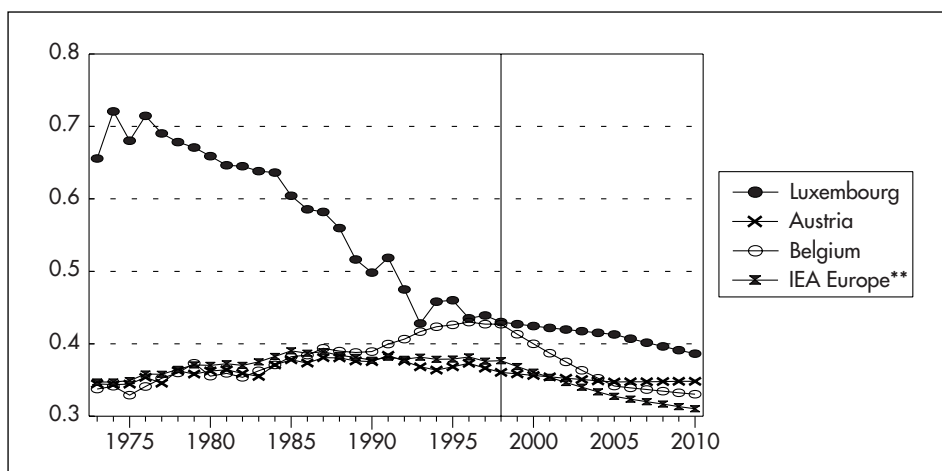
*Figure 10*  
**Energy Intensity in the Residential Sector in Luxembourg  
 and Other Selected IEA Countries, 1973-2010**  
 (Toe per thousand US\$ at 1990 prices and purchasing power parities)



\* excluding Norway from 1999 onwards.

Sources: *Energy Balances of OECD Countries*, IEA/OECD Paris, 1999; *National Accounts of OECD Countries*, OECD Paris, 1999, and country submissions.

*Figure 11*  
**Electricity Intensity\* in Luxembourg and in Other Selected IEA Countries,  
 1973-2010**



\* calculated as production plus net imports divided by GDP and measured in kWh per dollar of GDP at 1990 prices and purchasing power parity.

\*\* excluding Norway from 1999 onwards.

Sources: *Energy Balances of OECD Countries*, IEA/OECD Paris, 1999; *National Accounts of OECD Countries*, OECD Paris, 1999, and country submissions.



## Forecasts

The Department of Energy within the Ministry of Economic Affairs expects energy supply to increase at an annual rate of 1.9% between 1998 and 2005, mostly driven by economic growth. Energy consumption will increase in the industrial and commercial sectors and decrease in transport. A Combined Cycle Gas Turbine (CCGT) is being built and is expected to be commissioned in 2001 (see Chapter 7). Therefore, electricity generation will increase from 0.4 TWh gross in 1998 to 3.35 TWh gross in 2005. Electricity net imports are expected to decrease and natural gas imports will surge to 1.4 Mtoe in 2005 (see Chapters 6 and 7).

Energy supply will decrease after 2005 mostly due to a sharper reduction in oil use for transport. The government expects that the harmonisation of excise taxes on oil products will reduce the number of drivers refuelling in Luxembourg (see Chapter 5). Energy consumption in the residential sector will diminish because of increased energy efficiency and because most households are already well equipped with appliances. Energy consumption in the industrial and commercial sectors will increase slightly.

Energy intensity is expected to continue to decrease, however, at a lower rate than before, mostly because energy consumption in industry will no longer decrease.

Domestic energy production will continue to be based on renewable energy and will increase only slightly. As a consequence, Luxembourg's large dependence on imported energy will be maintained.

## ENERGY POLICY

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### Government Structure

In 1999, the Ministry of Energy was changed to a Department of Energy in the Ministry of Economic Affairs. The Ministry of Environment is in charge of the policy to curb air pollution and CO<sub>2</sub> emissions. Both ministries have authority for energy efficiency and renewable energy issues.

The Grand Ducal regulation<sup>3</sup> of 11 August 1996 established the *Conseil National de l'Énergie* as an advisory body to the government on energy issues. It provides advice on questions put by the minister in charge of energy and can, on its own initiative, give advice on energy policy matters which it considers useful.

### Energy Policy Objectives

The National Plan for Sustainable Development, finalised in 1998, lays out a strategy for sustainable development in Luxembourg's different economic areas (see box).

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3. Decree.

## **The Strategy of the 1998 National Plan for Sustainable Development**

- To achieve significant energy savings.
- To introduce the best available technology<sup>4</sup>.
- To balance environmental protection and economic growth in choosing the most cost-efficient solutions.
- To promote human behaviour compatible with the above objectives.
- To work for the adoption of these objectives at international level.
- To promote balanced development of the territory.
- To optimise the environmental management of the land.

The National Plan sets objectives and proposes measures which are described in detail in the relevant chapters. The government considers these proposed measures as guidelines in meeting the objectives listed below:

- To ensure security of energy supply.
- To diversify energy supplies.
- To develop highly efficient co-generation.
- To improve energy efficiency in all consumption sectors.
- To increase the use of renewable energy.

## **Energy Research and Development**

Owing to its small size, Luxembourg does not have public R&D programmes. One private company carries out applied research in the field of energy. Luxembourg imports its technology and the government does not plan to start financing energy R&D.

## **ENERGY TAXATION**

VAT on oil products differs among fuels. The general rate has been 15% since January 1993, except for light fuel oil for households and unleaded gasoline (12%).

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4. This was already included in the law of 9 May 1990, which has been replaced by the law of 10 June 1999.

Since January 1984, VAT on natural gas and electricity for households has been 6% and VAT on steam coal for households has been 12% since January 1993. A VAT of 3% is applied to automotive fuels used in public transport.

Excise taxes on automotive diesel and gasoline increased slightly in 1993 and 1994 and gasoline taxes increased again at the beginning of 1999 (Table 2). Taxes on LPG for cars have been LUF 2.18 per litre since 1995.

*Table 2*  
**Level of Gasoline and Automotive Diesel Excise Taxes, 1992-2000**  
(LUF per litre)

	<i>Automotive Diesel</i>	<i>Leaded Gasoline</i>	<i>Unleaded Gasoline</i>
01.01.1992	5.9	11.60	10.16
01.01.1993	7.3	12.46	10.16
01.01.1994	9.5	14.36	12.26
01.01.1995	10.0	16.11	14.01
01.01.1996	10.2	16.11	14.01
01.01.1997	10.2	16.11	14.01
01.01.1998	10.2	16.11	14.01
11.03.1999	10.2	17.11	15.01
01.01.2000	10.2	..*	15.01

Note: 11/03/1999 is the date of the increase in excise taxes. The other dates indicate the level of taxes at those dates.

\* leaded gasoline has not been sold in Luxembourg since June 1999.

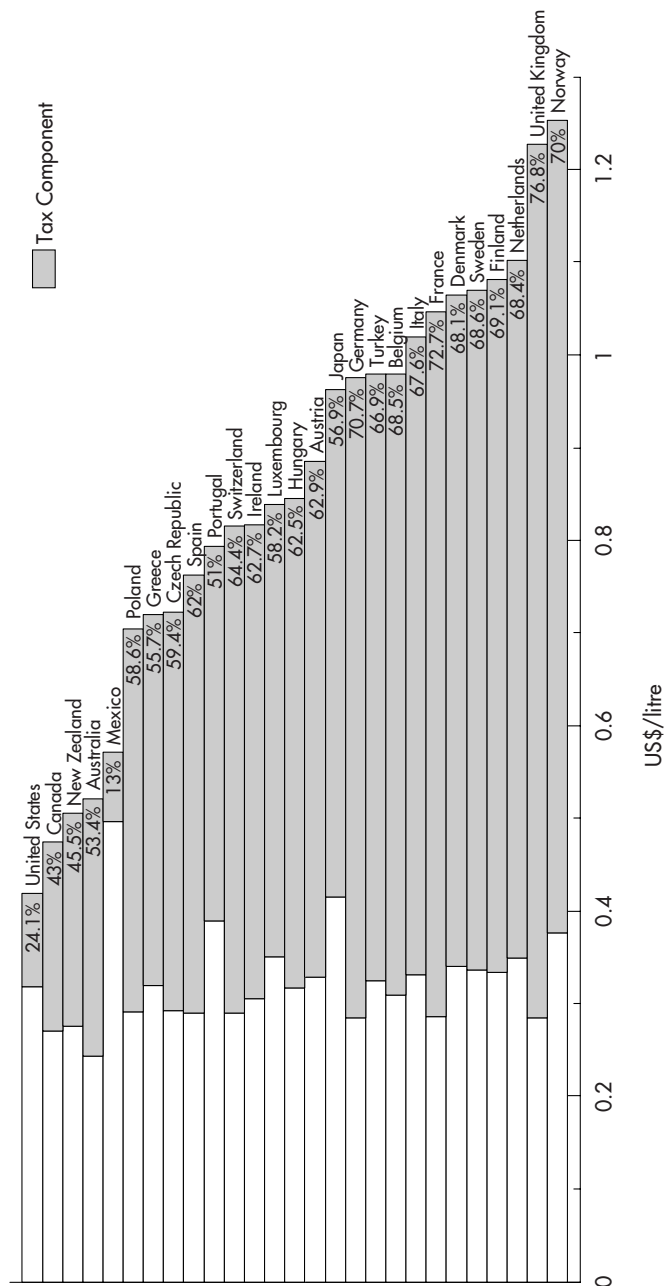
Source: *Energy Prices and Taxes*, IEA/OECD Paris, 2000.

Energy taxes are lower in Luxembourg than in neighbouring countries. However, the 1998 National Plan for Sustainable Development proposes the introduction of an energy tax to internalise the external costs of using energy.

Excise taxes on gasoline and diesel are significantly lower than the IEA Europe average, and in particular than in neighbouring countries, which is a strong incentive for neighbouring drivers to refuel in Luxembourg (Figures 12 and 13). Between 1993 and 1998, the tax differential for gasoline increased between Luxembourg, Belgium and France, and decreased between Luxembourg and Germany. The tax differential for automotive diesel decreased between Luxembourg and Belgium and Germany but increased between Luxembourg and France.

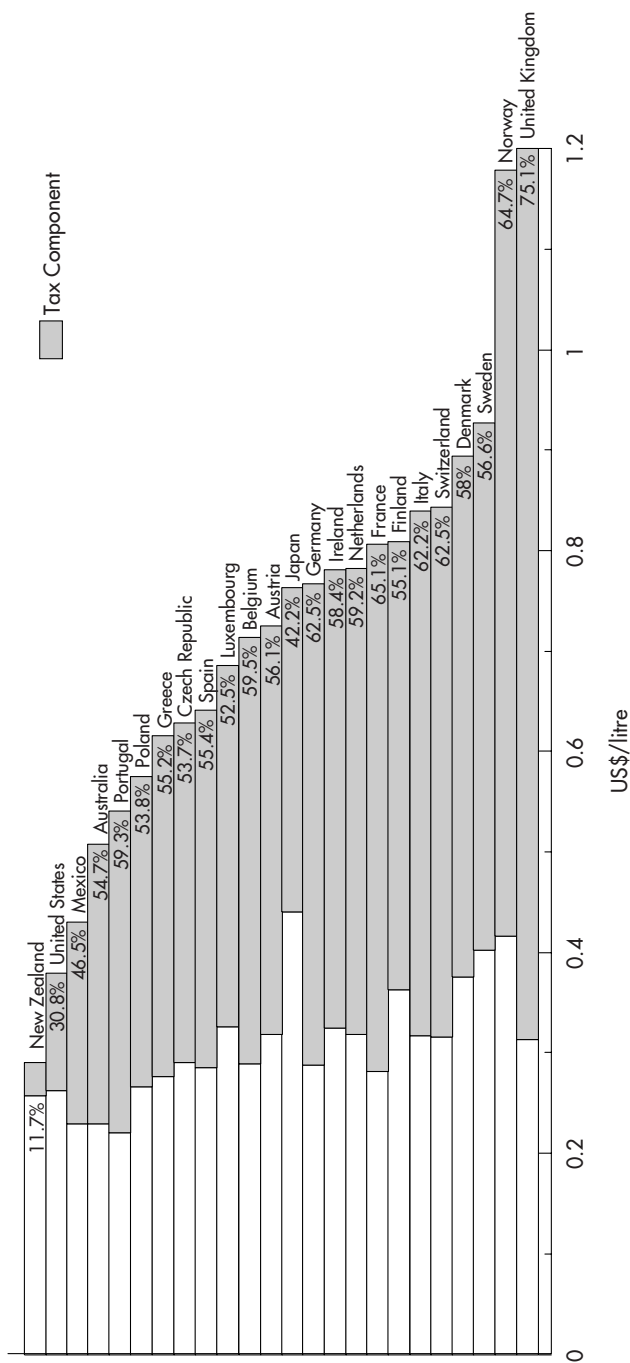
The excise tax on light fuel oil for industry and households has been LUF 210 per 1,000 litres since January 1993. There are no excise taxes on heavy fuel oil, natural

*Figure 12*  
**OECD Unleaded Gasoline Prices and Taxes, First Quarter 2000**



Source: *Energy Prices and Taxes*, IEA/OECD Paris, 2000.

*Figure 13*  
**OECD Automotive Diesel Prices and Taxes, First Quarter 2000**



Note: 4th Quarter 1999 for Belgium. Data not available for Canada, Hungary and Turkey.

Source: *Energy Prices and Taxes*, IEA/OECD Paris, 2000.

gas and coal. Until the vote of the electricity law in May 2000, CEGEDEL, the company in charge of supplies to the public grid, paid a concession fee of 6%. The tax revenue was dedicated to financing social security, e.g. the health care system. The new electricity law replaced this concession fee with a tax on electricity consumption (see Chapter 7).

Energy prices for households in Luxembourg are among the lowest of all OCDE European countries (Table 3). Light fuel oil and heavy fuel oil prices for industry are lower than the IEA Europe average. Electricity and natural gas prices for industry are discussed in the relevant chapters<sup>5</sup>.

*Table 3*  
**Taxes and Prices for Households in Luxembourg**  
**and in Other Selected IEA Countries, 1998**  
(US\$ per toe)

	<i>Light Fuel Oil</i>		<i>Natural Gas</i>		<i>Electricity</i>	
	<i>Tax</i>	<i>Price</i>	<i>Tax</i>	<i>Price</i>	<i>Tax</i>	<i>Price</i>
Austria	155.2	347.1	127.3	461.2	422.9	1,967.2
Belgium	57.5	230.1	96.5	455.4	356.6*	1,948.7*
France	171.4	395.0	82.6	483.2	350.8	1,499.3
Germany	88.4	265.6	87*	462.9*	251.3	1,847.1
Italy	660.6	917.5	353.2	767.8	537.5	1,853.4
Luxembourg	33.1	245.2	17.4	305.0	79.8	1,425.5
OECD Europe	..	364.5	..	472.1	..	1,508.5

\* 1997.

Source: *Energy Prices and Taxes*, IEA/OECD Paris, 1999.

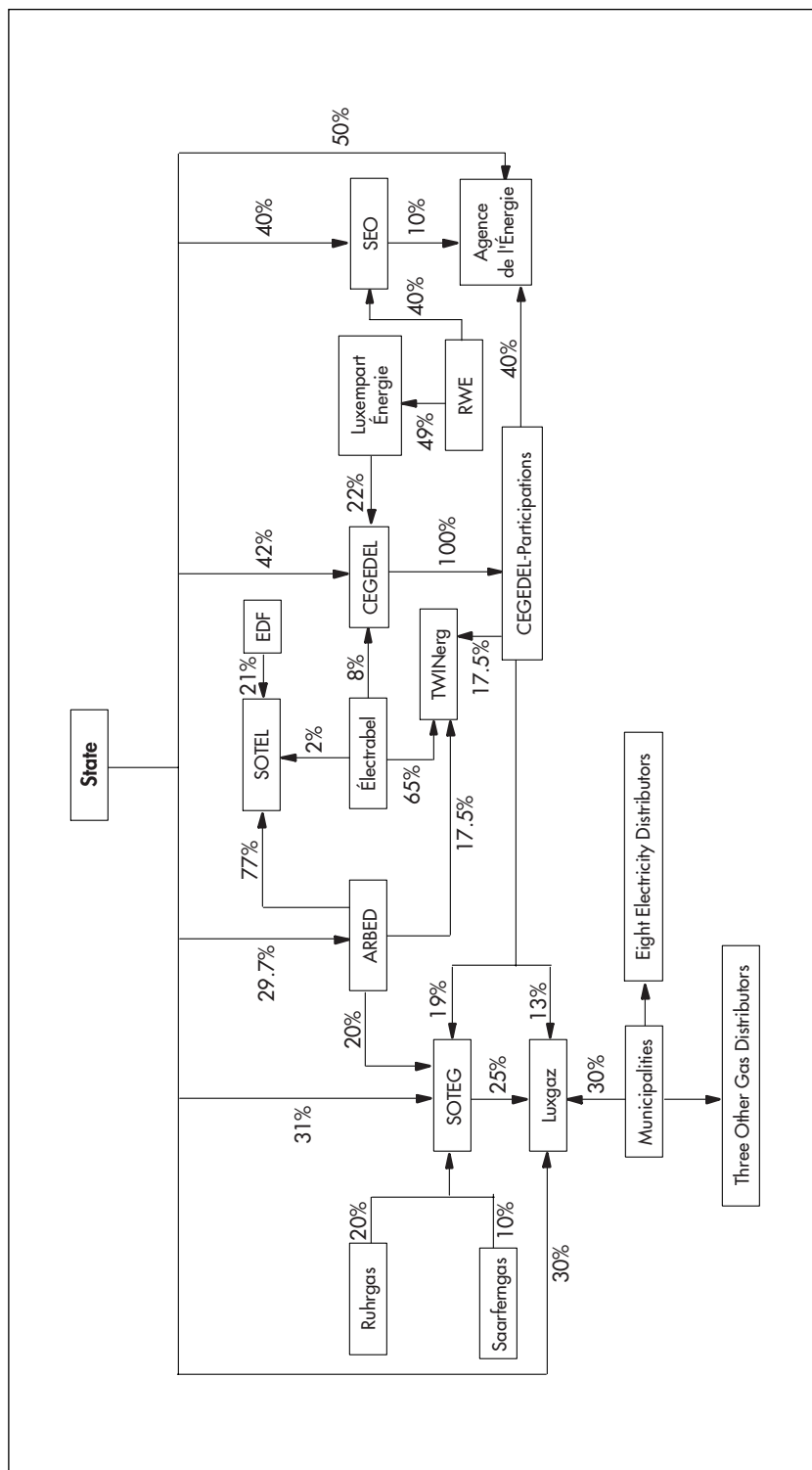
## INDUSTRY STRUCTURE

The state has shares in Luxembourg's main energy companies (Figure 14): 31% of the *Société de Transport de Gaz* (SOTEG), the gas transport company; 42% of the *Compagnie Grand-Ducale de l'Électricité* (CEGEDEL), the largest electricity import and distribution company; and 40% of the *Société Électrique de l'Our* (SEO). When the companies were created (such as SOTEG in 1974), the state held shares which it has gradually released. Four municipalities are directly involved in gas distribution and eight in electricity distribution.

There are also cross-shareholdings between companies. Since the beginning of the 1990s, CEGEDEL became involved in gas, renewable energy and co-generation

5. No data are collected by the IEA on Luxembourg's natural gas and electricity prices for industry as no average tariff or "marker" price is calculated by the national administration.

