LE GOUVERNEMENT
DU GRAND-DUCHÉ DE LUXEMBOURG
Ministère de l'Économie
et du Commerce extérieur

First
National Energy Efficiency Action Plan
for Luxembourg

under the EU Directive on energy end-use efficiency and energy services (2006/32/EC)

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List of abbreviations

dena: Deutsche Energie-Agentur (German Energy Agency)

ESD: EU Directive 2006/32/EC on energy end-use efficiency and energy services

EU ETS: European Emissions Trading Scheme

FEDIL: Luxembourg Business Federation

TCS sector: Trade, commerce, services (tertiary sector)

I&C: Information and communications

CHP: Combined Heat and Power generation

NAP: National Allocation Plan

NEEAP: National Energy Efficiency Action Plan for Luxembourg

1 Summary of the effects of measures and discussion of targets by 2016

The energy efficiency measures contained in this report have been grouped under the following three headings:

- **Early action measures (A):** Measures implemented during the period 1995 – 2007, which started to take effect during this period. What is important is for these measures still to be effective in 2016, taking account of the lifetimes of measures laid down in the Directive, where appropriate.
- **New measures (B):** Measures that are being implemented, but will only take effect as of 2008.
- **New planned/potential measures (C):** Measures that may also help to meet the requirements of Luxembourg's National Energy Efficiency Action Plan (NEEAP-L).

An analysis of the chapters dealing with the different sectors produces the following main messages for the NEEAP-L:

- The national saving target is 9%, equivalent to a saving of around 1 582 TWh. The interim target for Luxembourg by the end of 2010 is 3%, equivalent to a saving of 527 TWh. (Table 1-1).
- In theory Luxembourg can exceed the 9% target by national efforts (approx. 10.4%). (Table 1-2)
- Contributions have been made by early action (A), i.e. measures introduced in Luxembourg during the period 1995-2007 that will still be taking effect in 2016 (4%, including early action CHP), new measures (B) (4.1%) and planned/potential measures (C) (up to 2.3%). (Table 1-3).
- Possible future measures making major contributions are: Upgrading old buildings in the household sector, making new buildings energy efficient, improving thermal insulation in the trade, commerce, services sector, realising energy savings potential in cross-cutting technologies and electricity applications in the TCS sector, decentralised renewables in buildings. (Table 1-4 and Table 1-2).

Table 1-1: 2016 target for the ESD in Luxembourg

Domestic EE consumption[1]	Savings target
GWh/a	GWh/a
17 576	**1 582**

[1] EE : End-use energy consumption under the ESD

Table 1-2: Meeting the savings target in Luxembourg

Meeting target by 2016
%
10.38%

Table 1-3: Contribution to meeting the target made by the groups of measures A (early action), B (new measures), C (planned/potential measures)

Total early action (A)	TOTAL measures (excl. TT) (B)	TOTAL planned/potential measures (excl. TT) (C)	TOTAL
GWh/a	GWh/a	GWh/a	GWh/a
703 4.00%	727 4.14%	395 2.25%	**1 825** **10.38%**

excl. TT = excluding transit traffic

Table 1-4: Overview of the effects of measures in Luxembourg

Early action (A)					
Households WD96	Eff. new building + heating systems	TCS WD96	CHP	Promotion decent. renewables (EE) (without biomass)	Promotion of biomass use
GWh/a	GWh/a	GWh/a	GWh/a	GWh/a	GWh/a
295	76	118	167	26	22
1.68%	0.43%	0.67%	0.95%	0.15%	0.13%
A1	A2	A3	A5	A4	A4

(Table 1-4 continued)

New measures (B)							
Households LuxEeB 08	Household upgrading (old/new)	TCS WD08	Rise in national fuel prices	CO_2 vehicle tax	Promotion of least-polluting cars	Promotion decent. EE (without biomass)	Promotion of biomass use
GWh/a	GWh/a	GWh/a	GWh/a	GWh/a	GWh/a	GWh/a	GWh/a
372	37	40	61	86	75	12	45
2.11%	0.21%	0.23%	0.34%	0.49%	0.43%	0.07%	0.26%
B1	B2/B3	B4	B7	B8	B9	B5	B6

Planned/potential measures (C)							
Increase in upgraded households (old/new)	Renewal of heating	Energy labelling	TCS LuxEeB 10	Electricity potential TCS	Electricity Potential Ind.	Greater promotion decent. EE (without biomass)	Greater promotion biomass use
GWh/a	GWh/a	GWh/a	GWh/a	GWh/a	GWh/a	GWh/a	GWh/a
57	53	8	79	65	99	23	11
0.32%	0.30%	0.05%	0.45%	0.37%	0.57%	0.13%	0.06%
C1/C3	C2	C4	C5	C6	C7	C8	C9

The interim target for 2010 is a third of the overall target (527 GWh). Table 1-5 summarises the anticipated effects of the measures for the target year 2016 in the three groups mentioned above:

Table 1-5: Anticipated effects of measures for 2010 and 2016:

