



EUSUSTEL

European Sustainable Electricity; Comprehensive Analysis of Future European Demand and Generation of European Electricity and its Security of Supply

WORK PACKAGE 1

County-wise Analysis

Subtask 1.1.c

LUXEMBOURG

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1. Energy-related and socio-economic analysis: past, present and future

1.1. Factual information

1.1.1. Geography & population

Luxembourg counts 450,000 inhabitants and 172,000 numbers of households. It has a surface area of 2600 km² of which the north is part of the Ardennes massif and the south is a hilly plain. Surface height varies between 130 and 560 metres. One third of the surface area is covered by forests. Luxembourg has a modified continental climate with mild winters and cool summers, with an annual rate of 1630 hours of sunshine.

1.1.2. Economy

With its GDP of 25,000 x 10⁶ EUR, Luxembourg has the highest GDP¹ per capita of the EU. The main sector is the service sector, with a share of more than 80%. The diversified industry represents 16.5% and the agriculture only 0.5%.

1.1.3. Energy

An important issue in the energy balance of Luxembourg is the high import dependency for its energy needs. In the table below, the main energy indicators are presented (based on baseline scenario from [3]).

[PJ] ²	2000	2005	[PJ]	2000	2005
Gross Inland Consumption (=TPES)	152.46	178.5	Final Energy Demand (TFC) by Sector	148.68	167.16
Solids	5.46	4.2	Industry	39.9	46.2
Oil	95.76	110.46	Residential	25.2	26.88
Natural gas	28.14	41.58	Tertiary	4.62	5.04
Nuclear	0	0	Transport	78.96	89.04
Electricity	20.58	18.48	Final Energy Demand (TFC) by Fuel	148.68	167.16
Renewable energy forms	2.52	3.78	Solids	5.04	4.2
Net Imports	152.04	174.72	Oil	94.92	105.42
Import Dependency [%]	99.8	97.8	Gas	26.04	31.92
Energy Intensity Indicators (1990 = 100)			Electricity	20.58	23.1
Industry (Energy on Value Added)	30.4	28.5	Heat	1.26	1.68
Residential (Energy on Private	88.6	77.2	Other	0.84	0.42

¹ A list with abbreviations can be found at the end of this document.

² Based on conversion 1toe = 42 x 10⁹ J

Income)				
Tertiary (Energy on Value Added)	89.7	75.6		
Transport (Energy on GDP)	113.3	101.9		

1.1.4. Electricity

As it is the case with the overall energy needs, Luxembourg relies on import for its electricity demand. Electricity mainly comes from its neighbouring countries France, Germany and Belgium. The main electricity balances and indicators are summarised in the table below [3].

	2000	2005
Electricity Generation [TWhe]	0.43	2.32
Nuclear	0.00	0.00
Hydro & wind	0.15	0.19
Thermal (incl. biomass)	0.29	2.14
Electricity Generation [Gwe]	0.13	0.53
Nuclear	0.00	0.00
Hydro (pumping excluded)	0.04	0.04
Wind and solar	0.01	0.03
Thermal	0.08	0.46
Of which cogeneration units	0.03	0.05
Open cycle	0.03	0.09
Supercritical Polyvalent/Clean Coal and Lignite	0.00	0.00
Gas Turbines Combined Cycle	0.04	0.37
Small Gas Turbines	0.00	0.00
Fuel Cells	0.00	0.00
Geothermal Heat	0.00	0.00
Average efficiency for thermal electricity production [%]	34.8	49.1

1.1.5. Environmental issues

The main balances and indicators concerning the CO₂-emissions are summarised in the table below [3].

	2000	2005
CO₂-emissions [Mt of CO₂]	8.8	10.6
Electricity and Steam production	0.1	0.9
Energy Branch	0.00	0.0
Industry	1.7	1.8
Residential	1.4	1.5
Tertiary	0.1	0.1

Transport	5.6	6.2
CO₂-emissions Index (1990 = 100)	83.1	99.3
Carbon intensity [t of CO₂/toe of GIC]	2.43	2.48
CO₂-emissions/Capita [t of CO₂/inhabitant]	20.03	22.60
CO₂-emissions to GDP [t of CO₂/MEUR '00]	431.6	411.0
Carbon Intensity indicators		
Electricity and Steam production [t of CO ₂ /MWh]	0.15	0.32
Final energy demand [t of CO ₂ /toe]	2.46	2.42
Industry	1.73	1.63
Residential	2.35	2.36
Tertiary	0.68	0.71
Transport	2.97	2.95