*Figure 14*  
Major Shareholdings in the Energy Sector, 1999



Sources: Annual Reports, IEA.

through CEGEDEL-Participations. In the 1990s, SOTEL (*Société de Transport de l'Électricité*) and SOTEG's capital was opened to foreign shareholders. ARBED, the iron and steel industry owned 29.7% by the state, is a shareholder of SOTEG (20%) and owns 77% of SOTEL, the electricity company which imports and supplies electricity to its steel mills and the national railways company.

Voting rights correspond to the shares. Detailed descriptions of the shareholding structure are included in Chapters 6 and 7.

## CRITIQUE

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Luxembourg's energy situation has the following main characteristics:

- Domestic energy production is modest and stems only from renewable energy.
- Energy consumption per inhabitant and dependence on energy imports are high. Luxembourg imports more than 99% of its energy needs. It has the highest level of energy dependency of all IEA countries.
- Trends in energy consumption have been influenced by industrial restructuring and by increases in sales of transport fuels.
- Because of its small size and lack of indigenous sources, the Luxembourg energy market is greatly influenced by the energy policies and energy markets in surrounding countries.

Since the last in-depth review, progress has been achieved in Luxembourg's energy policies. The main measures are described below.

Electricity and natural gas imports have diversified, lessening energy security concerns. The commissioning of a CCGT in 2001 will reduce electricity imports and a new gas pipeline from Germany is being built to further diversify natural gas imports.

The government rightly considers market liberalisation in the whole of Europe to be an opportunity for consumers in Luxembourg as it will allow them to benefit from reduced energy prices. Nevertheless, Luxembourg implemented the European Directive on the Internal Electricity Market after more than one year of delay. The government, however, undertook a comprehensive process of consultation and is to be commended for its efforts to transpose the directive into Luxembourg law. The government also expects that a law implementing the European Directive on Natural Gas will be voted by the end of 2000.

Because of the small size of the country and the increasing links between electricity and natural gas due to the commissioning of the new CCGT and the cross-shareholdings between electricity and gas enterprises, establishing a single regulator for electricity and natural gas would be more efficient than having two different regulators.



Although decreasing, state and municipal ownership in energy companies remains significant in Luxembourg. This situation is inherited from the past, when the state participated in the industrialisation of the country. According to the government, there is no interference in companies' strategic decisions. This is welcome since in a liberalised system companies need to compete on a level playing field, free in their strategy and daily management. In addition, electricity and natural gas distribution activities, when undertaken directly by municipalities, should adapt to the new regulatory environment. As a first step, these activities should be separated from the administration and their accounts should be unbundled.

The government has been increasingly involved in energy efficiency, the promotion of renewable energy and policy measures to limit greenhouse gas emissions. Several Grand Ducal regulations have been issued to implement the 1993 framework law on energy efficiency. A National Plan for Sustainable Development including a large number of proposals related to energy, environment and transport, such as the introduction of an energy tax, was adopted in 1998.

In view of this increased number of tasks, e.g. market liberalisation and energy efficiency, the government should continue to work for close and effective co-operation among all the ministries involved in energy policy to ensure consistency and efficiency in policy-making.

Because of its size, its geographic situation in the centre of Europe and its dependence on energy imports, Luxembourg is dependent on energy markets and regulations in neighbouring countries. Therefore, co-operation at the regional level should be sought. This is exemplified by the two following cases, described in detail in the relevant chapters:

- Luxembourg's eligible consumers will benefit from the liberalisation of electricity and natural gas markets in Europe. However, the extent to which Luxembourg's consumers will be able to benefit from competition will depend, *inter alia*, on regulations outside the country, e.g. tariffs for access to the networks.
- Enhancing public transport would require, *inter alia*, co-operation with neighbouring countries due to the importance of cross-border transit.

Energy taxes are among the lowest of all IEA countries, leading to low energy prices in comparison with neighbouring countries. This is particularly the case for automotive fuels. As a consequence, cars and truck drivers from these countries refuel in Luxembourg, distorting the automotive fuels market. Internalisation of the external costs of using energy through taxation is commendable as it leads to undistorted energy prices. Increased energy taxes can also favour energy savings. It is therefore welcome that the National Plan for Sustainable Development considers levying an energy tax to better internalise the external cost of using energy, and that the Ministry of Economic Affairs foresees harmonisation of excise taxes at the EU level (see Chapter 5).

## RECOMMENDATIONS

The Government of Luxembourg should:

- ☐ Continue to introduce competition in the gas and electricity sectors. Set up a regulatory body with responsibility for both electricity and gas.
  - ☐ Ensure that entities with government or municipal shareholding are free in their strategic decision-making and daily management to allow them to compete on a level playing field.
  - ☐ Continue to work towards close and effective co-operation among all the ministries involved in energy policy.
  - ☐ Continue to co-operate with neighbouring countries on energy issues, e.g. electricity and natural gas liberalisation and inter-state transport.
  - ☐ Address automotive tax distortion by implementing the proposed measure in the National Plan for Sustainable Development to levy an energy tax to better reflect the cost of energy use.
-



## ENERGY EFFICIENCY AND ENVIRONMENT POLICY

As stated in Chapter 3, energy intensity has decreased mainly because of the restructuring of the iron and steel industry. However, it remains high in comparison with the levels in other IEA countries. Due to the high carbon content of energy use, CO<sub>2</sub> emissions are also at a high level: Luxembourg has the second highest level of energy-related emissions per capita (19.3 tonnes in 1998) among IEA countries after the United States.

### ENERGY EFFICIENCY POLICY

The Energy Efficiency Law of 5 August 1993 established a legal framework to adopt a wide range of regulations focused mainly on energy efficiency measures and also on the promotion of renewable energy. The 1993 law has five targets (see box) and at the end of 1999, several Grand Ducal regulations described below were issued to implement the law.

#### **Targets of the Energy Efficiency Law of 5 August 1993**

- To guarantee a sufficient, secure and economic energy supply.
- To promote energy savings and the rational use of energy.
- To favour the use of renewable energy sources, co-generation and the production of primary and secondary energy.
- To alleviate the negative impact of the production and consumption of energy on the environment.
- To co-ordinate all these activities in the framework of the European Union.

The 1998 National Plan for Sustainable Development sets as an objective a 20% reduction in energy intensity between 1993 and 2010. Measures envisaged in the plan are shown in the following box.

## **The 1998 National Plan for Sustainable Development: Main Energy Efficiency Measures by Sector**

### **General**

- To introduce an energy tax compatible with EU regulations.
- To favour the use of the best available technology.
- To increase information and dissemination efforts.
- To favour investments for energy savings. The creation of a fund to promote renewable energy and energy efficiency is under discussion.

### **Buildings**

- To improve the energy efficiency of new and existing buildings.
- To reach a 30% reduction between 1990 and 2020 in energy consumption for heating a constant surface in buildings.

### **Industries**

- To improve voluntary agreements.

### **Transport**

- To set annual taxes on vehicles according to their fuel consumption and emissions to incite the purchase of less polluting vehicles.
- To increase by 30% the share of public transport use for medium distances between 1997 and 2010.
- To reduce the use of transport and to reduce travel distances.
- To reduce the use of the most polluting transport means.
- To link Luxembourg's rail network to the high-speed rail network and to improve international railway connections.

## **Public Sector**

The Grand Ducal regulation of 11 August 1996 establishes the *Programme d'Actions d'Économies d'Énergie dans les Communes* (PEEC). It aims at launching initiatives and measures to be adopted by the municipalities to promote the rational use of energy and renewable sources of energy. The *Agence de l'Énergie* (see box), which is in charge of developing this programme, has the following responsibilities:

- To consult with the municipalities to help them benefit from the PEEC at the planning stage of projects.
- To motivate the municipalities in their energy strategy within the framework of the PEEC.
- To carry out pre-feasibility studies.
- To inform the municipalities about available financial support, licensing, tariffs, etc.

### ***The Agence de l'Énergie***

*The Agence de l'Énergie S.A.* was established in June 1991 as a company under private law whose shareholders are the government (50%), the electricity company CEGEDEL (40%) and the electricity company SEO (10%) (see Figure 14 in Chapter 3). *The Agence de l'Énergie* undertakes feasibility studies for energy efficiency and renewable energy projects and gives advice to municipalities. It has also managed the retrofitting of some micro hydro power plants with funding from the EU Thermie programme.

*The Agence de l'Énergie* is managing the building of a demonstration park in Remerschen, including an energy-efficient building, a 600 kW windmill and a 10 kW photovoltaic plant. The project is financed by the Ministry of Economic Affairs, CEGEDEL, RWE (Germany) and SEO.

In 1997, in the framework of the PEEC, three projects were eligible for a total subsidy of LUF 1.4 million after examination by a special commission established by the Grand Ducal regulation. This includes an information/motivation campaign in nine municipalities on the rational use of energy and renewable sources of energy, the installation of solar panel collectors in a swimming pool and the installation of a wood-burning central heating system in a primary school. In 1998, a total subsidy of LUF 10.3 million was granted to five municipalities.

## **Buildings**

The Grand Ducal regulation of November 1995 sets mandatory insulation standards for new buildings. It came into force in January 1996. Certified architects or engineers attest that the insulation standards have been taken into consideration when designing the building. In case of non-compliance during the construction phase, penalties are imposed and can result in cancellation of work.

The Grand Ducal regulation of August 1996 organises energy audits in residential and commercial buildings carried out by engineers, advisers or specialised bodies agreed by the minister in charge of energy. The audit is made at the request of the owner. The state refunds up to 49% of the cost of the audit with a limit of LUF 150,000 per building or enterprise when the owner has completed the work proposed by the expert in charge of the audit. The then Ministry of Energy has developed these energy audits on the basis of voluntary agreements with the various professional sectors concerned: industry (FEDIL), banks (ABBL), insurance (*Groupement des Assurances*), hospitals (*Entente des Hôpitaux*), trade (*Confédération du Commerce*) and hotels (HORESCA).

In residential buildings, the possibility of improving energy efficiency by this system is high since 75% of flats are owned and not rented. Owners have a direct interest in investing in energy efficiency in buildings as they get the benefit of energy savings.

## Appliances

A Grand Ducal regulation was issued in June 1996 to implement the EU directive on energy efficiency labelling for washing machines, tumble-dryers, refrigerators, freezers and dishwashers. The Grand Ducal regulation of August 1996 implements the EU directive which sets minimum efficiency requirements for hot water boilers and the Grand Ducal regulation of August 1998 implements the EU directive on energy efficiency standards for refrigerators and freezers.

## Industry and Commerce

The Grand Ducal Regulation of May 1994 establishes incentives for electricity generation from renewable sources and co-generation (see Chapter 7).

The Law of 27 July 1993 introduced specific rules for subsidies to companies at a maximum rate of 25% for investments aimed at environmental protection and the rational use of energy. The Law of December 1997 modified and completed the law of December 1996, which introduced special depreciation allowances for company investments in new technologies for improving energy efficiency, the use of renewable sources of energy and the recovery of waste energy in industrial processes.

The voluntary agreement signed in March 1996 by the former Ministry of Energy and the FEDIL (*Fédération des Industriels Luxembourgeois*) included a goal of an average 10% improvement in energy efficiency by 35 of its members between 1990 and 2000.

No individual targets were set. Companies have been free to choose the best means to improve their efficiency. The FEDIL has monitored the progress of each

enterprise and has provided an annual report to the Ministry of Economic Affairs. The FEDIL will issue a complete report in 2000, including recommendations for further progress. Two other voluntary agreements were signed with the *Entente des Hôpitaux* and with the financial sector for an average 20% energy efficiency improvement by their members in both sectors between 1991 and 2001.

## Transport

The Ministry of Transport supports public transport by low fares (which cover less than 15% of the costs), higher frequency of buses and trains, and the creation of car parks outside town centres connected by city buses. Because of the strategic position of Luxembourg as an important crossroad for the international transport of goods, the government made a commitment to develop combined rail/road transportation. Particular focus is given to the access and management of the rail terminal at Bettembourg to improve long-distance transport of goods from Europe to the Belgian and Dutch harbours. The government is implementing a new scheme to promote and modernise passenger rail transport.

## ENVIRONMENT POLICY

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### Greenhouse Gas Emissions

Luxembourg has the highest share of fossil fuels in energy supply (Figure 15) of all IEA countries. Energy-related CO<sub>2</sub> emissions per TPES have decreased but remain high (Figure 16). Although energy consumption has been decreasing, in 1998 energy-related CO<sub>2</sub> emissions per capita and per GDP remained higher than the IEA Europe average (Figure 17).

The Ministry of Environment estimates that CO<sub>2</sub> emissions decreased by 35% from 11.7 Mt in 1990 to 7.6 Mt in 1998. According to IEA estimates, energy-related CO<sub>2</sub> emissions decreased 25.7% between 1990 (10.9 Mt) and 1998 (8.1 Mt). As a result of the restructuring of the iron and steel industry (see below), emissions from coal were reduced dramatically (by 91% between 1990 and 1998), as were emissions in the manufacturing sector (by 69% between 1990 and 1998) and in electricity generation. However, emissions from transport (particularly road) have surged (Figure 18 and Table 4). This is mostly due to the increasing number of foreign drivers refuelling in Luxembourg (see Chapter 5).

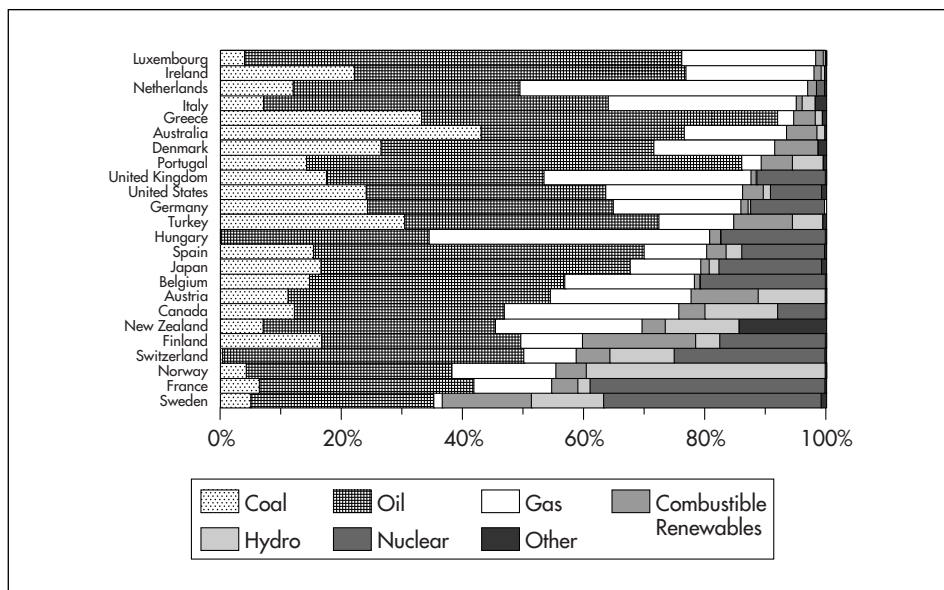
According to IEA's estimates based on Luxembourg's forecasts of energy consumption, energy-related CO<sub>2</sub> emissions will be 15.6% lower in 2010 than in 1990. Luxembourg's forecasts on GHG<sup>6</sup> emissions between 1990 and 2010 are

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6. The six gases identified in the Kyoto Protocol are: CO<sub>2</sub>, CH<sub>4</sub>, N<sub>2</sub>O, PFCs, HFCs and SF<sub>6</sub>.

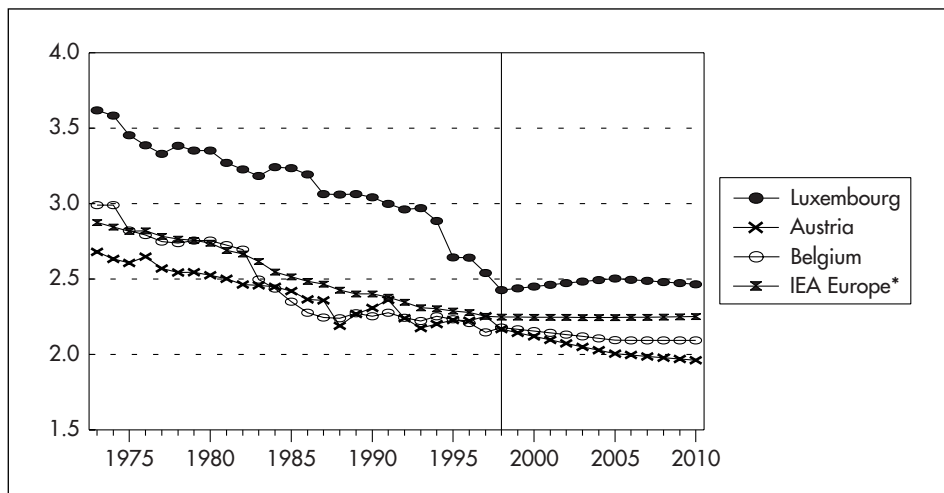


*Figure 15*  
**Total Primary Energy Supply by Fuel in IEA Countries, 1998**



Source: *Energy Balances of OECD Countries*, IEA/OECD Paris, 1999.

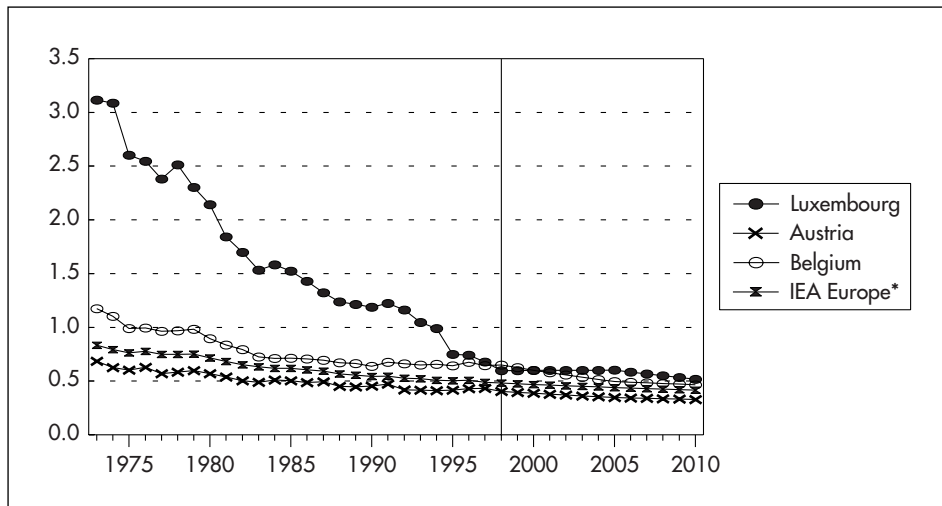
*Figure 16*  
**Energy-related CO<sub>2</sub> Emissions per TPES in Luxembourg  
and in Other Selected IEA Countries, 1973-2010**  
(Tonnes of CO<sub>2</sub>/tonne of oil equivalent)



\* excluding Norway from 1999 onwards.

Sources: *Energy Balances of OECD Countries*, IEA/OECD Paris, 1999; *National Accounts of OECD Countries*, OECD Paris, 1999, and country submissions.

*Figure 17*  
**Energy-related CO<sub>2</sub> Emissions per GDP (PPP) in Luxembourg**  
**and in Other Selected IEA Countries, 1973-2010**  
(Kg of CO<sub>2</sub>/US\$ using 1990 prices and purchasing power parities)



\* excluding Norway from 1999 onwards.

Sources: *Energy Balances of OECD Countries*, IEA/OECD Paris, 1999; *National Accounts of OECD Countries*, OECD Paris, 1999, and country submissions.