Electricity weighting 1

No.	National indicative annual energy savings target in 2016 (GWh) / Energy-efficiency, energy-service and other measures already taken[1] or planned since 1995 to achieve the target	1 582 / Expected annual energy savings for the end of 2016 (GWh)
	National indicative interim target for annual energy savings in 2010 (GWh)	527
	Measures in the household sector:	
	Early action	
A1	1996 Thermal Insulation Ordinance (WD 1996) (new and old buildings)	295
A2	Promotion of efficient new buildings / efficient heating systems (2001-2007)	76
	New measures (advanced planning)	
B1	Improvement in overall energy efficiency in dwellings (WD2008) (new and old buildings)	372
B2	Upgrading programme for old buildings (old buildings, as against old)	25
B3	Promotion of efficient new building (new buildings, as against WD08)	12
	Planned/proposed measures	
C1	Increase in old building upgrading programmes (old buildings, as against old)	32
C2	Heating renewal regulations	53
C3	Increase in promotion of efficient new building (new buildings, as against WD08)	25
C4	Electricity saving (labelling of electrical appliances)	8
	Measures in the tertiary sector:	
	Early Action	
A3	1996 Thermal Insulation Ordinance (WD 1996)	118
	New measures (advanced planning)	
B4	Improvement in U-values for non-domestic buildings (WD2008)	40
	Planned/proposed measures	
C5	Improvement in overall energy efficiency of non-domestic buildings (WD2010)[2]	79
C6	Realising electricity savings potential in the TCS sector	65
	Measures in the industry sector (insofar as affected by the Energy Efficiency Directive):	
	Planned/proposed measures	
C7	Realising electricity savings potential for industrial cross-cutting technologies	99
	Measures in the transport sector:	
	New measures (advanced planning)	
B7	Reduction in fuel consumption by raising fuel prices (national transport)	61
B8	CO2 car tax	86
B9	Promotion of least-polluting cars	75
	Cross-cutting measures:	
	Early action	
A4	Promotion of decentralised renewables by 2007 (electricity/heat without biomass use)	26
A4	Promotion of decentralised renewables by 2007 (heat, biomass use)	22
A5	Promotion of small CHP[3]	167
	New measures (advanced planning)	
B5	Further promotion of decentralised renewables (electricity/heat without biomass use)	12
B6	Further promotion of decentralised renewables (heat, biomass use)	45
	Planned/proposed measures	
	Increased promotion of decentralised renewables (electricity/heat without biomass use)	23
	Increased promotion of decentralised renewables (heat, biomass use)	11
	Overall energy savings expected for the ESD:	1 825

[1] Early action

[2] Provisions of the 2007 Overall Energy Efficiency Regulation for non-domestic buildings

[3] Evaluated as primary energy

2 General targets laid down in EU Directive 2006/32/EC on energy end-use efficiency and energy services

The aim of EU Directive 2006/32/EC on energy end-use efficiency and energy services[1] is to enhance the cost-effective improvement of energy end-use efficiency in the Member States by using the following measures:

- defining the necessary national indicative targets;
- establishing the necessary mechanisms, incentives and institutional, financial and legal frameworks to remove existing market barriers and imperfections that impede the efficient end use of energy;
- creating the conditions for the development and promotion of a market for energy services and for the delivery of other energy efficiency improvement measures to final consumers.

Article 4 of the Directive lays down the following indicative target in terms of quantity: Member States shall adopt and aim to achieve an overall national indicative energy savings target[2] of 9% for the ninth year of application of this Directive, to be reached by way of energy services and other energy efficiency improvement measures and they shall endeavour to achieve this target.

EU Directive 2006/32/EC establishes various reporting obligations. Member States must submit to the Commission the following National Energy Efficiency Action Plans (NEEAPs):

- a first NEEAP no later than 30 June 2007;
- a second NEEAP no later than 30 June 2011;
- a third NEEAP no later than 30 June 2014.

All NEEAPs must describe the energy efficiency measures planned to reach the targets set out in Article 4(1) and (2), as well as to comply with the provisions on the exemplary role of the public sector and on the supply of information and advice to final customers set out in Article 5(1) and Article 7(2).

The second and third EEAPs

- include a thorough analysis and evaluation of the preceding EEAP;
- include the final results with regard to the fulfilment of the energy savings targets set out in Article 4(1) and (2);

[1] Article 1, Directive 2006/32/EC

[2] Indicative energy savings target means: Reaching the target is not obligatory, but endeavouring to reach it is.

- include plans for – and information on the anticipated effects of - additional measures addressing any existing or expected shortfall in relation to the target;
- in accordance with Article 15(4), use and gradually increase the use of harmonised efficiency indicators and benchmarks, both for the evaluation of past measures and estimated effects of planned future measures;
- are based on available data, supplemented with estimates.

The present document meets Luxembourg's reporting requirements on its general savings target in Article 4, on the provisions on the exemplary role of the public sector set out in Article 5(1) and also on the supply of information and advice to final customers set out in Article 7(2).

3 EU Directive 2006/32/EC on energy end-use efficiency and energy services and its integration in other energy policy and climate change targets

EU Directive 2006/32/EC on energy end-use efficiency and energy services and its 9% savings target for 2016 establishes only one of several targets at European level, which are tightly interwoven and in some cases have contradictory requirements, given the specific situation in Luxembourg. Some of these targets were set by the EU Council in March 2007[3]:

- a **20% energy savings target for 2020.** It is important to note here that
  - this is a primary energy target;
  - the 20% saving, unlike the 9% ESD target, has to be measured against a future baseline in 2020 compared with 2006 and does not include any early action;
  - due to the primary-energy nature of the target, the supply mix plays a part, particularly the proportion of renewables and CHP, but also the share of highly efficient, traditional power stations;
  - possible savings through EU Emissions Trading are included in the target (unlike in the EU Energy Efficiency Directive!)
- **Luxembourg's Kyoto target for 2012 and the further target for 2020** [3], which is derived from the EU's overall CO2 target for 2020 - currently standing at 20% - by burden sharing. There is also a connection here with the detailed targets formulated in Emissions Trading and the National Allocation Plan (henceforth "NAP"). Depending on international participation in reaching the target, the European Union also envisages a 30% target.
- a **legally binding 20% renewables target for 2020** from 2007[3], which is also to be broken down between the individual EU Member States.

