

LUXEMBOURG

The energy sector

Luxembourg is the smallest IEA country, but its population 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.

Energy balances in Luxembourg (Source: Energy Policies of IEA Countries, 2001)

	1999	%		1999	%
Population (millions)	0.44		Total final consumption	3.43	
Energy consumption/capita	7.88		Coal	0.11	3.2
Total energy production (Mtoe)	0.05		Oil	2.20	64.1
Coal	-	-	Gas	0.61	17.8
Oil	-	-	Biomass & Wastes	0.02	0.6
Gas	-	-	Geothermal	-	-
Biomass & Wastes	0.04	80.0	Solar/Wind/Other	-	-
Nuclear	-	-	Electricity	0.47	13.7
Hydro	0.01	20.0	Heat	0.02	0.6
Geothermal	-	-	Total industry consumption	0.94	
Solar/Wind/Other	-	-	Coal	0.11	11.7
Net energy imports (Mtoe)	3.40		Oil	0.10	10.6
Coal	0.11	3.2	Gas	0.40	42.6
Oil	2.15	63.2	Biomass & Wastes	-	-
Gas	0.66	19.4	Geothermal	-	-
Electricity	0.48	14.1	Solar/Wind/Other	-	-
Total supply - TPES (Mtoe)	3.49		Electricity	0.32	34.0
Coal	0.11	3.2	Heat	0.02	2.1
Oil	2.20	63.0	Transport consumption	1.76	
Gas	0.66	18.9	Total other sectors consumption	0.73	
Biomass & Wastes	0.04	1.1	Coal	0.00	0.0
Nuclear	-	-	Oil	0.35	47.9
Hydro	0.01	0.3	Gas	0.21	28.8
Geothermal	-	-	Biomass & Wastes	0.02	2.7
Solar/Wind/Other	0.00	0.0	Geothermal	-	-
Electricity Trade	0.48	13.8	Solar/Wind/Other	-	-
Electricity generation	0.03		Electricity	0.15	20.5
Electricity generation (TWh)	0.36		Heat	0.01	1.4

Apart from its financial services sector, also heavy industry plays an important role in the economy. The emphasis is on iron and steel industry, chemical industry, in the production of tyres, glass, metal products, as well as food processes. All of these are very energy intensive processes.

Luxembourg has two separate non-connected grids: the public network is operated by Cegedel, also responsible for 70% of the distribution (about 560 MW, 330 GWh in 1999), supplied by RWE- Energie from Germany and the steel industry network in the South of the country, Sotel, which distributes about 1700 GWh, supplied by Electrabel from Belgium.

In Luxembourg, Total Primary Energy Supply is reducing (in 1988 27% below the level of 1973), due to the restructuring of the iron and steel industry, whose production declined drastically. Due to this fact along with energy efficiency gains, energy consumption by the iron and steel industry dropped from the 86% of energy use in industry in 1974 to 48% in 1997. In addition, between 1993 and 1997, ARBED replaced its three blast furnaces with electric arc furnaces and ceased using coal. The blast furnaces were producing gas, which was used directly by industry and to generate electricity. 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% from its maximum in 1978 to 1983, and 30.8% from 1993 to 1998. Natural gas supply multiplied threefold during the same period, replacing oil in industry and in the residential/commercial sector. Oil supply increased 23.5% from 1973 to 1998. Oil consumption increased rapidly in the transport sector, from 0.3 Mtoe in 1973 to 1.6 Mtoe in 1998.

Energy production stems only from renewable sources. Although production is modest, it has increased 45% since 1990. Most energy production is from combustible renewables and wastes and a small amount is from hydro.

Domestic generation is mostly from co-generators, which produced 184.3 GWh in 1998, while domestic hydro electricity generation amounted to 94.8 GWh. 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 and every year the installed capacity is increasing.
- 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.