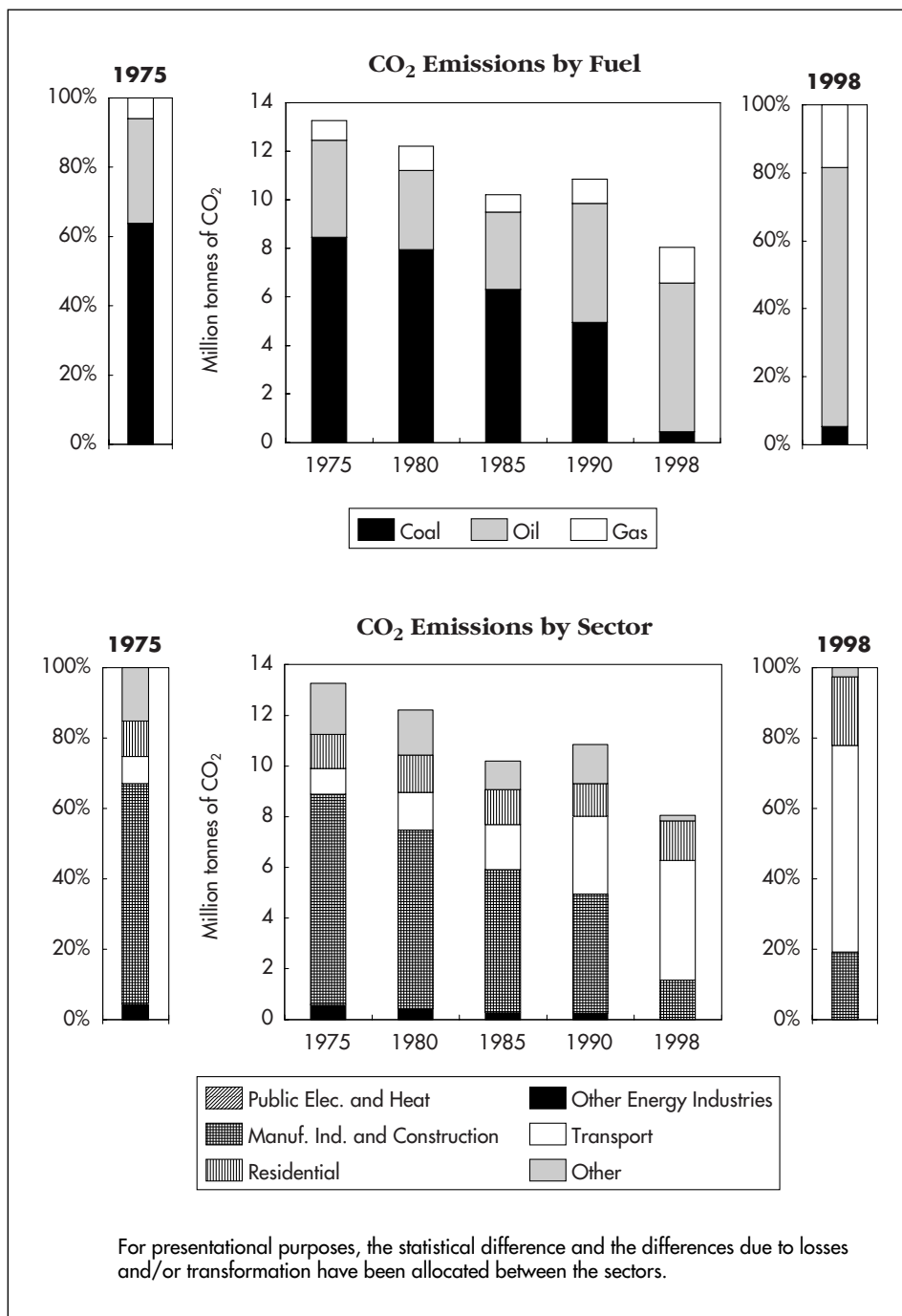
*Table 4*  
**Trends in Energy-related CO<sub>2</sub> Emissions, 1975-1998**  
(Mt)

	1975	1990	1998	1998/1990 (%)
<b>Fuel</b>				
Coal	8.45	4.94	0.44	-91
Oil	4.01	4.91	6.13	+24.8
Gas	0.80	1	1.48	+48
<b>Sector</b>				
Manufacturing	7.94	4.96	1.54	-69
Transport	1.01	3.05	4.72	+54.8
Of which: Road	0.81	2.64	3.83	+45
Residential/commercial	1.36	1.31	1.67	+27.5
Electricity	1.99	1.54	0.10	-93.5
Other*	0.96	0	0.02	-
<b>Total</b>	<b>13.26</b>	<b>10.86</b>	<b>8.05</b>	<b>-25.8</b>

\* losses and transformation processes.

Sources: *CO<sub>2</sub> Emissions from Fuel Combustion*, IEA 1999, and IEA database.

*Figure 18*  
**Energy-related CO<sub>2</sub> Emissions by Fuel and by Sector, 1975-1998**



Source: *CO<sub>2</sub> Emissions from Fuel Combustion*, IEA/OECD Paris, 1999.

shown in Table 5. According to forecasts, GHG emissions will decrease between 1990 and 2000 and increase afterwards. Between 1990 and 2010, the overall reduction in GHG emissions would be around 23%, compared with Luxembourg's 28% reduction goal under the EU burden-sharing agreement (see below).

*Table 5*  
**Luxembourg's Forecasts on GHG Emissions, 1990-2000**  
(kt of CO<sub>2</sub> equivalent)

	1990	1998	2010*
CO <sub>2</sub>	11,711	7,613	8,705
CH <sub>4</sub>	495	480	539
N <sub>2</sub> O	196	236	219
HFC	17	47	110
PFC			
SF <sub>6</sub>			
<b>Total</b>	<b>12,419</b>	<b>8,376</b>	<b>9,573</b>

\* scenario which includes some measures to curb GHG emissions: voluntary agreements with industry, reduction of emissions in road transport, energy savings in buildings and increased use of natural gas instead of oil.

Note: Due to different methodologies, data on CO<sub>2</sub> emissions differ between IEA and national statistics.

Source: National Strategy to Reduce GHG Emissions, Ministry of Environment, May 2000.

## Effects of the Modernisation of ARBED's Iron and Steel Industry on Pollutant Emissions in Luxembourg

The replacement of blast furnaces by electric arc furnaces in steel mills has contributed to a dramatic reduction in Luxembourg's CO<sub>2</sub> emissions, as well as other pollutants. Table 6 shows ARBED's estimates of its effects on CO<sub>2</sub> emissions based on different assumptions of the carbon content of electricity used in arc furnaces. Table 7 shows estimates made by independent laboratories on other pollutant emissions.

## Policy to Reduce GHG Emissions

Luxembourg ratified the UN Framework Convention on Climate Change by a Law of 4 March 1994 that took effect on 7 August 1994. Luxembourg's national communication to the First Conference of the Parties to the UNFCCC was issued in March 1995. No new national communication has been issued.

*Table 6*  
**Evolution in CO<sub>2</sub> Emissions from Steel Production, 1990-1998**

	1990	1991	1992	1993	1994	1995	1996	1997	1998
Estimate 1:									
Kg CO <sub>2</sub> /tonne	1,685	1,718	1,733	1,721	1,548	1,162	1,121	832	490
Estimate 2:									
Kg CO <sub>2</sub> /tonne	1,581	1,611	1,623	1,610	1,408	964	920	599	226
Estimate 1:									
Kt CO <sub>2</sub> per year	5,998	5,804	5,319	5,666	4,757	3,037	2,805	2,147	1,214
Estimate 2:									
Kt CO <sub>2</sub> per year	5,630	5,446	4,982	5,303	4,326	2,520	2,300	1,545	559

Estimate 1: imported electricity stems 50% from natural gas and 50% from coal.

Estimate 2: imported electricity stems 60% from nuclear energy, 20% from natural gas and 20% from coal.

Source: ARBED.

*Table 7*  
**Pollutant Emissions from the Steel Mills, 1990-1998**

		1990*	1998**	Reduction in %
Dusts	Kg/year	9,816,800	40,066	99.6
Zn***	Kg/year	129,400	10,491	91.9
Pb***	Kg/year	48,930	956	98
Cl***	Kg/year	1,405,000	4,747	99.7
F***	Kg/year	257,400	3,050	98.8
NO <sub>x</sub>	Kg/year	6,618,000	1,153,217	82.6
SO <sub>2</sub>	Kg/year	11,220,000	264,532	97.6
CO***	Tonne/year	418,800	2,127	99.5
PAH***	Kg/year	307	26	91.5
Dioxins	G/year	23	4.57	80.1

\* environmental impact assessment by the laboratory TÜV.

\*\* estimates by the laboratory MPU based on declared emissions.

\*\*\* see glossary.

Source: ARBED.

In November 1990, the government decided to stabilise CO<sub>2</sub> emissions at 1990 levels by the year 2000 and to achieve a 20% reduction of these emissions by 2005. According to the Kyoto Protocol, the EU as a whole agreed to reduce greenhouse

gas emissions by 8% from 1990 levels by the period 2008-2012. Under the burden-sharing agreement, Luxembourg is committed to reducing its emissions by 28%, the highest level of reduction in the EU.

The Ministry of Environment has estimated CO<sub>2</sub> emissions from transport fuels (excluding aviation fuels) purchased in Luxembourg and consumed outside the country to have been 2.7 million tonnes in 1998 (1.8 million tonnes in 1990). The Ministry of Environment also estimated CO<sub>2</sub> emissions from electricity generation imported to Luxembourg (Table 8). However, under the current UNFCCC rules, emissions related to domestic sales of energy belong to the country where sales occur.

*Table 8*  
**CO<sub>2</sub> Emissions from Electricity Generation**  
**Imported to Luxembourg, 1990-1998**  
(Tonnes)

<i>1990</i>	<i>1996</i>	<i>1997</i>	<i>1998</i>
2,292,000	2,770,000	2,852,000	2,966,000*

\* 2,295,000 tonnes from RWE and 672,000 tonnes from Électrabel.

Source: Ministry of Environment.

## Measures

In addition to the measures related to energy efficiency and in particular to the introduction of an energy tax, the other main measures envisaged in the 1998 National Plan for Sustainable Development are:

- To implement no-regret policies and to rely on flexible mechanisms.
- To promote environment-friendly technologies and production.
- To continue to favour natural gas penetration.

In May 2000, the government issued a National Strategy to Reduce GHG Emissions. The report stresses the need to ensure sustainable development and to set up a medium-term plan. The report recommends six categories of action:

- To ensure that electricity from renewable energies will amount to 10% of electricity consumption in 2010.
- To improve energy efficiency in energy generation.
- To increase energy savings.
- To set an eco-tax progressively.

- To curb the increase in road transport.
- To rely on flexible mechanisms allowed by the Kyoto Protocol.

The plan lists 29 measures, some of which have already been taken or have been envisaged in the 1998 National Plan.

## Other Emissions

The 1998 National Plan also sets a new target of reducing SO<sub>2</sub>, NO<sub>x</sub> and VOC emissions by 70% between 1990 and 2010. The Oslo Protocol sets the target of a 58% reduction in SO<sub>2</sub> emissions between 1980 and 2000. Thanks to the restructuring of the iron and steel industry and the introduction of electric arc furnaces, this target was reached before 2000 (Table 9). The Sofia Protocol sets a target of stabilising NO<sub>x</sub> emissions between 1987 and 1994. Total NO<sub>x</sub> emissions in Luxembourg have decreased since 1996, but emissions from transport have increased rapidly. The Geneva Convention sets the target of reducing volatile organic compounds (VOC) emissions by 30% between 1990 and 2000<sup>7</sup>. According to the Ministry of Environment's estimates, that target was reached in 1998.

Luxembourg faces urban ozone problems in summer. The maximum allowed level of 360 microgrammes per cubic metre has never been reached. However, the level of 180 microgrammes per cubic metre (above which the population has to be informed) was exceeded six times in 1996, five times in 1997 and eight times in 1998.

*Table 9*  
**Evolution in Pollutant Emissions\* Excluding GHG Emissions, 1980-2010**  
(Tonnes)

	<i>1980</i>	<i>1990</i>	<i>1997</i>	<i>1998</i>	<i>2005*</i>	<i>2010*</i>
SO <sub>2</sub>	24,000	15,000	5,712	3,600	8,266	8,480
NO <sub>x</sub>	23,000	23,000	20,364	17,000	..	..
VOC	..	21,000	17,724	13,000	..	..
CO	..	175,000	82,183	50,900	..	..
NH <sub>3</sub>	..	7,000	7,344	..	..	..

\* forecasts.

Source: Ministry of Environment.

7. The 1999 Göteborg Convention sets the following objectives for the period 1990 to 2010: -73% for SO<sub>2</sub> emissions, -52% for NO<sub>x</sub> emissions and -55% for VOC emissions.

## CRITIQUE

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Energy intensity decreased substantially, mostly because of the restructuring of the iron and steel industry. Energy efficiency policy in Luxembourg was given a welcome boost in 1993 with the adoption of a new framework law on energy efficiency. Because of the high carbon content in energy use, increased energy efficiency benefits the environment. In addition, since most of the energy consumed in Luxembourg is imported, these measures have also had a favourable impact on the country's trade balance.

Following a lengthy and broad consultation process, the government issued several implementing regulations and started implementing voluntary agreements in industry and commerce. The 1998 National Plan for Sustainable Development and the National Strategy to Reduce GHG Emissions rightly envisage further efforts to promote energy efficiency. Energy efficiency targets should be above business-as-usual trends<sup>8</sup>. It is important that these objectives be implemented with concrete and cost-efficient measures.

The government needs to start assessing the cost-benefit of the measures to improve energy efficiency, in particular their impact on pollutant emissions and on energy imports. The results of these assessments would allow policy-makers to concentrate on the most cost-effective measures. The cost-effectiveness assessment of these measures would also allow the public and policy-makers to be better informed about the usefulness of this policy and possibly increase the public effort in this respect.

The government should also monitor these measures to improve them, if necessary. This is especially important for the measure aimed at improving energy efficiency in buildings, as this is the only measure introduced to improve energy efficiency in this sector and the expected energy savings are considerable. As the government and public institutions may be too small to develop the necessary expertise, the assessment and monitoring could be undertaken by independent institutes.

In addition, the expected report on voluntary agreements in industry should be an opportunity to improve the effectiveness of these agreements. New targets should be set so that improvements in energy efficiency go beyond the business-as-usual trend. Monitoring should ensure that specific efforts are being made. The assessment of the results of the 1990-2000 plan should be used to set more precise targets for individual enterprises or groups of enterprises in the same sector, taking into account the results of the past decade. These voluntary agreements should continue to be extended and adapted to the other sectors of the economy, including the service sector, whose importance in Luxembourg's economy has increased substantially.

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8. The objective of the National Plan of a 20% reduction in energy intensity (primary energy consumption per GDP) between 1993 and 2010 was nearly reached in 1998.



Luxembourg's energy-related CO<sub>2</sub> emissions decreased dramatically after the restructuring of the iron and steel sector and, since 1990, the shift from blast furnaces to electric arc technology. Emissions from other sectors, especially transport, have been increasing continuously, which will contribute to an increase in the country's emissions upon completion of its iron and steel restructuring programme. While the new CCGT will generate lower CO<sub>2</sub> emissions than imported electricity, it will also increase domestic emissions from the electricity sector. In addition, increased industrial co-generation from fossil fuels will increase domestic carbon emissions.

CO<sub>2</sub> emissions in Luxembourg in 2000 are expected to be below their 1990 level, in accordance with the goals set under the UNFCCC in 1992. However, increased efforts will be required if the country is to achieve a 28% reduction in greenhouse gas emissions from 1990 levels between 2008 and 2012, as agreed in the EU burden-sharing agreement. Measures improving energy efficiency will reduce CO<sub>2</sub> emissions, given the carbon content of the country's energy use. In addition, the government's plan to implement a programme to reduce GHG emissions to meet the Kyoto target is welcome. One key measure could be the introduction of an energy tax. To the extent possible, this tax should reflect the carbon content of fuels as well as the internalisation of other environmental externalities (see Chapter 3). The resulting increase in energy prices should further encourage energy savings and improve the efficacy of energy efficiency measures. The use of the Kyoto flexibility mechanisms, as envisaged by the government, is also welcome as they are cost-effective tools to reduce greenhouse gas emissions.

CO<sub>2</sub> emissions from transport and urban air pollution in the major towns are increasing. The 1998 National Plan envisages increasing the share of public transport to counter this trend. Because of the importance of cross-border travel, an effective policy to increase the use of public transport should be developed in co-operation with neighbouring countries. The 1998 National Plan also considers an increase in taxes on cars to internalise better the environmental cost of transport. As most of the automotive fuel purchased in Luxembourg is consumed in other countries, internalisation of environmental costs through energy taxes would be more appropriate. In addition, taxes on cars would increase the cost of car ownership, but would not significantly address car use.

## RECOMMENDATIONS

The Government of Luxembourg should:

- ☐ Assess the cost-benefits of support for energy efficiency measures. In particular, the government should put in place a framework to measure the outcome of the programme to improve energy efficiency in existing buildings.

- ☐ Encourage the *Fédération des Industriels Luxembourgeois* (FEDIL) to continue the voluntary agreement with industry and to extend the agreement to other economic sectors and improve the monitoring system.
  - ☐ Develop and implement a comprehensive climate change mitigation plan with concrete measures in order to start getting current GHG levels on track towards meeting Kyoto commitments.
  - ☐ Continue to seek solutions at a regional level, i.e. with neighbouring countries, to reduce energy consumption in the transport sector.
-



## OIL

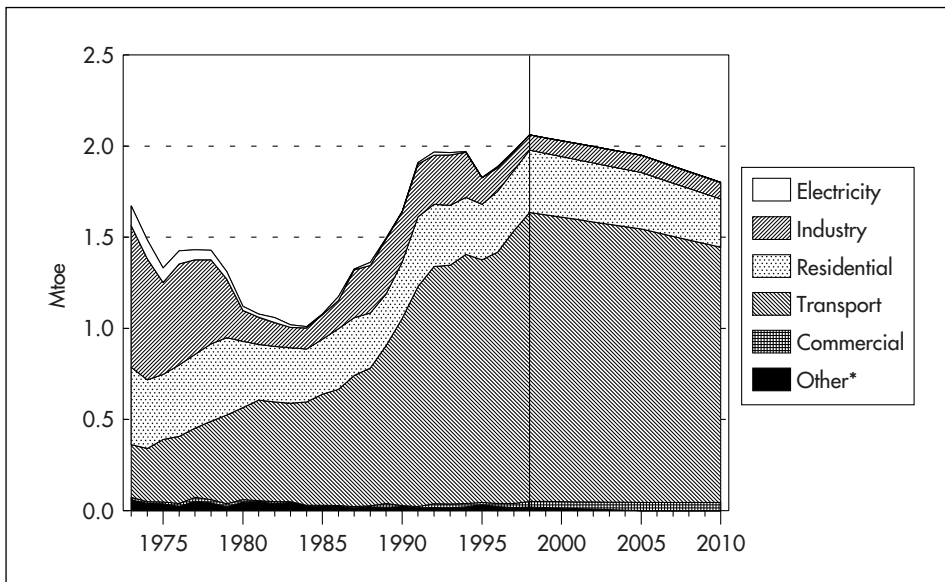
## INTRODUCTION

The oil sector in Luxembourg is unique among IEA countries in that Luxembourg neither produces nor refines any oil. Yet, its oil economy is far out of proportion to local use, especially regarding transportation fuels. Because of lower taxes than its neighbours on gasoline and diesel fuel, motorists and truckers often fill their tanks in Luxembourg to fuel their travels across Europe.