The combination of these different targets is in no way insignificant and requires thorough quantitative analysis and a discussion process, in order to identify a coherent line for Luxembourg. Inconsistencies arise when developing CHP, for instance, which may be counter-productive in relation to Luxembourg's Kyoto target or only of benefit to the ESD when it can be evaluated as primary energy.

[3] http://www.consilium.europa.eu/ueDocs/cms_Data/docs/pressData/de/ec/93139.pdf

4 Development of Luxembourg's energy industry

4.1 Development of the level and structure of energy consumption

There has been a significant change in the development of Luxembourg's energy consumption in recent years, both in terms of the sectoral consumption structure and also in relation to the structure of energy sources. The following figures relate to national energy use, i.e. excluding fuel consumption by transit traffic.

4.1.1 Sectoral consumption development

Overall Luxembourg's primary energy consumption has had a distinctive development from 1990. There was a clear downturn in the first half of the 1990s, particularly due to the movement away from coal-based steel production to electric furnaces, followed by another growth in consumption from the end of the 1990s; nevertheless, it was still almost 8% lower in 2005 than in 1990 (Table 4-1).

Table 4-1 Development of Luxembourg's sectoral energy consumption from 1990 to 2005 (excluding fuel exports)

	1990	1995	2000	2001	2002	2003	2004	2005
	Energy consumption in 1000 toe							
Primary energy consumption	2 881	2 411	2 155	2 295	2 377	2 443	2 629	2 664
Consumption and losses in the critical range[1]	181	120	52	130	252	282	318	330
Final energy consumption[3]	270	2 291	2 113	2 164	2 125	2 161	2 311	2 334
Industry	1 919	1 330	1 041	1 018	993	995	1 074	1 027
Transport[3]	241	354	424	439	451	474	499	593
Other sectors	541	607	647	707	681	691	738	714
	Structure of primary energy consumption in %							
Primary energy consumption	82	77	65	65	65	63	61	61
Consumption and losses in the critical range[1]	5	4	2	4	7	7	7	8
Final energy consumption[2]	7	73	64	62	58	56	54	54
	Structure of final energy consumption in %							
Final energy consumption[3]	100	100	100	100	100	100	100	100
Industry	71	58	49	47	47	46	46	44
Transport[3]	9	15	20	20	21	22	22	25
Other sectors	20	26	31	33	32	32	32	31

[1] Including statistical differences
[2] Excluding commercial air traffic
[3] Excluding fuel "exports" in road traffic.
Sources: Luxembourg Ministry of Economic Affairs: FiFo Institute for Public Economics, Cologne; own calculations

Even without fuel exports, Luxembourg's transport-related energy consumption has experienced the greatest increase by far; in 2005 it was almost 150% higher than in 1990. However, despite a marked structural change, industrial energy consumption was still ahead in this analysis, accounting for 44% in 2005 (71% in 1990) compared with the other sectors' share of 31% (20% in 1990) and also well ahead of transport with a share of 25% (9% in 1990).

Transformation consumption has risen considerably with the opening of the TWINerg power plant, even though it accounts for a significantly smaller share of total primary energy consumption compared with the other Member States.

4.1.2 Development of energy consumption by energy source

Without taking fuel exports into account, the most important primary energy source is natural gas, accounting for around 50% of primary energy consumption, followed by oil representing a good third and electrical energy with 11% (2005 figures). This means that all other energy sources only accounted for roughly 5% of primary energy consumption in 2005 (Table 4-2).

In relation to the energy sources used, all that has changed is the structure of the total final energy consumption. Although oil products are still the most important energy source, they only accounted for just under 40% of the total final energy consumption in 2005, while the proportion of natural gas rose to 31% and that of electrical energy to 23%. In the transport sector itself, oil retains its almost complete dominance with a share of just under 99%.

Table 4-2 Trend in Luxembourg's energy consumption from 1990 to 2005 according to sector and energy source structure, excluding fuel exports

Figures excluding fuel exports and commercial air traffic	1990	1995	2000	2005	1990	1995	2000	2005
	Primary energy consumption in 1000 toe				Structure of the primary energy consumption in %			
Total (excl. kerosene)	2 883	2 416	2 173	2 674	100.0	100.0	100.0	100.0
Solid fuel (coal)	1 199	528	128	83	41.6	21.8	5.9	3.1
Waste	27	25	31	36	0.9	1.0	1.4	1.3
Petroleum products (excl. kerosene)	847	819	766	929	29.4	33.9	35.3	34.7
Natural gas	478	619	745	1 310	16.6	25.6	34.3	49.0
Electrical energy (Imported electricity)	318	410	486	294	11.0	17.0	22.4	11.0
Biogas	0	0	1	7	0.0	0.0	0.1	0.3
Wood	15	15	15	16	0.5	0.6	0.7	0.6
	Total final energy consumption in 1000 toe				Structure of final energy consumption in %			
Total (excl. kerosene)	2 705	2 298	2 121	2 344	100.0	100.0	100.0	100.0
Solid fuel / coal	820	383	128	83	30.3	16.7	6.0	3.5
Blast-furnace gas	202	65	0	0	7.5	2.8	0.0	0.0
Total coal and blast furnace gas	1 021	448	128	83	37.8	19.5	6.0	3.5
Oil products (excl. kerosene)	847	819	766	929	31.3	35.6	36.1	39.6
Natural gas	464	571	693	726	17.2	24.9	32.6	31.0
Electrical energy	358	431	492	530	13.2	18.7	23.2	22.6
Hear/steam (from CHP)	0	14	27	60	0.0	0.6	1.3	2.6
Wood	15	15	15	16	0.6	0.7	0.7	0.7
Total heat and wood	15	29	42	0	0.6	1.3	2.0	0.0
	Final transport energy in 1000 toe				Structure of final transport energy consumption in %			
Total (excl. kerosene)	246	361	432	602	100.0	100.0	100.0	100.0
Oil products (excl. kerosene)	241	354	424	593	98.1	98.2	98.1	98.7
Electrical energy	5	7	8	8	1.9	1.8	1.9	1.3
Sources: Luxembourg Ministry of Economic Affairs: FiFo Institute for Public Economics, Cologne; own calculations								