1.2. Trends [1]

Growth rates [% per year]	'73-'79	'79-'90	'90-'97	'97-'98	'98-'05
TPES	-2.5	-0.8	-0.7	-2.5	1.9
Coal	-4.6	-4.3	-16.8	-63.8	-1.7
Oil	-4.0	2.1	2.7	4.4	-0.8
Gas	13.6	-0.8	5.5	1.1	12.2
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	-	-	-	-	-
TFC	-0.1	0.1	1.2	1.2	0.3
Electricity Consumption	2.7	1.6	3.2	2.9	2.0
Energy Production	36.6	1.6	5.5	-	2.4
Net Oil Imports	-3.5	1.8	2.5	6.7	-1.0
GDP	1.3	4.5	4.8	5.7	2.3
Growth in the TPES/GDP Ratio	-3.7	-5.0	-5.3	-7.8	-0.4
Growth in the TFC/GDP Ratio	-1.3	-4.2	-3.5	-4.3	-2.0

2. Policy

2.1. General framework

Luxembourg is largely dependent on imports of its neighbouring countries for all its energy needs. As a logical consequence, a good integration in the European gas and electricity network, with enough import capacity, is necessary. Gas import capacities with Germany have recently been increased. The former large energy (coal) use of the steel and iron industry has been reduced by the transformation of the blast furnaces to electric ones. Currently, Luxembourg does not face problems of energy supply.

Because of the very low excise taxes on automotive fuels, a lot of foreign border customers come to provide themselves in Luxembourg. Both measures on the national as on the European level will be necessary to tackle this problem.

Concerning the liberalisation, since 1 July 2004 the energy market (both gas and electricity) is open for all non-residential users. From 1 July 2007 on, it will be opened for all clients. Because of the small domestic market, with demand led by a few large consumers and only a small number of players, competition in gas and electricity is highly influenced by the situation in the neighbouring countries. This is important argument for a strong interaction and cooperation between the regulators of Luxembourg and its neighbouring countries.

As a consequence of the Kyoto protocol, Luxembourg is committed to reduce its GHG emissions by 28% between 1990 and 2008-2012.

2.2. Electricity policy

To decrease the import dependency, Luxembourg installed a new 350 MW CCGT in 2002. Before the installation of this combined cycle, the domestic production existed mainly out of hydropower (approximately 1.3 TWh per year).

To control the liberalised electricity market, the Institut Luxembourgeois de Régulation was established [4]. Its main tasks are to advice the minister responsible for energy matters, to control the transport tariffs and the access conditions and to avoid misuse of dominant market players.

2.3. Environmental policy

Although, GHG-emissions in 2002 were 21% below 1990 levels, it is a big challenge for Luxembourg to reach its Kyoto target. The current amelioration is a consequence of the restructuring process in the steel and iron industry. To reach the Kyoto targets and to reduce the energy demand per capita – which is among the highest in the EU - Luxembourg plans to use a combination of environmental measures and – for the bulk of the emissions – the Kyoto flexibility mechanisms.

The objectives of the National Plan for Sustainable Development are focused on two issues. Firstly, there is a planned reduction of energy use. Luxembourg wants to reduce its energy intensity by 20% by 2010 and to reduce the heating energy per surface unit of living by 30% by 2020.

Secondly, there is a strategy towards a clean and high efficient production of electricity. The aim is to cover up till 5.7% of electricity consumption by RES by 2010. Besides that, Luxembourg wants to promote autonomous electricity production with high efficiency technologies, starting in 2005.

The measures to reach those objectives are based on different pillars. The first one consists of promotion of energy efficiency in production and building industry. The goal is to stimulate cogeneration and heat networks, high efficiency technologies like condensing boilers, heat pumps, fuel cells and more efficient domestic appliances and an overall amelioration of insulation of buildings.

A second pillar is based on more fiscal and economic measures, to favour the use and the production of RES towards private and public customers mainly by investment subsidies and feed-in tariffs.

It is important for Luxembourg to take cost-effective measures to reach its energy policy targets.

A last issue towards the amelioration of the energetic efficiency in production is the continuously optimisation of the efficiency of the domestic 2002 built CCGT

3. References & Bibliography

- [1] IEA, Luxembourg 2000 Review
- [2] IEA, Luxembourg 2002 Compendium
- [3] European Energy and Transport, trends to 2030
- [4] www.ilr.etat.lu
- [5] Statistiques du Luxembourg <http://www.statistiques.public.lu/fr/>
- [6] Plan National pour un Développement Durable; Ministère de l'Environnement; 30 avril 1999
- [7] IEA, Luxembourg 2004 Review

4. Abbreviations

CCGT - Combined Cycle Gas Turbine (steam and gas)

GDP – Gross Domestic Product

GIC – Gross Inland Consumption

RES - Renewable Energy Sources

TFC – Total Final Consumption

TPES – Total Primary Energy Supply