## MARKET TRENDS

Total oil supply increased rapidly from 1984 to 1991 (9.5% per year) with the increase of consumption in the transport sector (Figure 19). Between 1991 and 1995, oil supply increased modestly, reflecting the flattening-out of oil consumption in the transport sector and the reduction of consumption in industry in 1994 and 1995. It increased again between 1995 and 1998 due to the sharp increase of consumption in the transport sector, which in 1998 accounted for more than 75% of final oil consumption.

*Figure 19*  
**Oil Supply by Sector, 1973-2010**



\* includes own use in the transformation sector and distribution losses.

Sources: *Energy Balances of OECD Countries*, IEA/OECD Paris, 1999, and country submission.

The increase in oil “consumption” in the transport sector is explained mostly by the increase in the number of non-resident drivers refuelling in Luxembourg to benefit from lower prices (see Chapter 3). However, because of an increase in gasoline and diesel taxation in Luxembourg in 1993 and 1994, the differential of taxation between Luxembourg and its neighbouring countries decreased. As a consequence, this reduced the benefits of refuelling in Luxembourg and automotive fuel consumption decreased in 1995. Purchases started to increase again when taxes continued to increase in neighbouring countries but not in Luxembourg, once again augmenting the tax differential in favour of Luxembourg. Table 10 shows estimates of fuels consumed abroad made by the Ministry of Environment for the calculation of domestic CO<sub>2</sub> emissions caused by fuels consumed abroad (see also Chapter 4). It is apparent that most of the automotive fuels sold in Luxembourg, in particular LPG, is consumed outside the country.

*Table 10*  
**Fuel Consumption in the Transport Sector\*,**  
**Including Fuel Consumed Abroad, 1997**  
 (Tonnes)

	<i>Total Fuel Sales</i>	<i>Consumption in Luxembourg</i>	<i>Consumption Abroad</i>	<i>Consumption Abroad/Total (%)</i>
Gasoline	542,030	226,335	315,695	58.3
Diesel	656,300	155,280	501,020	76.3
LPG	1,190	225	965	81.1
<b>Total</b>	<b>1,199,520</b>	<b>381,840</b>	<b>817,680</b>	<b>68.2</b>

\* excluding aviation fuels.

Source: Ministry of Environment.

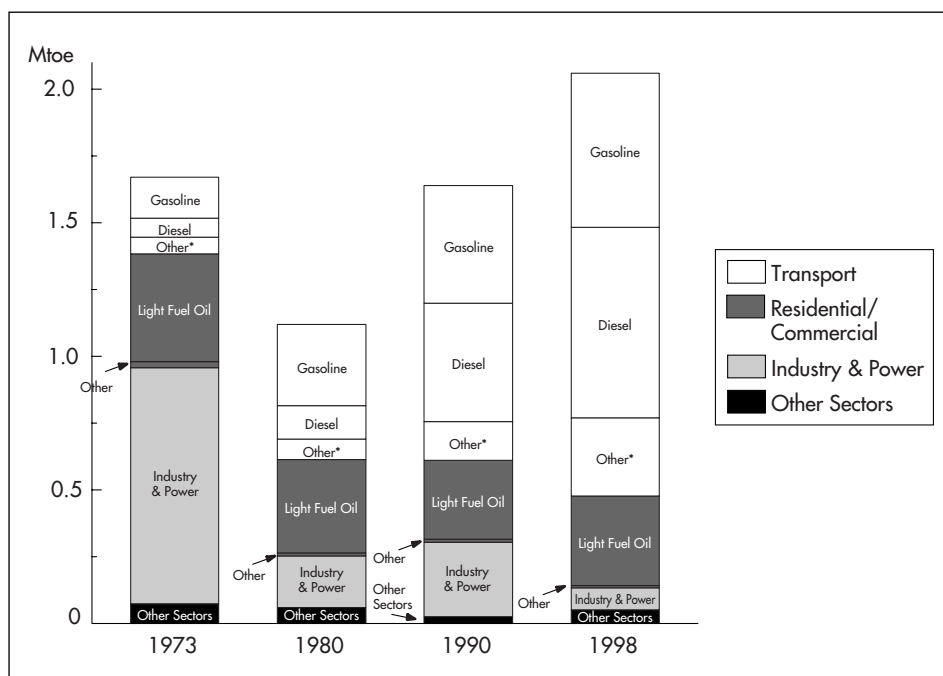
Because of the importance of road transport, diesel is the major fuel sold in Luxembourg (Figure 20). There is considerable refuelling of commercial trucking in Luxembourg as it lies along major north-south and east-west truck routes. Diesel used in passenger cars benefits from the relatively high percentage of diesel cars in neighbouring France.

Official forecasts indicate a decrease in total oil sales, in particular after 2005, and a decrease in all sectors: industry, residential, commercial and also transport. In industry and the residential/commercial sector, natural gas is expected to replace oil. In transport, the Ministry of Economic Affairs expects that increased harmonisation of excise taxes at EU level will reduce the number of drivers refuelling in Luxembourg while domestic consumption will stabilise.

## TRANSPORT AND DISTRIBUTION

As indicated above, Luxembourg is not an oil producer and has no refineries. All oil products are imported, mostly from Belgium (78% in 1998) and the Netherlands

**Figure 20**  
**Oil Products Consumption, 1973-1998**



\* includes LPG and aviation fuels.

Source: *Energy Balances of OECD Countries*, IEA/OECD Paris, 1999.

(13.6%). Products are increasingly imported by road, which has the highest share at the expense of rail and river (Table 11), because transport by truck is more flexible.

**Table 11**  
**Oil Products Imports by Means, 1998**  
(Million tonnes)

	<i>Road</i>	<i>Rail</i>	<i>Barge</i>	<i>CEPS</i>	<i>Total</i>
Gasoline	288,417	177,014	88,327	0	553,758
Gasoil/Diesel	519,818	428,418	180,325	0	1,128,561
Jet Fuel	0	0	0	276,162	276,162
Heavy Fuel Oil*	5,699	176	0	0	5,875
Bitumen	3,369	0	0	0	3,369
<b>Total</b>	<b>817,303</b>	<b>605,608</b>	<b>268,652</b>	<b>276,162</b>	<b>1,967,725</b>

CEPS: Central Europe Pipeline System.

\* low sulphur heavy fuel oil. There are no imports and no consumption of high sulphur heavy fuel oil.

Source: Office Commercial du Ravitaillement.

Luxembourg had 254 service stations in 1998. The number of inland stations has decreased (Table 12). The main reason is that owners have preferred to close service stations rather than invest to meet the new 1995 environmental regulations applied to service stations. The number of oil products distributors is also decreasing. In 1999, there were 15 companies distributing oil products in Luxembourg; 12 of them owned service stations. The eight largest ones, Shell, TotalFina, Aral, Q8, Esso, BP, Texaco and Seca accounted for around 80% of the sales of oil products.

*Table 12*  
**Gasoline and Automotive Diesel Sales per Service Station, 1993 and 1998**

1993					1998			
	<i>Number Stations</i>	<i>Sales (cm)</i>	<i>Share of the Market (%)</i>	<i>Sales per Station (cm)</i>	<i>Number Stations</i>	<i>Sales (cm)</i>	<i>Share of the Market (%)</i>	<i>Sales per Station (cm)</i>
<b>Border*</b>								
Gasoline	115	382,980	56.5	3,330	115	410,719	56.9	3,571
Diesel	116	222,529	35.1	1,918	117	251,403	33.9	2,149
<b>Motorway</b>								
Gasoline	6	60,439	8.9	10,073	8**	92,520	12.8	11,565
Diesel	6	300,567	47.4	50,095	8**	376,676	50.7	47,085
<b>Inland</b>								
Gasoline	192	234,266	34.6	1,220	129	219,192	30.3	1,699
Diesel	192	110,557	17.4	576	129	114,295	15.4	886
<b>Total</b>								
<b>Gasoline</b>	<b>313</b>	<b>677,685</b>	<b>100</b>	<b>2,165</b>	<b>252</b>	<b>722,431</b>	<b>100</b>	<b>2,867</b>
<b>Diesel</b>	<b>314</b>	<b>633,653</b>	<b>100</b>	<b>2,018</b>	<b>254</b>	<b>742,374</b>	<b>100</b>	<b>2,923</b>

\* service stations situated in "communes" at the border with sales above 1,500 cm.

\*\* Shell, Q8 and Texaco each have two service stations.

Source: Office Commercial du Ravitaillement.

## OIL PRICING POLICY

The government sets a ceiling on gasoline, automotive diesel, heating oil and LPG prices<sup>9</sup>. The pricing formula adds a standard cost of transport from Antwerp to Luxembourg, a standard distribution margin<sup>10</sup> and the cost of compulsory storage to the published price of oil products at Rotterdam. These different costs are determined by the government after discussion with the oil companies (*Groupement Pétrolier Luxembourgeois*).

9. This system does not exist for heavy fuel oil, whose consumption is decreasing quickly, and for kerosene.

10. This margin was increased in 1995 to allow investments to meet the new environmental standards applied to service stations.

The government decides when the maximum prices change according to price variations at Rotterdam. In general, prices are revised after consultation with oil companies when prices at Rotterdam change by 25/30 cents within two weeks. There are some eight to ten such changes per year. Companies set their prices at or close to the maximum level, with the exception of small independent retailers who set prices below that level.

## EMERGENCY STOCKS AND EMERGENCY RESPONSE MEASURES

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### General

Since Luxembourg is totally dependent on oil imports, with 70% of stocks held abroad, it is particularly vulnerable to international oil supply disruption. The stock situation in Luxembourg has been of concern to all IEA countries, especially to Luxembourg's neighbours.

In order to ensure security of supply, and to improve the security of aviation kerosene supply in particular, the government has a plan to rent storage facilities connected with the Central Europe Pipeline System (CEPS). In this connection, the Belgian military forces have obtained the approval of the Central Europe Operating Agency (CEOA) for non-military use of facilities, which would enhance supply security.

In addition, in accordance with IEA rules, refuelling with jet fuel will no longer be considered under exports.

### Emergency Response Policy

In order to ensure sufficient stocks to meet the IEA commitment, the government plans to change the legal framework, notably concerning:

- Creation of a stockholding agency.
- Increasing storage capacity for oil products generally.
- Stocking of aviation fuel, in particular.

### Emergency Organisation

The National Emergency Sharing Organisation (NESO) is established on an informal basis under the authority of the Minister of Economic Affairs. The Ministry of Economic Affairs is in charge of the administrative co-ordination, legal regulation and control of stocks, as well as data collection and transmission to the IEA.



Reflecting the small size of the country and the pricing system for oil products, a permanent relationship exists between the Administration and the association of oil-importing companies. This relationship can easily be strengthened in emergency situations and industry experts would also be involved in the NESO activities.

Allocation procedures are as follows:

- The NESO will contact companies individually and ask them to provide it with the necessary information.
- Since important amounts of stocks are stored at the refineries of their parent companies, it is necessary to schedule joint cargoes with the authorisation of the NESO concerned (Belgium, Germany and Netherlands).
- Every company participates in allocation procedures in proportion to its market share at the national level.

## Emergency Reserves

### Policies and Legal Instruments

Under the laws of 22 September 1982 and 8 December 1981, legal authority for drawdown of stocks would be given to the government. For the moment, only company-held stocks exist. In the case of co-ordinated stockdraw, a decree would forbid imports of oil products, except for stocks held abroad under bilateral agreements.

Luxembourg has bilateral agreements with Belgium, France, Germany and the Netherlands. Stocks held in these countries on behalf of Luxembourg companies have to be certified by the local authorities at the beginning of each quarter. Notifications are sent to the Ministry of Economic Affairs. On request of the minister, the authorities of the host country verify the existence and the amount of the stocks.

### Stockholding and Maintenance

The decree of 31 October 1973 defines a compulsory stock level for Luxembourg of 90 days of the previous year's consumption, including 45 days of gasoline and 55 days of distillates. The decree also defines penalties for failure to meet requirements. Since the penalties are too harsh to be accepted, the current legislation is not effective. The government therefore plans to amend the existing legislation to ensure adequate supply and compliance with the International Emergency Programme (IEP) commitment.

Having not met its 90 days of net imports IEP obligation for several years, Luxembourg improved its emergency reserve situation in the late 1990s. However the situation deteriorated since late 1999 and total oil stocks were at the level of 85 days of net imports on 1 April 2000. The Government of Luxembourg is being strongly encouraged to improve the situation by the IEA's Governing Board. The recent tightening of regulations for aviation fuel suppliers should help Luxembourg to meet the IEP obligation.

## CRITIQUE

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Luxembourg is totally dependent on oil products imports. Its oil sector is basically all retail. Imports and sales have increased dramatically over time, mostly because an increasing number of drivers refuel in Luxembourg to benefit from much lower prices than in neighbouring countries.

Maintaining a price differential with neighbouring countries allows Luxembourg to attract more consumers and increases state revenue from the tax due to volume, contrary to other countries where increases in fuel taxation increase the revenues from the tax despite possible volume losses. It is however recommended that fuel taxes also aim at internalising the external cost of using energy in order to lead to undistorted energy prices. It is therefore welcome that the government is considering an energy tax (see Chapter 3). This would lead to an increase in taxes which will reduce fiscal distortions with neighbouring countries and it is welcome that the Ministry of Economic Affairs expects that increased harmonisation of excise taxes at EU level will reduce the number of drivers refuelling in Luxembourg.

The government also sets price ceilings on the most important oil products, as for some other goods. The government wants to avoid possible increases in oil prices which would damage Luxembourg's economy, as all salaries are indexed on inflation. Also this system may prevent abuses of dominant position where competition is restricted. For instance, companies situated on the motorways may be tempted to increase the pre-tax price of oil products as long as the price differential with neighbouring countries remains attractive for foreign drivers.

Efficient competition keeps domestic prices close to those of international markets and encourages companies to decrease costs of supply, thus allowing them to reduce sale prices. Therefore, the government should rely on market forces, which are more efficient than government policies to keep oil product prices low. When abolishing the price ceiling on oil products, the government must ensure that competition authorities have enough power to investigate possible cases of abuse of dominant position or cartel activity.

## RECOMMENDATIONS

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The Government of Luxembourg should:

- ☐ Address automotive fuel tax distortion by better internalising the external cost of using oil products in taxes.
  - ☐ Remove price ceilings on gasoline, diesel, heating oil and LPG and ensure that competition authorities have enough power to track down those guilty of anti-competitive practices.
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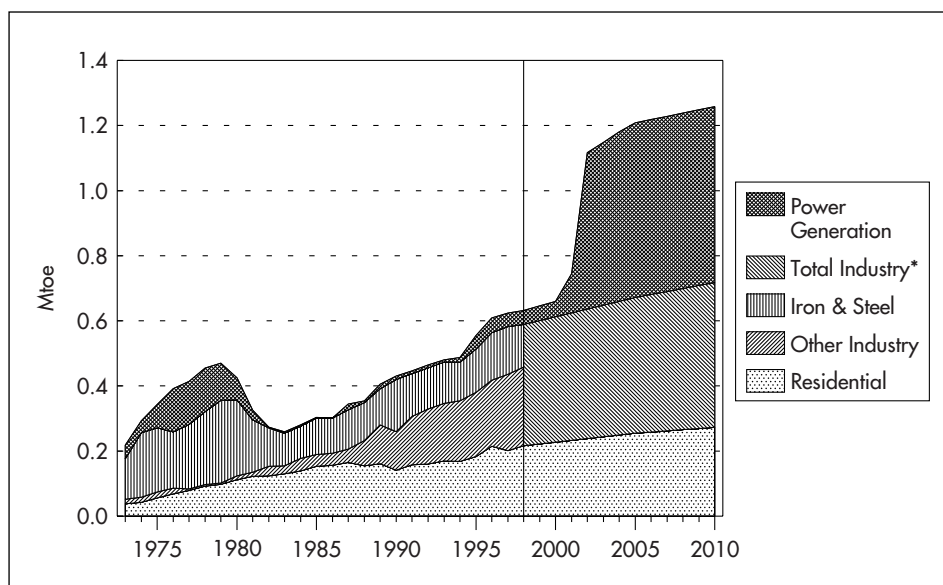
# NATURAL GAS

## CONSUMPTION

Natural gas consumption and imports started in 1972. In 1998, gas supply amounted to 0.6 Mtoe, i.e. 19% of total energy supply. Final consumption of gas was 18% of total final consumption of energy. Natural gas was mostly used in industry (more than 35% of gas used in industry in 1998 was in the iron and steel industry) and the residential/commercial sector and has developed in electricity generation, mainly in co-generation (Figure 21 and Table 13). In 1998, around 40% of households were supplied with gas.

The recent evolution in gas distribution by client is shown in Table 13.

*Figure 21*  
**Natural Gas Consumption by Sector, 1973-2010**



\* only Total Industry is available in the forecasts.

Notes: The figure does not include other transformation and energy sector consumption and transport. Government's forecasts. IEA estimates between 1998 and 2004.

Sources: *Energy Balances of OECD Countries*, IEA/OECD Paris, 1999, and country submission.

Natural gas supply is expected to increase to 1.47 Mtoe in 2010, mostly in electricity generation as a Combined Cycle Gas Turbine (CCGT) is expected to be completed in 2001 and industrial co-generation is expected to continue to develop (see Chapter 7). Natural gas consumption is expected to continue to increase, replacing oil products in the residential/commercial sector and, to a lesser extent, in the industrial sector.

*Table 13*  
**Natural Gas Sales by Category of Clients, 1993-1998**  
 (GJ PCS)

	1993	1994	1995	1996	1997	1998
Total Distribution*	9,932,265	9,749,655	10,797,724	12,685,099	12,037,695	13,043,726
Ville de Luxembourg	4,708,776	4,544,960	4,951,896	5,719,118	5,483,747	5,815,437
Sudgaz	4,373,623	4,277,168	4,684,028	5,404,811	5,014,340	5,400,749
Ville de Dudelange	713,806	685,027	734,585	842,686	754,918	787,570
Luxgaz	136,060	242,500	427,215	718,484	784,689	1,039,970
Iron and Steel	7,446,991	7,350,209	8,240,100	8,121,654	9,058,611	7,858,269
Other Industries**	5,007,962	5,523,137	6,780,430	7,507,643	7,974,458	8,430,361
<b>Total</b>	<b>22,387,219</b>	<b>22,623,002</b>	<b>25,818,253</b>	<b>28,314,396</b>	<b>29,070,764</b>	<b>29,332,355</b>

\* including supply to co-generators and small industries.

\*\* including supply to co-generators

Note: Data may differ from IEA statistics.

Source: Société de Transport de Gaz.

## INDUSTRY STRUCTURE AND IMPORTS

The *Société de Transport de Gaz* (SOTEG) was created in 1974 to import and transport natural gas and develop the transport grid. It has a *de facto* monopoly on gas imports and transport. In 1999, the length of its transmission grid was 320 km (Figure 22).

Until 1997, SOTEG was owned 50% by the state and 50% by ARBED, the iron and steel industry. Since 1998, SOTEG has been owned 31% by the state, 20% by ARBED, 20% by Ruhrgas, 19% by CEGEDEL and 10% by Saarferngas.