4.1.3 Energy industry indicators

The main drivers behind the trend in the energy industry were the sharp rise in population figures (by 20% or 75 000 inhabitants from 1990 to 2005) and the doubling of macroeconomic growth in real terms during the period 1990 to 2005 (equivalent to an average annual growth of 4.7 %).

It was only the marked improvement in **energy productivity** in the 1990s that allowed primary energy consumption to be reduced initially (also helped by the redevelopment of the steel industry) and its rise to be alleviated. This applies whether fuel exports are taken into account **(case I)** or disregarded **(case II).** Ultimately both cases impact on

the level of energy productivity and on the scale of improvements in this (cf. Table 4-3 and Fig. 4-1). However, it can also be seen that energy productivity has fallen slightly since the start of 2000, regardless of whether fuel exports are included or not, which means that growth in primary energy consumption between 2000 and 2005 was even greater than macroeconomic growth. To this extent, the two variables could not be disconnected from one another.

Table 4-3 Indicators of the trend in Luxembourg's energy industry from 1990 to 2005

	Unit	1990	1995	2000	2005	1990-1995	1995-2000	2000-2005	1990-2005
		Initial data				Changes in % p.a.			
Population[1)]	1 000	381.9	408.6	436.3	457.3	1.4	1.3	0.9	1.2
Gross domestic product[2)]	bn 2 000er €	13.5	16.3	22.0	26.9	3.9	6.1	4.1	4.7
Primary energy consumption I[3)]	1 000 toe	3 493	3 151	3 323	4 354	-2.0	1.1	5.6	1.5
Primary energy consumption II[4)]	1 000 toe	2 881	2 411	2 165	2 664	-3.5	-2.1	4.2	-0.5
Gross electricity consumption	m kWh	4 580	5 501	6 157	6 604	3.7	2.3	1.4	2.5
Greenhouse gas emissions I[3)]	m t $CO_{2equ.}$	12.51	9.94	9.43	12.68	-4.5	-1.0	6.1	0.1
Greenhouse gas emissions II[3)]	m t $CO_{2equ.}$	10.65	7.70	5.91	7.51	-6.3	-5.2	4.9	-2.3
		Indicators Case I (Including fuel exports; excluding commercial air traffic)							
Energy productivity[4)]	€/kgoe	3.86	5.19	6.62	6.18	6.1	5.0	-1.4	3.2
Electricity productivity[5)]	€/kWh	2.94	2.97	3.57	4.07	0.2	3.8	2.7	2.2
Emissions productivity[6)]	€/kg $C0_{2equ.}$	1.08	1.64	2.33	2.12	8.8	7.2	-1.9	4.6
Per capita energy consumption	toe/pop.	9.1	7.7	7.6	9.5	-3.4	-0.2	4.6	0.3
Per capital electricity consumption	kWh/pop.	11 993	13 462	14 113	14 443	2.3	0.9	0.5	1.2
Per capita emissions	t $CO_{2equ.}$/pop.	32.8	24.3	21.6	27.7	-5.8	-2.3	5.1	-1.1
		Indicators Case II (Excluding fuel exports; excluding commercial air traffic)							
Energy productivity[4)]	€/kgoe	4.68	6.78	10.16	10.10	7.7	8.4	-0.1	5.3
Electricity productivity[5)]	€/kWh	2.94	2.97	3.57	4.07	0.2	3.8	2.7	2.2
Emissions productivity[6)]	€/kg $C0_{2equ.}$	1.27	2.12	3.72	3.59	10.9	11.9	-0.8	7.2
Per capital energy consumption	toe/pop.	7.5	5.9	5.0	5.8	-4.8	-3.4	3.3	-1.7
Per capita electricity consumption	kWh/pop.	11 993	13 462	14 113	14 443	2.3	0.9	0.5	1.2
Per capita emissions	t $CO_{2equ.}$/pop.	27.9	18.8	13.5	16.4	-7.5	-6.4	3.9	-3.5

[1)] Source: Eurostat.- [2)] Source: National Allocation Plan 2008-2012 for Luxembourg.- [3)] Including fuel exports; excluding commercial air traffic.- [4)] Excluding fuel exports; excluding commercial air traffic.- [5)] Gross domestic product per unit primary energy consumption.
[6)] Gross domestic product per unit gross electricity consumption.- [7)] Gross domestic product per unit greenhouse gas emissions.

Sources: Luxembourg Ministry of Economic Affairs: FiFo Institute for Public Economics, Cologne; own calculations

Unlike energy productivity, **electricity productivity** increased constantly since the mid-1990s. However, the rate was consistently lower than macroeconomic growth, meaning that electricity consumption rose almost every year while growth rates weakened overall.

Macroeconomic **emissions productivity**, which rose particularly sharply in the 1990s, deteriorated alongside primary energy consumption from the start of 2000. This continues to be the case if fuel exports are disregarded.