Policy for renewables and CHP

- Law of 5 Aug. 1993 concerning the rational use of energy
- Ministry regulation from 6th Dec. 1994 related to the granting of subsidy for installations using new or renewable energies or using innovative and renewable technologies for the economy of energy.
- Regulation of 11 Aug. 1996 related to an action programme aimed at encouraging initiatives and measures taken by municipality administrations for the rational use of energy and utilisation of innovative and renewable energies (Action programme for the economies of energy municipality, PEEC).
- Law 'Industry' of 27 July 1993: Article 7 from the law foresees subvention regimes or investments concerning environmental protection and the rational use of energy emerging from the following operations
 - Specific investments aimed at the prevention, reduction or elimination of products or exploitation waste
 - Investment related to rational use of energy of utilisation of renewable energies

The aim of the government is to promote the use of cogeneration installations where its application seems to be rational in an economical and makes ecological sense. The actual

tariffication system for electricity produced and injected in the public network will be maintained, even extended to other categories of power (until 12 MWel) if these installations provide a local heating network. The tariffs will probably be adapted related to reduction of the investment costs (concerning the second category only). The Ministry of Environment as responsible for the direct subsidies, will probably balance subsidies by a direct increase of the financial assistance from the State. A new regulation for that purpose is set to replace the existing one from 6 Dec. 1994.

At political level, the Ministry of Environment will operate on 29 measures divided in 6 major axes: renewable energies, energy efficiency in the production of energy, energy economies, ecofiscality, transport, international. The measure 3, second axis, is dedicated to the promotion of industrial and domestic cogeneration. The objective of the government is to promote the installation of new plant on the industrial level, and support small installation for the tertiary sector, and also compact units for the private houses by:

- The project of a new regulation related to subsidies for the promotion of rational sources of energy and the development of renewable energy sources.
- The environmental protection funds

Since the early 1990's, the government has provided framework for cogeneration development. The two main steps taken have been:

- The creation of Luxenergiel, a company specialized in the construction and operation of cogeneration installations. Currently, the state owns 6% of its capital and the government has announced that it plans to sell this stake.
- The introduction of a regulation on 30 May 1994 concerning the production of electricity based on renewables or cogeneration. This created stable legal framework for cogeneration and renewables and introduced the obligation upon the public network and the electricity supplier to buy cogeneration electricity at an attractive tariff. This regulation does not apply to industrial installation, but only to "domestic cogeneration" with an installed capacity up to 1500kWel. The tariff applied to this regulation is based on the avoided costs of the importer of electricity. The amount that cogenerators get for selling is sometimes higher than what they would have to pay for buying.

This regulation, initially limited to installations below 1500 kWel is extended to installations up to 12000 kWel , with reduced tariffs for installations larger than 3000 kWel.

CHP and biomass-CHP

In Luxembourg, the electricity production in 1999 from cogeneration was 190.75 GWh. Cogeneration is well implement. Since the first installation in the late eighties, cogeneration has met a continuous growth. If only indigenous production is taken into account, cogeneration stands for a high share, 58.5% of the own electricity production, but Luxembourg has to import about 95% of its electricity needs. Therefore, the positive government attitude towards cogeneration and renewables is not surprising.

In 1999, the autoproduction in Luxembourg covers about 6% of the electrical end consumption (5500 GWh/y). More than half of the autoproduction coming from cogeneration (190 GWh/y), mainly from 2 industrial cogenerations based on gas turbines, the remaining from so-called domestic cogeneration based on reciprocating engines. A jump in the autoproduction rate will occur in 2001, when the 350 MW TGV plan will be operative, autoproduction will then cover about 40% of national electricity consumption. The government targets a 50.5 autoproduction rate for 2010.

At the end of 1998, there were 20 non-industrial co-generation facilities with a total capacity of 14.5 MW. In 2000, 30 CHP/district heating stations were in operation in Luxembourg. These are almost totally fuelled with natural gas, while the exploitation of renewables and waste incineration is practically non-existent. A new cogeneration/district heating system is being on the site where the European institutions are located.

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 March 2000, there were three industrial installations in operation with an electricity capacity of 26.7MWe. There are other projects under study in important industrial companies.

A 350 MWel electricity plant based on CCGT technology, called TGV, has been constructed, and should be operational from 2001. The electricity will partly be used by Sotel (100 MW) and by Cegedel (100MW), the rest being injected in the Belgian net. This means that a substantial part of the country's electricity needs will be covered by generation inside the country. Using part of the heat of the plant for supporting a district heating system is being considered.

Small- scale cogeneration consists exclusively of reciprocating engines, none of which has a capacity greater than 1500 kWel. By January 2000, there were a total of 32 such installations, mostly injecting into the public electricity net, with an overall installed capacity in the public net, their overall capacity is not exactly known, but is at least 7433 kWel.