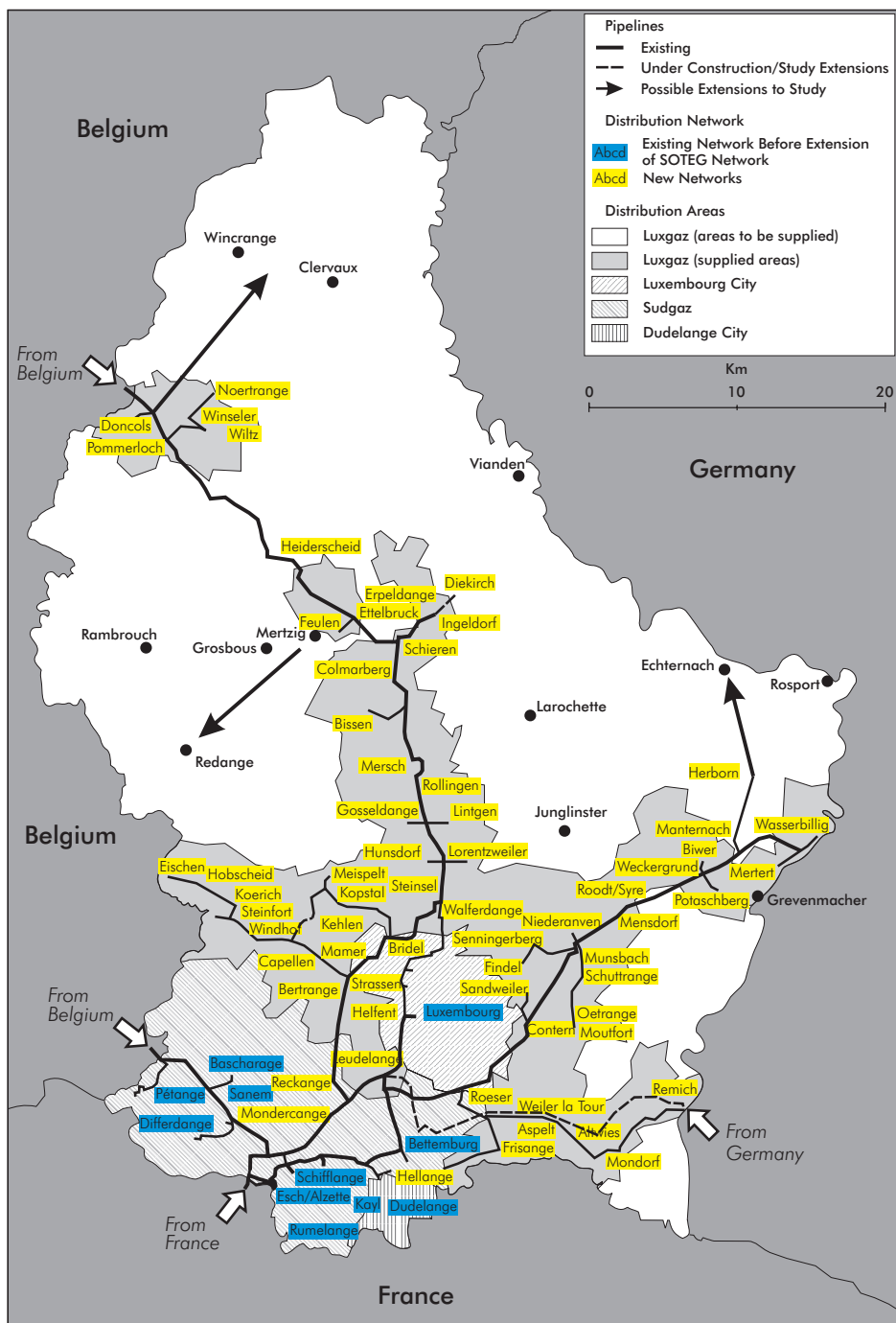
SOTEG is in charge of providing gas to its customers at the lowest possible price. There is no natural gas storage.

In 1995, SOTEG signed a contract with Distrigaz of Belgium for the supply of a maximum of 180,000 cubic metres per hour from October 1995 to 30 September 2010. The contract is flexible enough to supply the market in case of large seasonal fluctuation in demand. In 1991, SOTEG also signed a contract with Gaz de France for the supply of a maximum of 20,000 cubic metres per hour. This contract is renewed every year.

As of 2001, Ruhrgas will supply SOTEG with natural gas to supply the new CCGT. The contract extends until 2015 and provides for the following conditions:

- A maximum of 67,000 cm per day was contracted for the supply of the CCGT. Gas price fluctuations are linked to coal prices. Gas price is set at a level to make electricity produced by the CCGT competitive with imported electricity. If the

**Figure 22**  
**Map of the Natural Gas Infrastructure and Distribution Areas in Luxembourg**



Source: SOTEG.

price of gas is not satisfactory, SOTEG can renegotiate the conditions of the contract or change supplier.

- Some additional gas can be purchased.

A new gas pipeline is being built to import gas from Germany. The new pipeline is to be completed in July 2000. It runs from Mittelbrunn in Germany to Leudelange in Luxembourg. Its length in Luxembourg is 28 kms. In Germany this pipeline can be connected to Megal, which is used to transport gas from Russia. The new gas pipeline will have a capacity of 300,000 cm per day, well above the capacity necessary to transport the existing contracted gas, in order to be able to transport increased gas quantities in the future.

Natural gas is distributed by four distribution entities which have a *de facto* monopoly in their concession area (Figure 22). These entities are managed directly by municipalities which also undertake several other activities such as public transport and water distribution. Some municipalities participate directly in investments in gas distribution. The distribution entities are:

- *Usine à gaz de la Ville de Luxembourg*, which distributes gas in the municipalities of Luxembourg, Strassen and Hespérange. It is owned by the municipality of Luxembourg.
- *Usine à gaz de la Ville de Dudelange*, owned by the municipality of Dudelange.
- Sudgaz, owned by 15 municipalities. In 1998, it distributed gas to 35,000 clients in these municipalities and its distribution grid was 800 km.
- Luxgaz Distribution created in 1990. It is 30% owned by 30 municipalities, each of them having a stake of 1%; 30% owned by the state; 25% by SOTEG; 13% by CEGEDEL and 2% by the *Fédération des Installateurs*. At the end of 1998, Luxgaz's grid was 440 km. The company is extending its grid in the north of the country.

In 2000, the distribution grid is expected to extend to about 50% of the municipalities, covering 85% of the population.

## NATURAL GAS PRICES TO FINAL CONSUMERS

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SOTEG sets gas prices to its customers (distributors and industries with consumption above 2 mcm) on a cost plus basis. Prices set for the distributors are the same. Gas prices for industries may be negotiated when the gas price at a cost plus basis is not competitive with other fuels.

Natural gas prices for households and businesses below an annual consumption of 2 mcm<sup>11</sup> are set by the municipal companies based on the price of heating oil.

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11. In practice the 2 mcm dividing point separating industrial consumers is more flexible than described here.

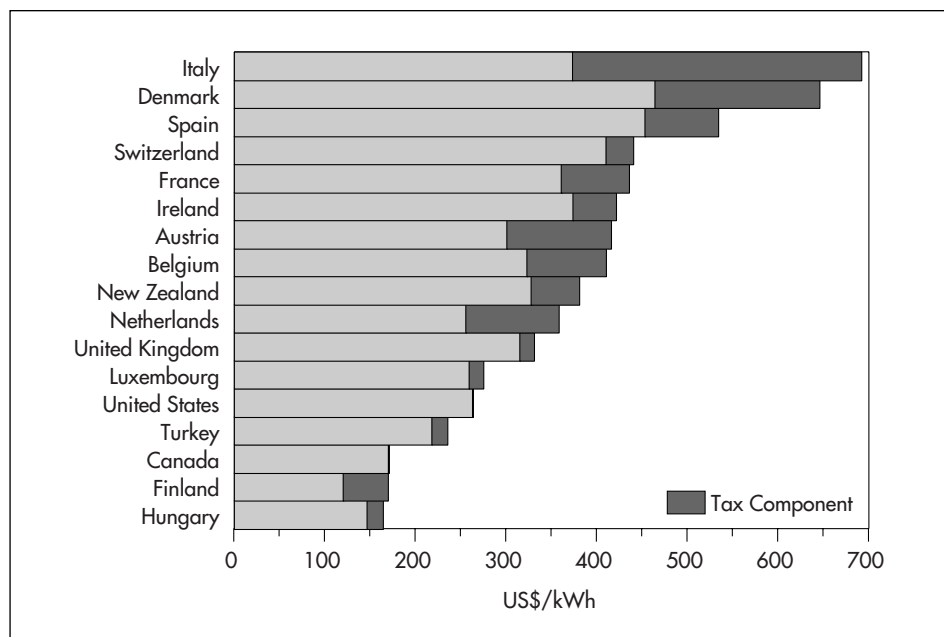
However, gas prices to final consumers differ among distributors. On average, natural gas prices for households are slightly higher than heating oil prices (Table 14). Natural gas prices for households are lower than the IEA average (Figure 23).

*Table 14*  
**Energy Prices in the Household Sector, 1995-1999**  
(LUF per toe)

	<i>Light Fuel Oil</i>		<i>Natural Gas</i>		<i>Electricity</i>	
	<i>Incl. Tax</i>	<i>Excl. Tax</i>	<i>Incl. Tax</i>	<i>Excl. Tax</i>	<i>Incl. Tax</i>	<i>Excl. Tax</i>
1995	8,855	7,662	9,767	9,214	50,116	47,209
1996	10,307	8,958	10,993	10,371	51,163	48,256
1997	10,883	9,473	11,789	11,121	51,512	48,605
1998	8,899	7,703	11,070	10,443	51,744	48,837
1999	9,744	8,456	10,284	9,702	51,977	49,070

Source: *Energy Prices and Taxes*, IEA/OECD Paris, 2000.

*Figure 23*  
**Natural Gas Prices and Taxes in IEA Countries (Household Sector), 1998**



Note: Data not available for Australia, Germany, Greece, Japan, Norway, Portugal and Sweden. Ex-tax price for the United States.

Source: *Energy Prices and Taxes*, IEA/OECD Paris, 1999.



In 1998, the *Conseil National de l'Énergie* (see Chapter 3) issued a study on electricity and gas prices in comparison with the other EU countries, using Eurostat statistics. With regard to natural gas, the main findings were as follows:

- In 1997, natural gas prices for households were much lower than the EU average because of lower taxes; pre-tax prices of gas were slightly lower than the EU average. This is consistent with IEA statistics (Figure 23).
- Natural gas prices for large industrial consumers were much higher than the EU average. Prices for smaller industrial consumers were below the EU average.
- Between 1993 and 1997, natural gas prices increased at a higher rate than in the rest of the EU.

## IMPLEMENTATION OF THE EC DIRECTIVE ON THE INTERNAL NATURAL GAS MARKET

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In July 2000, the government adopted a bill to implement the European Directive on the Internal Natural Gas Market. It expects that a law will be voted by the end of 2000.

At a first stage, consumers with a consumption of more than 25 mcm per year will be allowed to choose their suppliers. This represents six consumers in Luxembourg and 42% of domestic natural gas consumption. To meet the requirement of the EC directive, SOTEG has unbundled its transport and sales accounts.

## CRITIQUE

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Natural gas consumption has increased rapidly, but supplies have been diversified, increasing Luxembourg's security of energy supply. In particular, the gas pipeline being built from Germany will further diversify supplies. The substitution of natural gas for oil products will help in reducing CO<sub>2</sub> emissions.

As Luxembourg is increasing its international pipeline connections and capacity, consumers will increasingly be able to benefit from competition in the European market and purchase gas on the best possible terms. The first stage of liberalisation will involve only a limited number of industrial consumers. However, these large consumers are the ones which can benefit the most from competition, since natural gas prices for large industrial consumers in 1997 were higher than the EU average.

SOTEG has rightly prepared for this new environment. Recent gas contracts have been adapted to meet future developments by including greater flexibility, with an extended possibility to renegotiate the contracts regularly. SOTEG, which has some state shareholding, should also continue to be free in its strategic decision-making

and management so that it can compete on a level playing field with the other suppliers in the market.

According to the European gas directive, the government had to introduce competition in this sector by August 2000. In its reform, the government should focus on the issues described below.

Companies need to compete on a level playing field. Therefore, several measures need to be taken. Separating gas distribution entities from municipal administrations and making them separate legal entities with separate accounts should be a first step. These companies should also be corporatised, i.e. managed according to the same rules as private companies, free of political interference in their corporate strategies, investment decisions and daily management. In addition, accounts for gas trading (purchases and sales), transmission, distribution and non-gas activities should be unbundled. The unbundling of accounts will also prevent revenue from one activity subsidising another activity.

The introduction of competition may create incentives for cross-subsidies favouring eligible customers over captive customers. Therefore, captive customers should be protected against such practices.

The proper functioning of the natural gas market will depend on the effectiveness of the regulator. The regulator should be strong enough and have adequate resources to uncover any possible anti-competitive practice, to take appropriate measures and to deal with customers' complaints.

Setting transparent and non-discriminatory tariffs for access to the grid is important for the development of competition. Regulated third party access may be the most appropriate system as distances are short and this system may simplify tariff-setting procedures.

Given the geographic situation of the country, consumers in Luxembourg will be able to choose between SOTEG and other suppliers outside the country. Therefore, the proper functioning of competition will also depend on regulations adopted outside Luxembourg. For instance, if tariffs and conditions for use of the pipelines prevent newcomers from competing on a level playing field, Luxembourg consumers' freedom of choice will be limited. Cross-border tariffs should also not impede competition with foreign suppliers.

## RECOMMENDATIONS

The Government of Luxembourg should:

- ☐ Implement competition in the gas market as soon as possible.
- ☐ Maintain an arm's-length relationship with companies having public ownership.

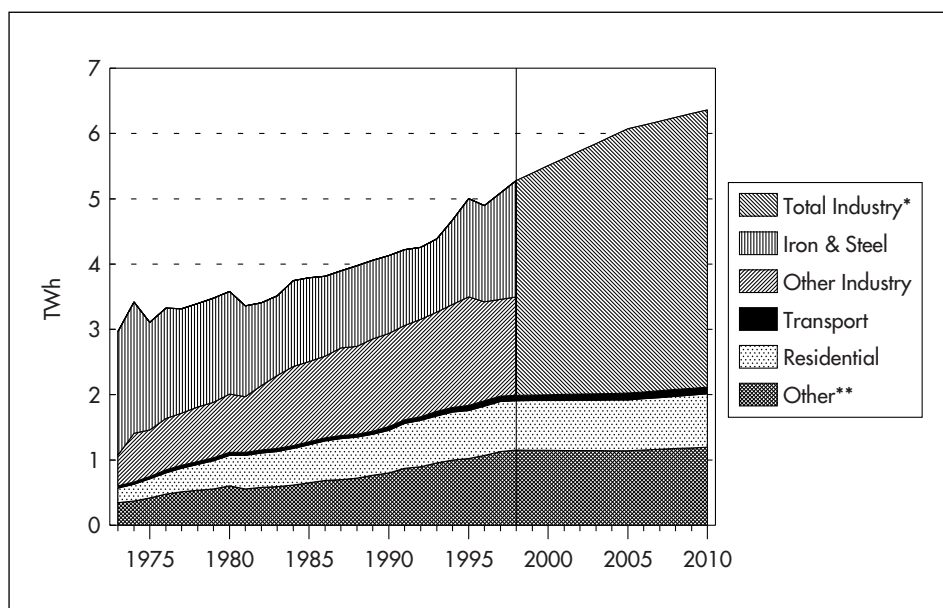
- ☐ When introducing competition, corporatise the small municipal entities and require the separation of accounts for all activities of gas suppliers.
  - ☐ Set up a regulator with adequate powers, duties and resources to supervise and control the prices charged to final consumers and to deal with customers' complaints.
  - ☐ Co-operate with neighbouring countries for the introduction of effective competition in the natural gas sector at regional level.
-

# ELECTRICITY AND RENEWABLE ENERGY

## DEMAND AND SUPPLY TRENDS

In 1998, electricity final consumption was 5.3 TWh. Industry was the largest energy consumer with 61% of electricity consumption (Figure 24). The increase in electricity consumption has accelerated since the beginning of the 1990s because of the replacement of blast furnaces by electric arcs in the iron and steel industry.

*Figure 24*  
**Electricity Consumption by Sector, 1973-2010**



\* only Total Industry is available in the forecasts.

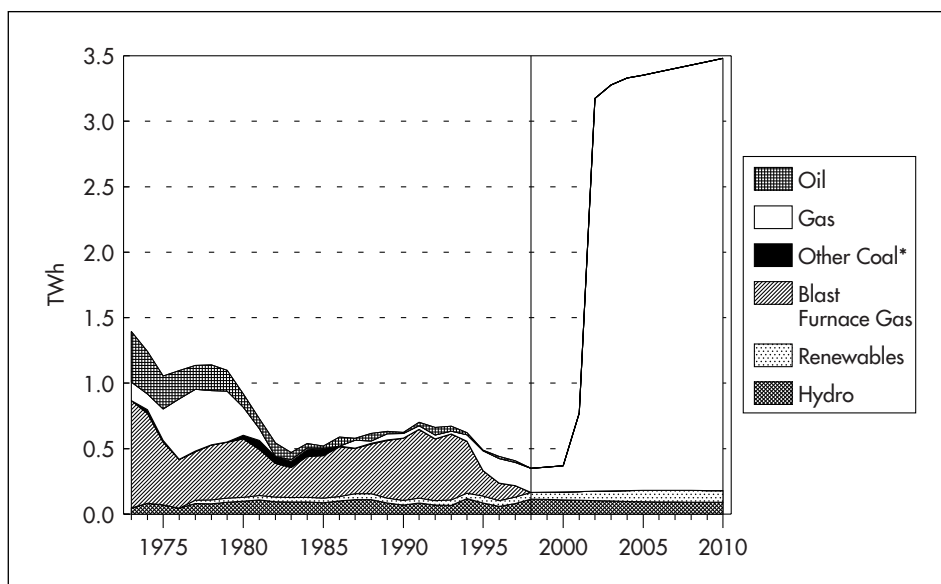
\*\* includes commercial, public service and agricultural sectors.

Sources: *Energy Balances of OECD Countries*, IEA/OECD Paris, 1999, and country submission.

In 1998, electricity generation was 315 GWh net (Figure 25 and Table 15, which also shows provisional data for 1999). Gas from blast furnaces used to provide for the major part of electricity generation. Because of the reduction in production capacity of this industry in the 1970s and 80s and the introduction of electric arc furnaces as of December 1993, electricity generation from blast furnaces decreased and stopped in 1998.

Domestic generation is mostly from co-generators, which produced 184.3 GWh in 1998 (see below for more disaggregated data). At the end of 1998, there were

*Figure 25*  
**Electricity Generation by Fuel, 1973-2010**



\* includes hard coal, brown coal, patent fuel, coke oven coke and lignite briquettes (BKB).

Note: Government's forecasts. IEA estimates between 1998 and 2004.

Sources: *Energy Balances of OECD Countries*, IEA/OECD Paris, 1999, and country submission.

20 non-industrial co-generation facilities with a total capacity of 14.5 MW. Industrial co-generation decreased in the iron and steel industry after the restructuring of this sector but increased in the chemical and petrochemical and transport equipment industries.

In 1998, domestic hydro electricity generation amounted to 94.8 GWh. This excludes electricity from the pumped storage plant of Vianden (see box).

### **The Vianden Pumped Storage Plant**

In 1998, the 1,100 MW Vianden pumped storage plant produced 924 GWh. Vianden imports electricity from RWE in Germany to pump water and exports electricity directly to Germany (RWE) for peak demand. Vianden is not connected to Luxembourg's grid and its electricity generation does not appear in Luxembourg's balances.

Vianden is owned and operated by SEO. In 1998, Vianden imported 1,272 GWh and exported 923 GWh.