Fig. 4-1 Macroeconomic energy, electricity and emissions productivity with and without greenhouse gas emissions in Luxembourg from 1990 to 2005

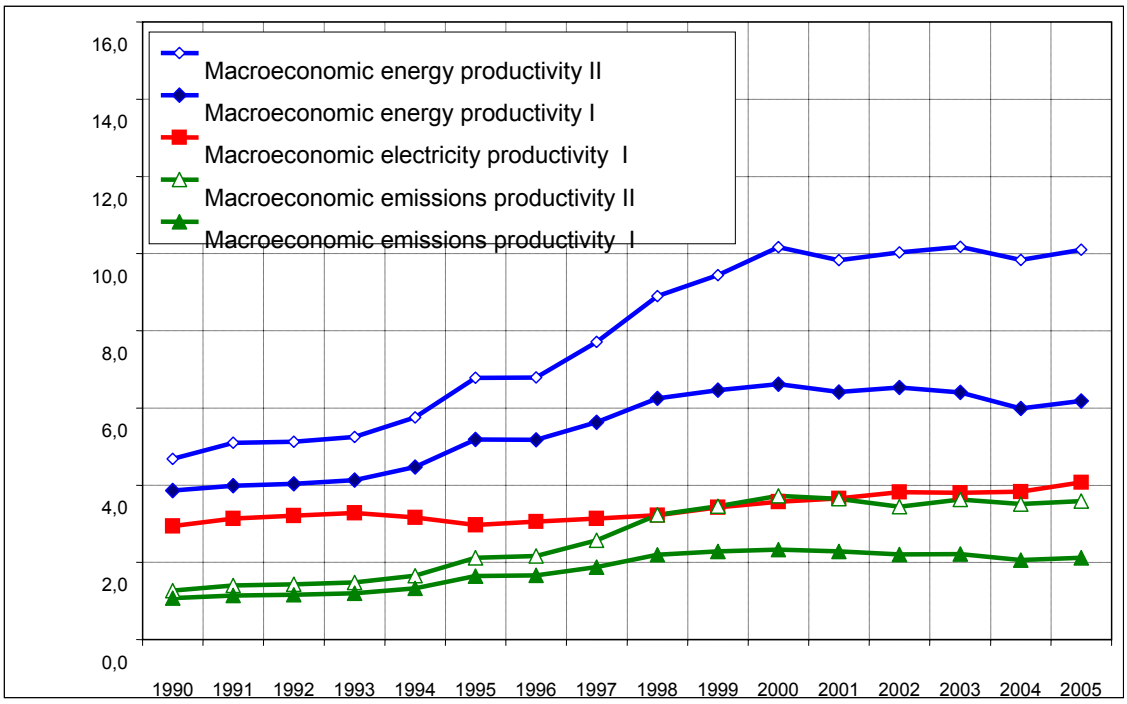
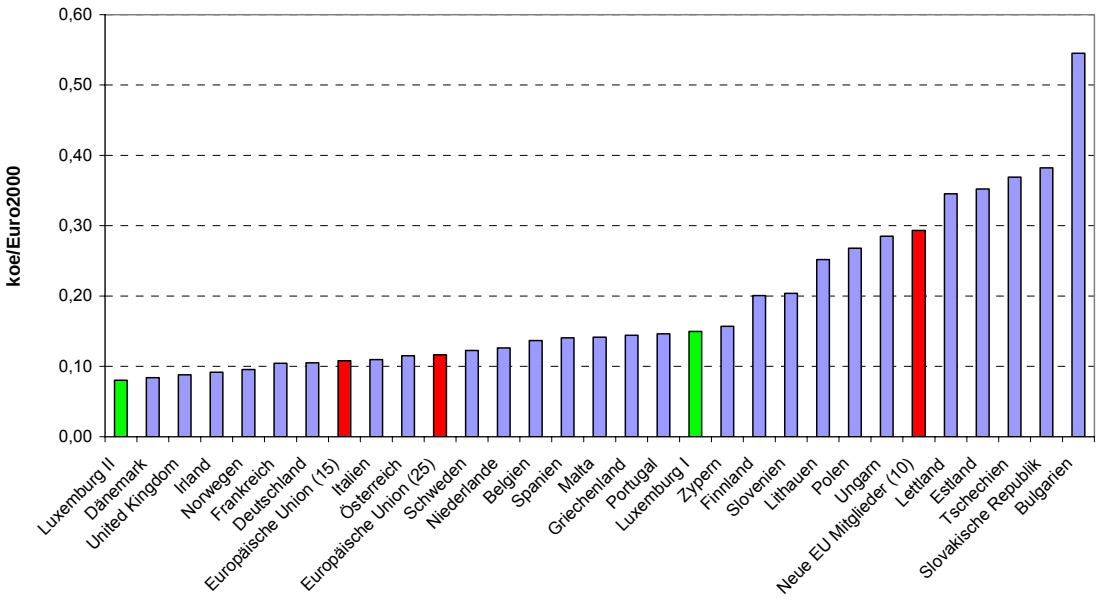


Fig. 4-2 Final energy intensity of Luxembourg in 2004 compared with the other EU Member States



Luxembourg II/Denmark/United Kingdom/Ireland/Norway/France/Germany/EU (15)/Italy/Austria/EU (25)/Sweden/Netherlands/Belgium/Spain/Malta/Greece/ Portugal/Luxembourg I/Cyprus/Finland/Slovenia/Lithuania/Poland/Hungary/New EU Members (10)/Latvia/Estonia/Czech Republic/Slovak Republic/Bulgaria

Source: Luxembourg Ministry of Economic Affairs, Odyssee database

A comparison between Luxembourg's final energy intensity in 2004 and that in the other EU Member States shows that Luxembourg is lowest when transit traffic is excluded (Luxembourg II in Fig. 4-2). However, this is only a limited indication of an efficient economy, as sectoral indicators have to be included for a more accurate comparison and a series of adjustments have to be made (e.g. for different structures within the economy).