*Table 15*  
**Breakdown of Electricity Generation and Imports, 1998-1999**  
(GWh)

	1998	1999
<b>Generation</b>		
Hydro		
State-owned	48.3	45.6
SEO*	41.9	44.8
Private	4.6	5.1
<b>Total</b>	<b>94.8</b>	<b>95.5</b>
Thermal		
SIDOR**	30.3	34.6
Other	0.5	0.4
<b>Total</b>	<b>30.8</b>	<b>35</b>
Co-generation	184.3	190.8
Wind energy	4.6	17.1
Biogas	0.5	1
Solar PV	0	0
<b>Total Generation</b>	<b>314.9</b>	<b>339.4</b>
<b>Net imports</b>		
From RWE	3,186.8	3,298.1
From Électrabel	1,930.6	1,998.2
<b>Total</b>	<b>5,117.4</b>	<b>5,296.3</b>

\* Société Électrique de l'Our; hydro power plants excluding Vianden.

\*\* electricity from wastes.

Note: Data may differ from IEA statistics.

Source: Department of Energy, Ministry of Economic Affairs.

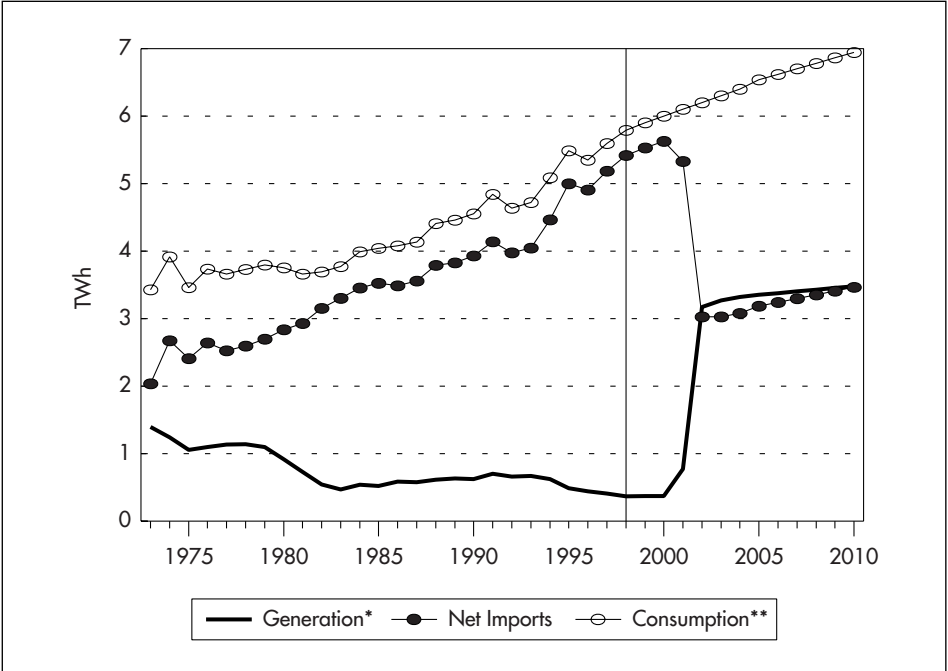
Non-hydro renewable energy sources are mostly used in electricity generation. In 1998, energy from renewable sources was as follows:

- Municipal waste was used to generate 30.3 GWh of electricity, i.e. the majority of Luxembourg's non-hydro renewable electricity supply.
- Electricity generation from wind energy started in January 1997 with the connection of four 500 kW wind turbines to the grid. In 1998, they provided 4.6 GWh to the grid. In January 1999, 16 wind turbines with a total capacity of 9.2 MW were connected to the grid. In January 2000, 10 MW of capacity were installed.
- Electricity generation from biogas started in 1997 and was 0.5 GWh in 1998. Use of wood in the domestic sector was estimated to be 15 ktoe in 1998, i.e. 0.5% of final energy consumption.
- Two photovoltaic stations of 3 kW each were commissioned in September 1993.

# ELECTRICITY TRADE

Electricity imports have been increasing to fill the gap between decreasing domestic generation and increasing demand (Figure 26). In 1998, imports amounted to 6 TWh, i.e. 4.1 TWh from Germany and 1.9 TWh from Belgium; Luxembourg exported the 923 GWh production from Vianden to Germany. Net imports amounted to more than 95% of final consumption.

Figure 26  
Electricity Consumption, Generation and Net Imports, 1973-2010



\* gross production minus amount of electricity produced in pumped storage plants.  
\*\* final consumption, transmission and distribution losses, and energy sector consumption.  
Note: Government's forecasts. IEA estimates between 1998 and 2004.  
Sources: *Energy Balances of OECD Countries*, IEA/OECD Paris, 1999, and country submission.

# INDUSTRY STRUCTURE

## Société Électrique de l'Our (SEO)

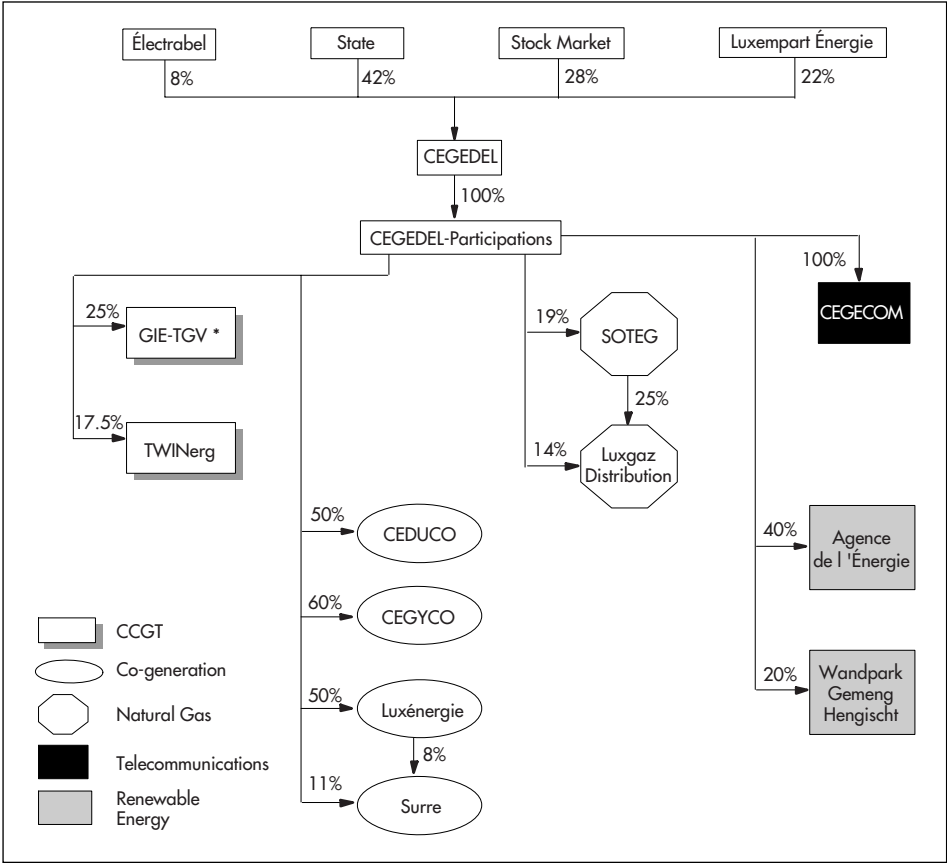
The *Société Électrique de l'Our* generated 41.9 GWh in 1998, in addition to the production of Vianden. SEO is owned 40% by the state, 40% by the German utility RWE and 20% by private investors. SEO owns three hydro plants in Luxembourg on the Moselle with a total capacity of 16.8 MW, and in 1994 acquired four hydro plants in France on the Moselle with a total capacity of 10.4 MW. SEO created a subsidiary,

CEDECEL, to own and manage these plants. SEO sells its domestic production to CEGEDEL and its production in France (36.9 GWh in 1998) to EDF<sup>12</sup>.

## The Compagnie Grand-ducale de l'Électricité (CEGEDEL)

In 1999, the *Compagnie Grand-ducale de l'Électricité* was owned 42% by the state, 8% by the Belgian utility Électrabel, 22% by Luxempart Énergie (a group of private investors comprised of 51% Luxempart and 49% RWE Energie) and 28% was floated on the stock market (Figure 27). The company's activities are defined in a concession

Figure 27  
CEGEDEL's Shareholding, 1999



\* the GIE-TGV is in charge of promotion for the building of the Combined Cycle Gas Turbine (CCGT- see below). The shareholders are ARBED, CEGEDEL-Participations, SOTEL and the state, each having 25%.  
Sources: CEGEDEL and IEA.

12. In addition, SEO has shares in companies involved in wind energy and in the *Agence de l'Énergie* (see Chapter 4).



contract with the government, which was extended in 1995. CEGEDEL has to ensure safe and competitive supplies to end-users. The 1995 contract covers the period up to 2007 and defines CEGEDEL's public service missions (e.g. obligation to supply electricity) and actions to protect the environment, to adapt to the liberalisation of the electricity market, to diversify its activities and in particular to encourage co-generation. In 1998, the whole group comprised 480 people.

CEGEDEL is not an electricity producer. It buys and transports electricity. Electricity supplies are as follows:

- CEGEDEL is supplied with electricity from RWE Energie. SEO purchases electricity from RWE Energie and resells it to CEGEDEL. A new contract between SEO and RWE will come into force in January 2001. The supply contract allows renegotiating some contractual elements every year and within a period of three years all contractual elements can be renegotiated. In 1998, imports from RWE amounted to 89.9% of CEGEDEL's total supply.
- Through CEGEDEL-Participations, CEGEDEL has been increasingly involved in industrial co-generation. A joint venture called CEDUCO was created with Du Pont de Nemours for the construction and management of a co-generation plant. The electricity sold to CEGEDEL amounted to 2.4% of the company's supplies. The electricity sold to CEGEDEL by the joint venture with Goodyear called CEGYCO amounted to 1.7% of CEGEDEL's supplies. In addition, Luxénergie (owned 60.08% by CEGEDEL-Participations) builds and manages co-generation systems for households and tertiary activities. Co-generation amounted to 5.2% of CEGEDEL's electricity supplies.
- CEGEDEL also buys electricity from SEO's electricity plants (1.2% of total supplies in 1998), from three hydro plants owned by the state<sup>13</sup> and from privately-owned micro power plants (1.4%). Electricity from hydro amounted to 2.7% of CEGEDEL's electricity supplies.
- CEGEDEL buys electricity from SIDOR (electricity from waste) for a total of 30.3 GWh in 1998, i.e. 0.8% of supplies, from SOTEL (see below-1.3% of the total), from wind energy (4.6 GWh, 0.1% of the total) and biogas (0.5 GWh).

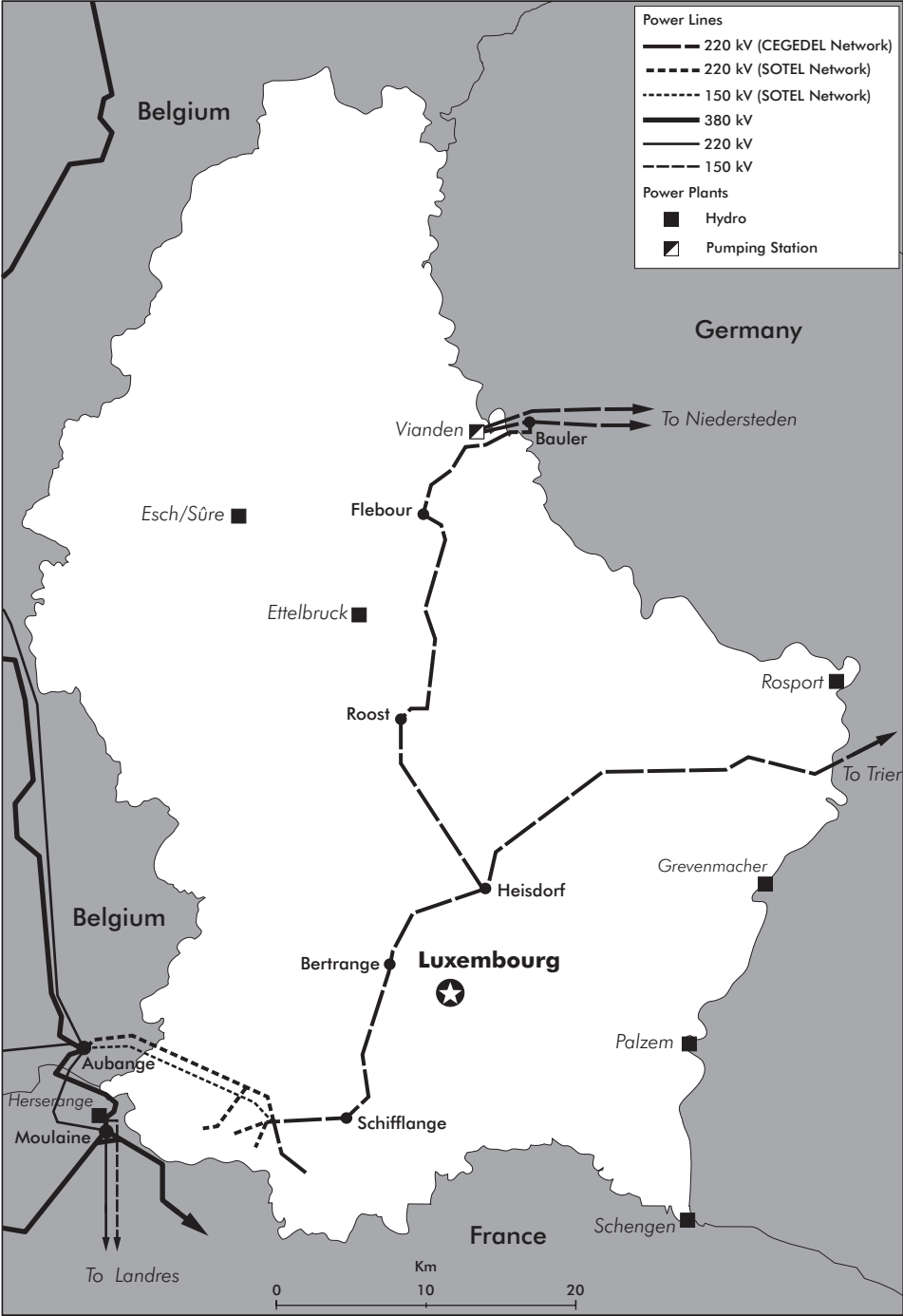
In 1998, CEGEDEL sold 3.4 TWh, i.e. 64% of final electricity consumption; 2 TWh were sold on the 65 kV lines to 36 industrial clients and distributors; 674 GWh were sold on the 20 kV lines to 1,945 clients and distributors and 756 GWh were sold to 129,352 clients on the low-voltage grid. No final consumer was supplied through the 220 kV line, which is designed only to import electricity from Germany.

CEGEDEL's grid was 6,404 km in 1998, of which 3,851 km are low-voltage, 2,462 km are 65 kV and 20 kV and 91 km are 220 kV (Figure 28). The company has been making considerable investments to bury lines. In 1998, 3,387 km of low-voltage grid and 792 km of the 20 kV lines were buried.

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13. Esch-sur-Sûre (10.7 MW), Rosport (6.2 MW), Ettelbruck (86 kW). They produced 48.3 GWh in 1998.

*Figure 28*  
**Map of the Electricity Grid**



Sources: CEGEDEL, SOTEL.

## The Société de Transport de l'Électricité (SOTEL)

The *Société de Transport de l'Électricité* (SOTEL) is a co-operative company directly and indirectly owned 77% by ARBED, the iron and steel company; 21% by EDF and 6% by others (including Électrabel, 2%). SOTEL imports electricity from Belgium under a contract with Électrabel that runs until the end of 2000. A new contract has been signed with Électrabel for the total supply of SOTEL. However, a certain amount of the needs of SOTEL can be supplied also by a third party in order to take advantage of the liberalised electricity market. In 1998, Électrabel supplied 96.8% of SOTEL's needs, followed by EDF (2.3%) and CEGEDEL (0.9%). The company is not in charge of the public service and does not buy electricity from co-generators and renewable energy. It supplies electricity to ARBED's steel mills and to the railway company. In 1998, SOTEL supplied 1.9 TWh, an 11.8% increase over 1997, mainly due to the commissioning of the electric arc furnace of Esch-Beval.

## Two Different Grids

SOTEL receives electricity from Électrabel through different medium-voltage lines and is on the regulation range (e.g. voltage, frequency) of Électrabel. CEGEDEL receives electricity from RWE through the 220 kV line and is on the regulation range of RWE. SOTEL's and CEGEDEL's grids are not connected but they share a double back-up line of 220 kV each. This allows some power exchanges of a limited quantity and for a limited period of time. The two companies can decide to interconnect the two lines under a mutual agreement<sup>14</sup>.

## Distribution companies

There are 11 independent distributors. Eight of them are owned by the municipalities and three are in private hands. Distributors have a concession which gives them a monopoly in their area of distribution. The two major distribution companies, the town of Luxembourg and the town of Esch-sur-Alzette, distribute respectively 670 GWh and 100 GWh per year.

## MEASURES TO PROMOTE ELECTRICITY FROM CO-GENERATION AND RENEWABLE SOURCES

In 1991, the government established the *Agence de l'Énergie* (see Chapter 3), which estimates *inter alia* the potentials of renewable energies. It completed a wind map in 1994 and estimated wind potential at 1% of electricity consumption. It managed the retrofitting of micro hydropower plants with financing from the EU.

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14. A permanent interconnection between SOTEL's and CEGEDEL's grids would mean interconnecting with a 220 kV line RWE and Électrabel's grids, which are already interconnected with 400 kV lines. This would create problems in maintaining the stability of the whole grid.

The National Plan for Sustainable Development of 1998 (see Chapter 3) sets the following targets:

- To increase the share of renewable energy in the public system (electricity distributed by CEGEDEL) from 2.5% in 1997 to 5% in 2010.
- To increase the share of co-generation in electricity consumption from 7% in 1997 to 15% in 2010.
- To increase the share of electricity autoproduction in total electricity consumption in the public system from 10% in 1997 to 45% in 2005.
- To double the share of wood in final energy consumption from 0.5% to 1% in 2010.

A ministerial regulation of 1994 provided for support for co-generation and renewable energy. A grant to non-industrial co-generators of LUF 6,000 per kW for the installation of the first 5,000 kW was provided. This came to an end in 1997, when the ceiling was reached. Industrial co-generators are eligible for special depreciation allowances in the framework of the 1997 law (see Chapter 4). Wind turbines with a capacity of less than 50 kW have received a direct subsidy of 25% of the investment cost. There is a limitation of LUF 60,000 per turbine. For wind turbines with a capacity above 50 kW, a subsidy of LUF 3,000 per kW with a maximum of LUF 6 million was granted to the first five projects. Projects involving solar energy, biomass, biogas and heat pumps in the residential sector have received a subsidy of 25% of the investment cost with a ceiling of LUF 60,000 per house. In the non-residential sector, projects have received 25% of the investment cost with a ceiling of LUF 1.5 million for each installation.

Until the end of 1999, a ministerial regulation of 1997 provided for a subsidy of 25% of the costs of the connection of existing houses to the heat grid. The ceiling was LUF 25,000 per connection.