5 General national indicative energy savings target

5.1 Calculation of the general national indicative energy savings target

The calculation of the general national indicative energy saving target for Luxembourg is based on the country's energy balance sheets for 2001-2005. According to the methods laid down in the ESD, the indicative savings target must be determined based on the average over the last available 5-year period. The corresponding values are summarised in Table 5-1. Domestic final energy consumption excluding transit traffic was approx. 25 TWh in 2005. Approx. 21% of this was accounted for by the household sector, 12% by the tertiary sector, 19% by the industry sector (excluding ETS companies), 29% by ETS companies and 19% by the transport sector. The indicative energy saving target for Luxembourg determined in this way is 1 582 TWh.

Table 5-1: Summary of the basis for calculating the national indicative energy savings target

GWh					
	2001	**2002**	**2003**	**2004**	**2005**
Final energy consumption energy balance sheet (excl. kerosene)	**39 371**	**39 520**	**41 870**	**45 744**	**46 802**
of which electricity	5 633	5 674	6 016	6 422	6 159
Industry overall	11 839	11 546	11 574	12 491	11 866
of which ETS companies	7 408	7 355	6 866	**7 294**	7 214
of which ETS companies electricity	1 647	1 636	1 527	1 622	1 704
Transport overall (excl. kerosene)	19 311	20 054	22 256	24 667	26 536
of which transit traffic	14 818	15 209	17 285	20 215	*21 760*
share of transit traffic	76.7%	75.8%	77.7%	82.0%	*82.0%*
for info.: kerosene	3 920	4 247	4 424	4 738	4 892
Other sectors (households/services)	8 221	7 919	8 040	8 587	8 393
Total of all sectors excluding transit traffic	**24 553**	**24 310**	**24 585**	**25 530**	**25 036**

	2001-2005		Source: Luxembourg energy balance sheets, own calculations
	Final energy*	**9%**	
5-year average	**17 576**	**1 582**	
(*excl.ETX companies, excl.transit traffic, electricity weighting=1)			

The following Table 5-2 provides detailed figures for 2001-2005 for calculating the national indicative energy savings target.

Table 5-2: Individual tables 2001-2005 for calculating the national indicative energy savings target

	2001				
	Oil products[1]	**Natural gas**	**Coal and other[2]**	**Electricity**	**Overall**
	Unit GWh				
Domestic final energy consumption[1,6]	8 812	8 241	1 866	5 633	24 553
Exception: Energy consumption by companies participating in the European Emissions Trading Scheme	235	3 799	1 726	1 647	7 408
Domestic final energy consumption in the context of the ESD[3,6]	**8 577**	**4 442**	**141**	**3 985**	**17 145**
of which: Household sector[4]	2 430	2 079	186	704	5 399
Tertiary sector[4]	598	912	177	1 134	2 821
Industry (in the context of the ESD)[5]	1 158	1 451	-	2 045	4 431
Transport sector[6]	4 392	-	-	101	4 493
Agriculture[7]	-	-	-	-	-

	2002				
	Oil products[1]	**Natural gas**	**Coal and other[2]**	**Electricity**	**Overall**
	Unit GWh				
Domestic final energy consumption[1,6]	8 754	8 184	1 698	5 674	24 310
Exception: Energy consumption by companies participating in the European Emissions Trading Scheme	233	3 772	1 713	1 636	7 355
Domestic final energy consumption in the context of the ESD[3,6]	**8 521**	**4 412**	**-15**	**4 038**	**16 956**
of which: Household sector[4]	2 182	2 048	194	719	5 143
Tertiary sector[4]	537	899	184	1 157	2 777
Industry (in the context of the ESD)[5]	1 061	1 465	-	2 059	4 191
Transport sector[6]	4 741	-	-	104	4 845
Agriculture[7]	-	-	-	-	-

	2003				
	Oil products[1]	**Natural gas**	**Coal and other[2]**	**Electricity**	**Overall**
	Unit GWh				
Domestic final energy consumption[1,6]	8 785	8 189	1 596	6 016	24 585
Exception: Energy consumption by companies participating in the European Emissions Trading Scheme	218	3 522	1 600	1 527	6 866
Domestic final energy consumption in the context of the ESD[3,6]	**8 567**	**4 667**	**-4**	**4 489**	**17 718**
of which: Household sector[4]	2 108	2 118	222	741	5 189
Tertiary sector[4]	518	929	211	1 192	2 851
Industry (in the context of the ESD)[5]	1 074	1 620	-	2 452	4 707
Transport sector[6]	4 867	-	-	104	4 971
Agriculture[7]	-	-	-	-	-

(Table 5-2 continued)

	2004				
	Oil products[1]	**Natural gas**	**Coal and other[2]**	**Electricity**	**Overall**
	Unit GWh				
Domestic final energy consumption[1,6]	8 399	8 779	1 930	6 422	25 530
Exception: Energy consumption by companies participating in the European Emissions Trading Scheme	231	3 741	1 699	1 622	7 294
Domestic final energy consumption in the context of the ESD[3,6]	**8 168**	**5 038**	**230**	**4 799**	**18 236**
of which: Household sector[4]	2 193	2 271	261	796	5 521
Tertiary sector[4]	539	997	248	1 282	3 066
Industry (in the context of the ESD)[5]	1 083	1 771	-	2 622	5 197
Transport sector[6]	4 352	-	-	100	4 452
Agriculture[7]	-	-	-	-	-