In addition to these direct subsidies, the Grand Ducal regulation of 1994 sets the buy-back tariff for electricity from non-industrial co-generation and renewable sources. CEGEDEL (but not SOTEL) has a purchase obligation. The buy-back tariff for co-generators with a capacity of 1 to 150 kW averages LUF 2.95 per kWh; from 151 to 1,500 kW, the tariff averages LUF 2.3 per kWh for day supplies and LUF 1.2 per kWh for night supplies. There is an annual subsidy of LUF 4,500 per kW installed if electricity is supplied during peak load. Electricity plants using renewable sources receive the same payments as co-generators. Electricity from wind energy and solar PV receives an extra bonus of LUF 1 per kWh.

CEGEDEL purchases hydro-electricity from SEO at a price which allows SEO to cover its costs of production and to make a profit. Electricity from state and private micro power plants is purchased at a price set by the Grand Ducal regulation of 1994, which also allows the plants to recover their costs.

## THE COMBINED CYCLE GAS TURBINE (CCGT) IN ESCH-SUR-ALZETTE

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In 1998, the GIE-TGV launched a call for tender for the construction and management of a 350 MW CCGT located near Esch-sur-Alzette. The contract was attributed to Électrabel. The company TWINerg, owned 65% by Électrabel, 17.5% by CEGEDEL and 17.5% by ARBED (Figure 14 in Chapter 3 and Figure 27), was created to build and manage the plant. A capacity of 100 MW has been dedicated to CEGEDEL, another 100 MW to SOTEL and the remaining 150 MW to the Belgian grid. Electricity destined for CEGEDEL will transit through Germany and Belgium without extra costs for CEGEDEL. Completion is expected by the end of 2001. The CCGT is expected to produce around 3 TWh and to supply about 40% of Luxembourg's electricity consumption.

SOTEL and CEGEDEL signed a 15-year take-or-pay contract with TWINerg for the supply of electricity on base load. TWINerg signed a back-up contract with Électrabel.

The CCGT will be supplied with gas from SOTEG under a contract between SOTEG and Ruhrgas (the major German gas company), which sets gas prices allowing the CCGT to sell electricity at a competitive price (see Chapter 6).

The CCGT is expected to produce 190 MW<sub>th</sub> of heat, of which 150 MW<sub>th</sub> would be dedicated to industry's consumption and 40 MW<sub>th</sub> could supply a district heating grid. However, the high costs of investments and operation for this district heating system would lead to a price well above that of natural gas. A task force has been created to evaluate the feasibility of this project, including the possibility of attracting industrial clients.

## FORECASTS

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According to the Department of Energy in the Ministry of Economic Affairs, electricity consumption will continue to increase. Consumption in the residential sector will stabilise, mostly because households are already equipped with a large number of electric appliances and there is not much room for additional equipment and electricity consumption. Electricity consumption in industry will continue to increase.

Electricity generation is expected to increase from 370 GWh gross in 1998 to 3.35 TWh gross in 2005. By 2010, electricity net imports are expected to be reduced by one-third from the level of 1998.

## ELECTRICITY TARIFFS AND PRICES

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The *Accord Tarifaire* of 1991 sets CEGEDEL's prices to end-users on the different voltage levels (65 kV, 20 kV, and 400 V) according to the price of imported electricity and based on a cost plus calculation. CEGEDEL sells electricity to the distributors at the same price.

Electricity prices are the same for the same category of consumers except in the municipalities of Luxembourg, Esch-sur-Alzette, Echternach and the commune of Steinfort, which set their own prices to final consumers. A new *Accord Tarifaire* has to be established taking into account the introduction of competition in the electricity market. Electricity consumers can complain about high electricity prices to the *Office des Prix*<sup>15</sup>.

There is a reduced VAT on electricity of 6%. There is no excise tax on electricity consumption. However, a concession fee of 6% in 1999 was applied to CEGEDEL until the vote of the electricity law in May 2000. This tax was partially designed to finance social security, e.g. the health care system. It has been replaced by a general tax on electricity consumption (see below).

In 1998, the *Conseil National de l'Énergie* (see Chapter 3) issued a study on electricity and gas prices in comparison with the other EU countries, using Eurostat statistics. With regard to electricity, the main findings were as follows:

- In 1997, electricity prices for households in Luxembourg were lower than the average in EU countries. However, pre-tax prices were much higher than the EU average. This is consistent with IEA statistics (Figure 29).
- Electricity prices for small and medium industries in Luxembourg were higher than the average for EU countries; prices for large industries were on average lower.
- Since 1993, pre-tax electricity prices for industries and households in Luxembourg have increased at a faster pace than in the rest of the EU, including its neighbours (Belgium, France and Germany).

In 1998, CEGEDEL decreased its prices by 0.6% for its 65 kV customers and by 0.2% for its 20 kV customers. It increased prices by 0.3% for its small consumers.

## INTRODUCTION OF COMPETITION

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In May 2000, Parliament voted a law to implement the European Directive on the Internal Electricity Market.

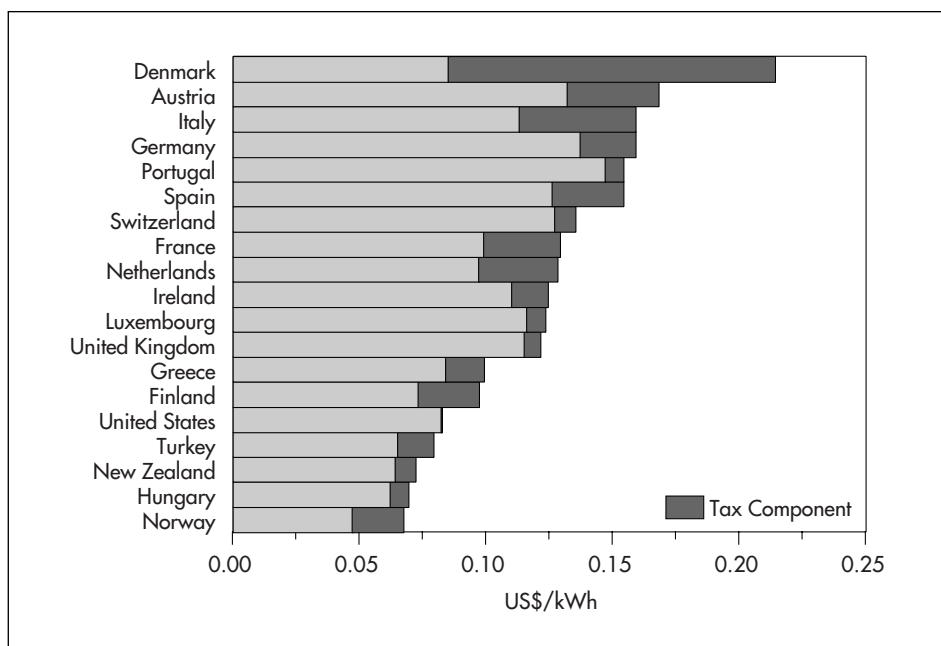
### Public Service Obligations and Tax

The law provides for public service obligations, i.e. the equality of treatment within the same category of eligible customers, information on energy savings and environmental protection as well as the purchase obligation for electricity from renewable sources and co-generation. The government, after advice from the

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15. The *Office des Prix* is in charge of controlling prices in Luxembourg. The office receives complaints from consumers and can set lower prices if they are above the normal price resulting from the market. In some sectors (e.g. furniture), the office sets the retail margins.

*Figure 29*  
**Electricity Prices and Taxes for Households in IEA Countries, 1998**



Note: Data not available for Australia, Belgium, Canada, Japan and Sweden. Ex-tax price for the United States.

Source: *Energy Prices and Taxes*, IEA/OECD Paris, 1999.

regulator, will decide on which companies these obligations fall. A system managed by the regulator has been set up to compensate companies for the extra costs of the public service.

The CEGEDEL tax has been replaced by a tax on electricity consumption which applies to every consumer including autoproducers<sup>16</sup> but excluding electricity production for pumped storage. The rate is set annually by Parliament and can vary according to consumption: below one GWh, between one GWh and 100 GWh and above 100 GWh<sup>17</sup>. The tax can be refunded for industrial customers if they prove they are implementing energy savings.

## Market Opening

Until December 2000, the market will be opened for consumers<sup>18</sup> of more than 100 GWh per year. The market will be opened for consumers of more than 20 GWh

16. Autoproducers are defined as electricity consumers that produce electricity mainly for themselves.

17. All steel mills and three clients of CEGEDEL consume more than 100 GWh.

18. Consumers per site of consumption, including co-generators.

between January 2001 and December 2002, then for consumers of more than 9 GWh between January 2003 and December 2004. After that date, the market will be opened for consumers of more than one GWh. CEGEDEL and SOTEL both have three eligible consumers of more than 40 GWh. These six consumers accounted for 39% of electricity consumption in Luxembourg in 1997. There are 200 consumers of more than 20 GWh. In January 2001, about 56% of the market will be opened, 72% will be opened in January 2003 and 75% in January 2005. Distributors of more than 90 GWh per year will be eligible as of January 2003 and distributors of more than one GWh will be eligible as of January 2005.

The minister in charge can refuse an import contract with a generator outside the European area if that generator does not meet the normal safety and technical standards.

## Access to the Grid and the Grid Operator

Regulated third party access is established. The grid operator publishes the tariffs for access to the grid, the use of the grid, as well as ancillary services. The minister approves the tariffs after consultation with the regulator. The minister may impose maximum or minimum tariffs. Tariffs should be transparent and non-discriminatory.

The owners of the transmission companies are also the operators but they will be able to choose another operator. Grid operators have to provide all operators of the other grids the information necessary for efficient management of the whole transportation system. The owners of the distribution grid<sup>19</sup> are also its operators.

The law states that the operators must avoid any discrimination between users and in particular should avoid favouring affiliate companies or shareholders.

## The Regulator

A regulator is set up to deal with abuses of dominant position. The regulator looks *inter alia* into complaints from eligible consumers about supply contracts, negotiations and access to the grid. Decisions are subject to appeal to the administrative court. The regulatory body is the *Institut Luxembourgeois de Régulation*. The regulator is headed by seven members nominated by the government.

## Unbundling

Integrated companies need to unbundle the accounts of generation, transmission, distribution and non-electricity activities. Luxembourg decided not to benefit from

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19. The distribution lines are defined as those below 110 kV.



the possibility of a partial derogation from the EC directive allowing distribution and production accounts to stay integrated but to spin off transport accounts (see box).

### **The EU Commission Partially Approved the Luxembourg Transitional Regime Concerning the Electricity Directive**

The Government of Luxembourg requested a transitional regime for CEGEDEL because the possible loss of customers could create financial difficulties in view of the supply agreement with RWE. Luxembourg also asked whether CEGEDEL could derogate from accounting obligations (separate accounts for generation, transmission, distribution and non-electricity activities) because of the administrative burden and because the result would have a negative impact on CEGEDEL's commercial position (CEGEDEL's competitors would be able to identify its average costs of electricity supplies).

In July 1999, the EU Commission decided that:

- No transitional regime could be set up. The loss of market share cannot be a sufficient reason to justify a transitional regime.
- At least the accounts of CEGEDEL's transmission activity must be published in the notes to the overall accounts (CEGEDEL has to publish the transport accounts for the 220 kV and the 65 kV lines). This derogation remains in effect until 31 December 2001.

## **Authorisation Procedure**

An authorisation procedure has been set up for the building of new generation plants. The ministry in charge of energy may consider the following criteria before authorising a new plant: security of supply, site issues, protection of the environment, energy efficiency of the new plant, the nature of the input fuel, the technical ability and the financial capacity of the company which will build the plant.

## **CRITIQUE**

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### **Electricity**

The commissioning of the CCGT will reduce dependence on electricity imports. TWINerg's clients expect that this commissioning will allow them to foster competition among potential suppliers of CEGEDEL and SOTEL and will put further pressure on electricity purchase prices.

The Government of Luxembourg has made great efforts to implement the EC Directive on the Internal Electricity Market and has worked to reach a consensus among all major players for its implementation. The government expects that Luxembourg will benefit from this liberalisation process as it will allow consumers to buy electricity at lower prices.

The introduction of competition and the building of the CCGT is bringing major changes for electricity suppliers. The electricity industry is preparing itself for competition. CEGEDEL has started to separate accounts for transport, distribution and sales. SOTEL's and CEGEDEL's electricity contracts have been renegotiated to be more flexible.

State ownership in electricity companies is an inheritance of the past and has been reduced over time. The government does not consider that it interferes in the daily management and the strategic decisions of the companies. Non-interference is necessary as electricity companies should compete on a level playing field and no extra burden should be put on national companies.

Municipal electricity companies are not separated from the administration of the municipalities. These entities should be separated from the administration, corporatised (i.e. managed according to the same rules as private companies) and their accounts should be unbundled. This is necessary to ensure that prices to their customers are cost-reflective and that the revenues from electricity supplies are not used to subsidise other activities, such as public transport.

The regulator needs to ensure that there are no cross-subsidies in favour of eligible consumers in Luxembourg. Therefore, the regulator should be given adequate powers, duties and resources to supervise and control the prices charged to final consumers and to deal with customers' complaints.

The owner of the grid may also be the operator. This facilitates the management of Luxembourg's small grid but does not facilitate neutrality. Under these conditions, it is welcome that, according to the new law, the grid operator has to avoid any discrimination between the users of the grid and in particular should avoid favouring affiliate companies or shareholders. The regulator should have enough means to ensure that no such discrimination occurs.

The government should consider allowing independent traders to buy and sell electricity as a means of fostering competition. Further opening of the electricity market could also be envisaged so that all consumers can become eligible and benefit from competition in the electricity sector.

Because of the small size of Luxembourg, eligible consumers will have a large possible choice among SOTEL, CEGEDEL and foreign suppliers. Therefore, the proper functioning of competition will also depend on regulations and practices outside the country, e.g. tariffs and conditions for the use of the grid (which should allow newcomers and incumbents to compete on a level playing field), and on the prevention of anti-competitive practices such as cross-subsidies in favour of eligible

consumers. For instance, if suppliers outside Luxembourg could use cross-subsidies to provide electricity to eligible consumers in Luxembourg at a price below the cost of supply, this would be unfair competition for CEGEDEL and SOTEL. Cross-border tariffs should also not impede competition with foreign suppliers<sup>20</sup>.

The existence of two different grids is the result of the historical development of the industry in Luxembourg. Connection of the grids of SOTEL and CEGEDEL is possible although technically it seems not easy to achieve. This connection, however, may have benefits for Luxembourg's consumers, such as improvement in electricity dispatch. It is therefore welcome that the two companies may agree to build this interconnection.

## Renewable Sources of Energy and Co-generation

Electricity generation from renewable energy and co-generation has expanded rapidly due to generous buy-back tariffs and direct subsidies. In 1998, the capacity of wind energy per number of inhabitants was the highest in Europe. The cost of support to renewable energy and co-generation through the buy-back tariff has increased rapidly and has been paid only by CEGEDEL's clients. The Department of Energy forecasts that this support could rise from an estimated LUF 200 million in 1999 (LUF 100 million for co-generation) to LUF 700 million in 2010 if the same tariff and regulation are maintained.

It is welcome that, according to the new electricity law, the cost of support to renewable energies will fall on all consumers. The government should ensure that such support does not put too heavy a burden on electricity consumers. This could be achieved through improving the cost-effectiveness of the support. The best way to ensure that energy production from renewable sources is sustainable in the long term is to ensure that their production costs decrease to a level which makes them competitive. Luxembourg's measures to promote renewable energies should put downward pressure on their costs. The buy-back tariff could be revised to include incentives to reduce generation costs. The purchase contracts for small hydro plants at a price which covers their generation costs should be revised in order to include more incentives to reduce costs. Competition among renewable energies could be introduced, for instance through bidding procedures for the building of electricity generation capacity from renewable energy. In addition, green certificates as a market-based means of promoting renewables could be implemented in Luxembourg, drawing on the experience of other countries.

The *Agence de l'Énergie* has done valuable work in advising municipalities about renewable energy and energy efficiency and by publishing studies on the feasibility of projects (including their cost-effectiveness). Therefore, its activity should be encouraged, in particular in the field of information dissemination.

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20. The Florence process aims at setting a single tariff formula for cross-border deals.

The government should consider phasing out subsidies to co-generation. This mature technology does not need any subsidy. Co-generation plants, if properly sized for the heat load, should be highly efficient and therefore not require subsidies. Electricity from co-generation should be purchased at market prices. This phasing-out should also contribute to reducing electricity prices to final consumers.

District heating is also developing. It is important that infrastructures be built with economic rationale. It is therefore welcome that the district heating grid from the new CCGT will not be built if it would provide heat to customers at a much higher price than from other fuels.

In the domestic sector, heat competes with other fuels such as natural gas. However, once the district heating system is installed, consumers may be unwilling to change equipment when the price of heat rises above that of other fuels. Therefore, a competent body should ensure that heat prices are cost-reflective and that customers are not charged too high a price.

## RECOMMENDATIONS

The Government of Luxembourg should:

### Electricity

- ☐ Maintain an arm's-length relationship with the companies having state ownership in the electricity sector so that they have the same freedom to operate in the market as any other businesses.
- ☐ Corporatise the small municipal entities and require the separation of accounts for all their activities.
- ☐ Co-operate with neighbouring countries for the introduction of effective competition in the electricity sector at regional level.
- ☐ Ensure that the regulator is given adequate powers, duties and resources to supervise and control the prices charged to final consumers, to deal with customers' complaints and to ensure that there is no discrimination between the users of the grid.
- ☐ Encourage companies to explore further the cost-benefits of closer co-operation between the two grids.

## Renewable Sources of Energy

- ☐ Ensure that the measures used to promote renewable energies put downward pressure on their costs by introducing competition among them and ensure that these measures do not put too heavy a burden on final consumers.
- ☐ Encourage the activities of the *Agence de l'Énergie*, i.e. carrying out studies on renewable sources and energy efficiency and advising municipalities.

## Co-generation

- ☐ Consider phasing out subsidies to co-generation, as this is a mature technology.
  - ☐ Give adequate powers to a competent body to supervise and control heating prices.
-

## ANNEX

## ENERGY BALANCES AND KEY STATISTICAL DATA

Unit: Mtoe

<b>SUPPLY</b>							
	1973	1990	1997	1998	2005	2010	2015
<b>TOTAL PRODUCTION</b>	<b>0.00</b>	<b>0.03</b>	<b>0.05</b>	<b>0.05</b>	<b>0.05</b>	<b>0.05</b>	..
Coal <sup>1</sup>	–	–	–	–	–	–	..
Oil	..	–	–	–	–	–	..
Gas	–	–	–	–	–	–	..
Comb. Renewables & Wastes <sup>2</sup>	–	0.03	0.04	0.04	0.04	0.04	..
Nuclear	–	–	–	–	–	–	..
Hydro	0.00	0.01	0.01	0.01	0.01	0.01	..
Geothermal	–	–	–	–	–	–	..
Solar/Wind/Other <sup>3</sup>	–	–	–	–	0.00	0.00	..
<b>TOTAL NET IMPORTS<sup>4</sup></b>	<b>4.51</b>	<b>3.55</b>	<b>3.35</b>	<b>3.31</b>	<b>3.74</b>	<b>3.67</b>	..
Coal <sup>1</sup>	–	–	–	–	–	–	..
Exports	2.44	1.13	0.31	0.11	0.10	0.10	..
Imports	2.44	1.13	0.31	0.11	0.10	0.10	..
Oil	0.01	0.01	0.01	0.02	–	–	..
Exports	1.69	1.67	1.98	2.12	1.95	1.80	..
Imports	–	–	–	–	–	–	..
Bunkers	1.67	1.65	1.97	2.10	1.95	1.80	..
Gas	0.22	0.43	0.63	0.63	1.42	1.47	..
Exports	0.22	0.43	0.63	0.63	1.42	1.47	..
Imports	0.07	0.06	0.07	0.08	0.18	0.18	..
Electricity	0.24	0.40	0.52	0.55	0.46	0.48	..
Exports	0.18	0.34	0.45	0.47	0.27	0.30	..
Imports	–	–	–	–	–	–	..
<b>TOTAL STOCK CHANGES</b>	<b>–0.01</b>	<b>–0.01</b>	<b>0.01</b>	<b>–0.04</b>	<b>–</b>	<b>–</b>	..
<b>TOTAL SUPPLY (TPES)</b>	<b>4.51</b>	<b>3.57</b>	<b>3.40</b>	<b>3.32</b>	<b>3.79</b>	<b>3.72</b>	..
Coal <sup>1</sup>	2.44	1.13	0.31	0.11	0.10	0.10	..
Oil	1.67	1.64	1.97	2.06	1.95	1.80	..
Gas	0.22	0.43	0.63	0.63	1.42	1.47	..
Comb. Renewables & Wastes <sup>2</sup>	–	0.03	0.04	0.04	0.04	0.04	..
Nuclear	–	–	–	–	–	–	..
Hydro	0.00	0.01	0.01	0.01	0.01	0.01	..
Geothermal	–	–	–	–	–	–	..
Solar/Wind/Other <sup>3</sup>	–	–	–	–	0.00	0.00	..
Electricity Trade <sup>5</sup>	0.18	0.34	0.45	0.47	0.27	0.30	..
<b>Shares (%)</b>							
Coal	54.1	31.7	9.2	3.4	2.6	2.7	..
Oil	37.1	46.0	58.0	62.1	51.4	48.4	..
Gas	4.9	12.0	18.4	19.1	37.3	39.5	..
Comb. Renewables & Wastes	–	0.7	1.1	1.1	1.1	1.1	..
Nuclear	–	–	–	–	–	–	..
Hydro	0.1	0.2	0.2	0.3	0.2	0.2	..
Geothermal	–	–	–	–	–	–	..
Solar/Wind/Other	–	–	–	–	0.1	0.1	..
Electricity Trade	3.9	9.5	13.1	14.0	7.2	8.0	..

0 is negligible. – is nil. .. is not available.

Please note: Forecast GDP figures are based on the 1993 submission.

<b>DEMAND</b>							
<b>FINAL CONSUMPTION BY SECTOR</b>							
	1973	1990	1997	1998	2005	2010	2015
<b>TFC</b>	<b>2.94</b>	<b>2.96</b>	<b>3.22</b>	<b>3.26</b>	<b>3.31</b>	<b>3.24</b>	..
Blast Furnace Gas	0.74	0.20	0.04	—	—	—	..
Other Coal <sup>1</sup>	0.24	0.35	0.15	0.11	0.10	0.10	..
Oil	1.54	1.64	1.97	2.06	1.95	1.80	..
Gas	0.18	0.42	0.58	0.59	0.67	0.72	..
Comb. Renewables & Wastes <sup>2</sup>	—	—	0.02	0.02	0.01	0.01	..
Geothermal	—	—	—	—	—	—	..
Solar/Wind/Other	—	—	—	—	—	—	..
Electricity	0.26	0.36	0.44	0.46	0.52	0.55	..
Heat	—	—	0.01	0.02	0.06	0.06	..
<b>Shares (%)</b>							
Blast Furnace Gas	25.1	6.8	1.2	—	—	—	..
Other Coal	8.1	11.7	4.8	3.5	3.0	3.1	..
Oil	52.1	55.3	61.3	63.2	58.8	55.6	..
Gas	6.0	14.2	18.1	18.1	20.3	22.2	..
Comb. Renewables & Wastes	—	—	0.5	0.5	0.4	0.4	..
Geothermal	—	—	—	—	—	—	..
Solar/Wind/Other	—	—	—	—	—	—	..
Electricity	8.7	12.0	13.7	14.0	15.8	16.9	..
Heat	—	—	0.4	0.7	1.7	1.8	..
<b>TOTAL INDUSTRY<sup>6</sup></b>	<b>2.09</b>	<b>1.34</b>	<b>0.97</b>	<b>0.89</b>	<b>1.00</b>	<b>1.04</b>	..
Blast Furnace Gas	0.74	0.20	0.04	—	—	—	..
Other Coal <sup>1</sup>	0.20	0.34	0.15	0.11	0.10	0.10	..
Oil	0.81	0.30	0.12	0.10	0.10	0.09	..
Gas	0.14	0.28	0.38	0.37	0.42	0.45	..
Comb. Renewables & Wastes <sup>2</sup>	—	—	—	—	—	—	..
Geothermal	—	—	—	—	—	—	..
Solar/Wind/Other	—	—	—	—	—	—	..
Electricity	0.20	0.23	0.27	0.28	0.35	0.37	..
Heat	—	—	0.01	0.02	0.04	0.04	..
<b>Shares (%)</b>							
Blast Furnace Gas	35.4	15.1	3.8	—	—	—	..
Other Coal	9.7	25.3	15.6	12.4	9.6	9.2	..
Oil	38.6	22.0	12.3	11.3	9.5	8.7	..
Gas	6.6	20.8	39.2	42.1	41.7	42.8	..
Comb. Renewables & Wastes	—	—	—	—	—	—	..
Geothermal	—	—	—	—	—	—	..
Solar/Wind/Other	—	—	—	—	—	—	..
Electricity	9.7	16.8	27.9	31.9	34.8	35.1	..
Heat	—	—	1.0	2.1	4.3	4.2	..
<b>TRANSPORT<sup>7</sup></b>	<b>0.29</b>	<b>1.03</b>	<b>1.50</b>	<b>1.59</b>	<b>1.51</b>	<b>1.41</b>	..
<b>TOTAL OTHER SECTORS<sup>8</sup></b>	<b>0.56</b>	<b>0.59</b>	<b>0.74</b>	<b>0.78</b>	<b>0.81</b>	<b>0.79</b>	..
Coal <sup>1</sup>	0.03	0.01	0.00	0.00	0.00	0.00	..
Oil	0.44	0.31	0.35	0.37	0.36	0.31	..
Gas	0.04	0.14	0.20	0.22	0.26	0.27	..
Comb. Renewables & Wastes <sup>2</sup>	—	—	0.02	0.02	0.01	0.01	..
Geothermal	—	—	—	—	—	—	..
Solar/Wind/Other	—	—	—	—	—	—	..
Electricity	0.05	0.13	0.16	0.16	0.17	0.17	..
Heat	—	—	0.00	0.01	0.01	0.02	..
<b>Shares (%)</b>							
Coal	6.1	1.0	0.3	0.3	0.5	0.5	..
Oil	78.4	53.6	47.9	48.1	44.0	39.3	..
Gas	6.8	24.1	27.2	27.9	31.6	34.6	..
Comb. Renewables & Wastes	—	—	2.0	1.9	1.7	1.8	..
Geothermal	—	—	—	—	—	—	..
Solar/Wind/Other	—	—	—	—	—	—	..
Electricity	8.8	21.3	22.1	21.2	20.5	21.9	..
Heat	—	—	0.4	0.6	1.6	1.9	..

<b>DEMAND</b>							
<b>ENERGY TRANSFORMATION AND LOSSES</b>							
	1973	1990	1997	1998	2005	2010	2015
<b>ELECTRICITY GENERATION<sup>9</sup></b>							
INPUT (Mtoe)	0.44	0.20	0.10	0.07	0.58	0.58	..
OUTPUT (Mtoe)	0.12	0.05	0.04	0.03	0.29	0.30	..
(TWh gross)	1.39	0.62	0.41	0.37	3.35	3.48	..
<b>Output Shares (%)</b>							
Blast Furnace Gas	58.8	76.4	21.4	–	–	–	..
Other Coal	–	–	–	–	–	–	..
Oil	27.6	1.4	3.2	–	–	–	..
Gas	10.2	5.4	43.5	55.3	94.6	94.8	..
Comb. Renewables & Wastes	–	5.4	11.5	12.2	1.5	1.4	..
Nuclear	–	–	–	–	–	–	..
Hydro	3.4	11.2	19.7	31.2	2.8	2.6	..
Geothermal	–	–	–	–	–	–	..
Solar/Wind/Other	–	–	0.7	1.4	1.1	1.1	..
<b>TOTAL LOSSES</b>	<b>1.54</b>	<b>0.61</b>	<b>0.19</b>	<b>0.06</b>	<b>0.48</b>	<b>0.48</b>	<b>..</b>
of which:							
Electricity and Heat Generation <sup>10</sup>	0.32	0.14	0.05	0.02	0.23	0.23	..
Other Transformation	1.08	0.41	0.09	–	–	–	..
Own Use and Losses <sup>11</sup>	0.14	0.06	0.05	0.04	0.25	0.25	..
<b>Statistical Differences</b>	<b>0.02</b>	<b>0.00</b>	<b>–0.00</b>	<b>0.00</b>	<b>–</b>	<b>–</b>	<b>..</b>
<b>INDICATORS</b>							
	1973	1990	1997	1998	2005	2010	2015
GDP (billion 1990 US\$)	6.14	10.74	14.97	15.82	18.55	20.78	..
Population (millions)	0.35	0.38	0.42	0.43	0.45	0.49	..
TPES/GDP <sup>12</sup>	0.73	0.33	0.23	0.21	0.20	0.18	..
Energy Production/TPES	0.00	0.01	0.01	0.01	0.01	0.01	..
Per Capita TPES <sup>13</sup>	12.83	9.30	8.08	7.79	8.43	7.65	..
Oil Supply/GDP <sup>12</sup>	0.27	0.15	0.13	0.13	0.11	0.09	..
TFC/GDP <sup>12</sup>	0.48	0.28	0.21	0.21	0.18	0.16	..
Per Capita TFC <sup>13</sup>	8.39	7.70	7.64	7.64	7.36	6.66	..
Energy-related CO <sub>2</sub> Emissions (Mt CO <sub>2</sub> ) <sup>14</sup>	16.3	10.9	8.6	8.1	9.5	9.2	..
CO <sub>2</sub> Emissions from Bunkers (Mt CO <sub>2</sub> )	–	–	–	–	–	–	..
<b>GROWTH RATES (% per year)</b>							
	73–79	79–90	90–97	97–98	98–05	05–10	10–15
TPES	–2.5	–0.8	–0.7	–2.5	1.9	–0.4	..
Coal	–4.6	–4.3	–16.8	–63.8	–1.7	–	..
Oil	–4.0	2.1	2.7	4.4	–0.8	–1.6	..
Gas	13.6	–0.8	5.5	1.1	12.2	0.7	..
Comb. Renewables & Wastes	–	3.0	5.8	–5.4	2.6	–	..
Nuclear	–	–	–	–	–	–	..
Hydro	12.2	–2.6	2.2	42.9	–3.1	–	..
Geothermal	–	–	–	–	–	–	..
Solar/Wind/Other	–	–	–	–	–	5.9	..
TFC	–0.1	0.1	1.2	1.2	0.3	–0.5	..
Electricity Consumption	2.7	1.6	3.2	2.9	2.0	0.9	..
Energy Production	36.6	1.6	5.5	–	2.4	0.4	..
Net Oil Imports	–3.5	1.8	2.5	6.7	–1.0	–1.6	..
GDP	1.3	4.5	4.8	5.7	2.3	2.3	..
Growth in the TPES/GDP Ratio	–3.7	–5.0	–5.3	–7.8	–0.4	–2.6	..
Growth in the TFC/GDP Ratio	–1.3	–4.2	–3.5	–4.3	–2.0	–2.7	..

Please note: Rounding may cause totals to differ from the sum of the elements.



## Footnotes to Energy Balances and Key Statistical Data

1. Includes lignite and peat, except for Finland, Ireland and Sweden. In these three cases, peat is shown separately.
2. Comprises solid biomass and animal products, gas/liquids from biomass, industrial waste and municipal waste. Data are often based on partial surveys and may not be comparable between countries.
3. Other includes tide, wave and ambient heat used in heat pumps.
4. Total net imports include combustible renewables and waste.
5. Total supply of electricity represents net trade. A negative number indicates that exports are greater than imports.
6. Includes non-energy use.
7. Includes less than 1% non-oil fuels.
8. Includes residential, commercial, public service and agricultural sectors.
9. Inputs to electricity generation include inputs to electricity, CHP and heat plants. Output refers only to electricity generation.
10. Losses arising in the production of electricity and heat at public utilities and autoproducers. For non-fossil-fuel electricity generation, theoretical losses are shown based on plant efficiencies of 33% for nuclear, 10% for geothermal and 100% for hydro.
11. Data on “losses” for forecast years often include large statistical differences covering differences between expected supply and demand and mostly do not reflect real expectations on transformation gains and losses.
12. Toe per thousand US dollars at 1990 prices and exchange rates.
13. Toe per person.
14. “Energy-related CO<sub>2</sub> emissions” specifically means CO<sub>2</sub> from the combustion of the fossil fuel components of TPES (i.e. coal and coal products, peat, crude oil and derived products and natural gas), while CO<sub>2</sub> emissions from the remaining components of TPES (i.e. electricity from hydro, other renewables and nuclear) are zero. Emissions from the combustion of biomass-derived fuels are not included, in accordance with the IPCC greenhouse gas inventory methodology. TPES, by definition, excludes international marine bunkers. INC-IX decided in February 1994 that emissions from international marine and aviation bunkers should not be included in national totals but should be reported separately, as far as possible. CO<sub>2</sub> emissions from bunkers are those quantities of fuels delivered for international *marine* bunkers and the emissions arising from their use. Data for deliveries of fuel to international *aviation* bunkers are not generally available to the IEA and, as a result, these emissions have not been deducted from the national totals. Projected emissions for oil and gas are derived by calculating the ratio of emissions to energy use for 1998 and applying this factor to forecast energy supply. Future coal emissions are based on product-specific supply projections and are calculated using the IPCC/OECD emission factors and methodology.

# ANNEX

## INTERNATIONAL ENERGY AGENCY "SHARED GOALS"

The Member countries\* of the International Energy Agency (IEA) seek to create the conditions in which the energy sectors of their economies can make the fullest possible contribution to sustainable economic development and the well-being of their people and of the environment. In formulating energy policies, the establishment of free and open markets is a fundamental point of departure, though energy security and environmental protection need to be given particular emphasis by governments. IEA countries recognise the significance of increasing global interdependence in energy. They therefore seek to promote the effective operation of international energy markets and encourage dialogue with all participants.

In order to secure their objectives they therefore aim to create a policy framework consistent with the following goals:

**1 Diversity, efficiency and flexibility within the energy sector** are basic conditions for longer-term energy security: the fuels used within and across sectors and the sources of those fuels should be as diverse as practicable. Non-fossil fuels, particularly nuclear and hydro power, make a substantial contribution to the energy supply diversity of IEA countries as a group.

**2 Energy systems should have the ability to respond promptly and flexibly to energy emergencies.** In some cases this requires collective mechanisms and action: IEA countries co-operate through the Agency in responding jointly to oil supply emergencies.

**3 The environmentally sustainable provision and use of energy** is central to the achievement of these shared goals. Decision-makers should seek to minimise the adverse environmental impacts of energy activities, just as environmental decisions should take account of the energy consequences. Government interventions should where practicable have regard to the Polluter Pays Principle.

**4 More environmentally acceptable energy sources** need to be encouraged and developed. Clean and efficient use of fossil fuels is essential. The development of economic non-fossil sources is also a priority. A number of

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\* Australia, Austria, Belgium, Canada, Denmark, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Japan, Luxembourg, the Netherlands, New Zealand, Norway, Portugal, Spain, Sweden, Switzerland, Turkey, the United Kingdom, the United States.

IEA Members wish to retain and improve the nuclear option for the future, at the highest available safety standards, because nuclear energy does not emit carbon dioxide. Renewable sources will also have an increasingly important contribution to make.

**5 Improved energy efficiency** can promote both environmental protection and energy security in a cost-effective manner. There are significant opportunities for greater energy efficiency at all stages of the energy cycle from production to consumption. Strong efforts by governments and all energy users are needed to realise these opportunities.

**6 Continued research, development and market deployment of new and improved energy technologies** make a critical contribution to achieving the objectives outlined above. Energy technology policies should complement broader energy policies. International co-operation in the development and dissemination of energy technologies, including industry participation and co-operation with non-Member countries, should be encouraged.

**7 Undistorted energy prices** enable markets to work efficiently. Energy prices should not be held artificially below the costs of supply to promote social or industrial goals. To the extent necessary and practicable, the environmental costs of energy production and use should be reflected in prices.

**8 Free and open trade** and a secure framework for investment contribute to efficient energy markets and energy security. Distortions to energy trade and investment should be avoided.

**9 Co-operation among all energy market participants** helps to improve information and understanding, and encourage the development of efficient, environmentally acceptable and flexible energy systems and markets worldwide. These are needed to help promote the investment, trade and confidence necessary to achieve global energy security and environmental objectives.

(The Shared Goals were adopted by IEA Ministers at their 4 June 1993 meeting in Paris.)

# ANNEX

## GLOSSARY AND LIST OF ABBREVIATIONS

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In this report, abbreviations are substituted for a number of terms used within the International Energy Agency. While these terms generally have been written out on first mention and abbreviated subsequently, this glossary provides a quick and central reference for many of the abbreviations used.

bcm	billion cubic metres.
BKB	lignite briquettes ( <i>Braunkohlenbriketts</i> ).
cal	calorie.
CERT	Committee on Energy Research and Technology of the IEA.
CHP	combined production of heat and power; sometimes, when referring to industrial CHP, the term “co-generation” is used.
Cl	chlorine.
cm	cubic metre.
CO	carbon oxide.
EU	The European Union, whose members are Austria, Belgium, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Luxembourg, the Netherlands, Portugal, Spain, Sweden and the United Kingdom.
F	fluorine.
GDP	gross domestic product.
GW	gigawatt, or $1 \text{ watt} \times 10^9$ .
IEA	International Energy Agency, whose Members are Australia, Austria, Belgium, Canada, Denmark, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Japan, Luxembourg, the Netherlands, New Zealand, Norway, Portugal, Spain, Sweden, Switzerland, Turkey, the United Kingdom and the United States.
LDC	local distribution companies.
LPG	liquefied petroleum gas; refers to propane, butane and their isomers, which are gases at atmospheric pressure and normal temperature.
LUF	Luxembourg francs.
mcm	million cubic metres.
Mt	million tonnes.
Mtoe	million tonnes of oil equivalent; see toe.

MW	megawatt of electricity, or $1 \text{ Watt} \times 10^6$ .
MWh	megawatt-hour = one megawatt $\times$ one hour, or one watt $\times$ one hour $\times 10^6$ .
OECD	Organisation for Economic Co-operation and Development.
PAH	polycyclic aromatic hydrocarbons.
Pb	lead.
ppm	parts per million.
PPP	purchasing power parity: the rate of currency conversion that equalises the purchasing power of different currencies, i.e. estimates the differences in price levels between different countries.
R&D	research and development, especially in energy technology; may include the demonstration and dissemination phases as well.
TFC	total final consumption of energy; the difference between TPES and TFC consists of net energy losses in the production of electricity and synthetic gas, refinery use and other energy sector uses and losses.
toe	tonne of oil equivalent, defined as $10^7$ kcal.
TPA	third party access.
TPES	total primary energy supply.
TW	terawatt, or $1 \text{ watt} \times 10^{12}$ .
TWh	terawatt $\times$ one hour, or one watt $\times$ one hour $\times 10^{12}$ .
UNFCCC	United Nations Framework Convention on Climate Change.
VOC	volatile organic compound.
Zn	zinc.

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