	2005				
	Oil products[1]	**Natural gas**	**Coal and other[2]**	**Electricity**	**Overall**
	Unit GWh				
Domestic final energy consumption[1,6]	8 586	8 445	1 852	6 159	25 042
Exception: Energy consumption by companies participating in the European Emissions Trading Scheme	311	3 551	1 648	1 704	7 214
Domestic final energy consumption in the context of the ESD[3,6]	**8 275**	**4 894**	**204**	**4 455**	**17 828**
of which: Household sector[4]	2 056	2 215	287	799	5 356
Tertiary sector[4]	506	972	273	1 286	3 037
Industry (in the context of the ESD)[5]	1 032	1 707	-	2 276	4 652
Transport sector[6]	4 682	-	-	94	4 776
Agriculture[7]	-	-	-	-	-

Average over the 5-year period	**GWh**	**17576**
9% energy savings target in 2016	**GWh**	**1582**
Adopted energy savings target (9%)	**GWh**	**1582**
Adopted interim target for 2010	**GWh**	**527**

[1] Excluding aircraft fuels in accordance with Article 3 of the Energy Efficiency Directive
[2] Including district heat and wood
[3] Military applications could not be shown separately due to the data situation and are therefore included In the data
[4] Breakdown between households and tertiary sector based on bottom-up calculations
[5] Discrepancy in the total due to statistical differences in the other fuels
[6] Excluding transit traffic (see notes in the text)
[7] Included in the tertiary sector

5.2 Specific aspects involved in calculating the national indicative target

5.2.1 Transit traffic

Luxembourg's energy balance sheet is dominated by the transport sector, which is in turn heavily influenced by transit traffic. In 2005 only 18% of energy use in the transport sector (excluding aircraft fuels) could be attributed to domestic energy consumption; by far the largest share of consumption was due to transit traffic, Transit traffic was excluded from energy efficiency planning measures, as measures in this area only lead to a shift rather than an improvement in energy efficiency.

5.2.2 Notes on the treatment of sectors covered by the EU Emissions Trading Scheme and on military energy consumption

EU Directive 2003/87/EC of the European Parliament and of the Council of 13 October 2003 establishes the European Emissions Trading Scheme (EU ETS)[4], Companies involved in this scheme are explicitly excluded from the target calculation in Efficiency Directive 2006/32/EC (Art, 2(b)). Also excluded from the Directive is energy consumption by the armed forces for defence purposes, essentially fuel consumption, In Luxembourg the energy consumption relating to this is small and was not therefore adjusted. The available data does not allow this either.

However, the influence of the emissions trading companies is significantly greater. Roughly 61% of the industrial final energy demand (including electricity) comes from emissions trading companies. The adjustment methodology is briefly described below. The companies concerned are first identified through the installations from the emissions registers. There are approx. 20 installations, which are focused primarily in the iron/steel and cement sector, By making a comparison with the sector's energy consumption, it is possible to determine that certain sectoral shares have to be excluded from Luxembourg's most important industries (including electricity consumption by the companies).

5.2.3 Overview of the conversion factors used

A conversion factor of 1 was used for electricity, i.e. electricity is treated as final energy. An exception to this is small CHPs[5], which have to be assessed as primary energy, in order to enable any savings to be generated through the calculation system within the meaning of an efficiency measure.

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4 OJ L 275, 25.10.2003, p. 32. Directive as amended by Directive 2004/101/EC (OJ L 338, 13.11.2004, p. 18).

5 Installations up to 1 MW electrical.

The following conversion factors were used for fuel (Table 5-3). The conversion factors from Annex II of the ESD are also given for comparison purposes. There are hardly any differences. Natural gas and wood are given in different units. However, the calculated conversion factors (densities) are entirely consistent with standard values.

Table 5-3: Conversion factors used for individual fuels

Energy conversion factors

		National factors		Factor, Annex II to Directive		
	Unit	GJ		Unit	GJ	t/m3
		PCI	PCS		PCI	Calc. density
Industrial coal	t	28		t	17,2-30,7	
Lignite briquette	t	20		t	20	
coke	t	28,5		t	28,5	
petrol	t	44		t	44	
jet fuel	t	43		t		
diesel, fueloil	t	42,3	45,2	t	42,3	
LPG	t	45,8		t	46	
natural gas	10^3 m^3	37,8	41,8	t	47,2	0,80
wood	m^3	7,15		t	13,8	0,52
waste	t	11,96		t	7,4-10,7	
biodiesel	t	36,9		t		
electricity	GWh	$3,6 \cdot 10^3$		GWh	$3,6 \cdot 10^3$	

[1] Piled metre = 0.7 solid cubic metres

6 Methodology for quantifying measures

Various data sources were used to quantify measures, in particular:

- Luxembourg's energy balance sheets for the period 1995-2005
- Sectoral information sources, e.g.
  - building structure statistics;
  - energy consumption of companies in the ETS sector;
  - statistics on renewables;
  - CHP statistics.
- For projections of activity sizes, sectoral studies on the country's development were evaluated, e.g. the Integrated Transport and Regional Development Concept for Luxembourg (2004).
- Where structures were missing, this data was enhanced by information on sectoral structures in countries with roughly comparable structures (D, NL, F, B), particularly on:
  - equipment rates of households with electrical appliances;
  - details on the structure of the service sector (TCS).

Furthermore, measures were modelled based on the collected data:

- At the first stage, a consistent numerical framework was developed.
- Consequently, a basic development of activity variables was defined based on work for the NAP carried out by the Institute for Public Economics at the University of Cologne (henceforth "FIFO"), but also on other sectoral investigations, e.g. transport, as mentioned above.
- The third stage involved the classification and screening of efficiency measures for the NEEAP-L according to their importance and possible impact.
- Parameters were then set for the measures, taking account of their contents and adding further assumptions if the measure was not yet final.
- The measures were then assessed with the help of the LEAP model, a bottom-up simulation model, or using results such as price elasticities in the transport sector, which FIFO had established in earlier studies. The results were presented in Excel.

7 Sectoral description of energy-efficiency, energy-service and other measures planned or already implemented in order to improve energy efficiency

7.1 Classification of energy efficiency improvement measures in the NEEAP

The calculation bases of the individual measures in the different sectors and also the main assumptions relating to these are described below. There are three categories of measures, which are

(1) **Early action measures (A):** Measures implemented during the period 1995 – 2007, which started to take effect during this period. What is important is for these measures still to be effective in 2016, taking account of the lifetimes of measures[6] specified in the Directive.

(2) **New measures (B):** Measures that are being implemented but will only take effect as of 2008.

(3) **New planned/potential measures (C):** Measures that can also help to meet the requirements of the NEEAP-L.

The basic approach is described in the Households section and is identical for all sectors.

7.2 Overview of measures

The following individual measures are discussed within these three groups:

Early action measures (A):

A1 (households):	Thermal Insulation Ordinance 1996 (WD1996) (new/old buildings)
A2 (households):	Promotion of energy efficiency in new homes/efficient heating systems (2001-2007)
A3 (TCS sector):	Thermal Insulation Ordinance 1996 (WD1996)
A4 (renewables):	Promotion of decentralised renewables in the building sector by 2007
A5 (CHP):	Promotion of decentralised CHP (outside emissions trading)

[6] Directive 2006/32/EC specifies: Roof insulation (private dwellings) 30 years, cavity wall insulation (private dwellings) 40 years, glazing (E to C rated) (in m2) 20 years, boilers (B to A rated) 15 years, heating controls – upgrade with boiler replacement -15 years, compact fluorescent lights (retail lights) 16 years. However, these values are currently being revised by a CEN Workshop and the EMEES Project (http://www.evaluate-energy-savings.eu).

New measures (B):

- B1 (households): Improvement in the overall energy efficiency of private dwellings (WD2008) (new/old buildings)
- B2 (households): Old building upgrade programme
- B3 (households): Promotion of energy-efficient new homes (new building compared with WD2008: low-energy housing, passive housing)
- B4 (TCS sector): Improvement in U-values of non-domestic buildings (WD2008)
- B5 (renewables): Promotion of decentralised renewables (solar thermal applications, PV, without biomass)
- B6 (renewables): Use of biomass in households (e.g. pellet heating)
- B7(nat. transport): Reduction in fuel consumption by raising fuel prices
- B8 (nat. transport): CO_2-related vehicle tax
- B9 (nat. transport): Promotion of least-polluting cars

New planned/potential measures (C):

- C1 (households): Increase in old building upgrade programmes
- C2 (households): Renewal of the oldest heating systems
- C3 (households): Increased promotion of energy-efficient new homes (new building compared with WD2008)
- C4 (households): Electricity savings on electrical appliances
- C5 (TCS sector): Improvement in the overall energy efficiency of buildings in the TCS sector (WD2010)
- C6 (TCS sector): Realising electricity savings potential in the TCS sector
- C7 (industry): Realising electricity savings potential for industrial cross-cutting technologies
- C8 (renewables): Further realising of decentralised potential for renewables in the building sector (middle development path, excluding biomass)
- C9 (renewables): Further expansion of biomass use in households

These measures are discussed individually below.

7.3 Energy efficiency improvement (EEI) measures in the household sector

Table summarising all energy efficiency improvement measures in the household sector:

No	Title of the EEI measure	EEI action targeted	Duration	Annual energy saving expected in 2016
A1	Ordinance of the Grand Duchy of 22 November 1995 on the thermal insulation of buildings (dwellings)	Improved insulation of building cavities compared with the pre-1996 standard (new buildings and conversions)	01/01/1996 - 31/12/2007	295 GWh [predominantly natural gas/oil]
A2	Ordinances of the Grand Duchy of 17 July 2001 and 3 August 2005 on the promotion of rational energy usage and renewables	Promotion of energy-efficient new building (new building compared with WD 1996: low-energy housing, passive housing) and efficient heating systems (condensing boilers)	Programme I (2001-2004) and programme II (2005-2007)	76 GWh [predominantly natural gas/oil]
B1	Ordinance of the Grand Duchy of 30 November 2007 on improving the overall energy efficiency of buildings (dwellings)	Improved overall energy efficiency of dwellings (new buildings and conversions)	As of 01/01/2008	372 GWh [predominantly natural gas/oil]
B2	Building upgrading programme according to the Ordinance of the Grand Duchy of 21 December 2007 on promoting rational energy use and renewables	Improved cavity insulation in old buildings based on the Ordinance on improving the overall energy efficiency of dwellings,	01/01/2008 – 31/12/2012	25 GWh [predominantly natural gas/oil]
B3	Support programme for efficient new building according to the Ordinance of the Grand Duchy of 21 December 2007 on promoting rational energy use and renewables	Promotion of low-energy housing, passive housing	01/01/2008 31/12/2012	12 GWh [predominantly natural gas/oil]
C1	Expansion of old building upgrade programmes	Improved cavity insulation in old buildings based on the Ordinance improving the overall energy efficiency of dwellings	As of 01/01/2010	32 GWh [predominantly natural gas/oil]
C2	Renewal of the oldest heating systems	Heating renewal programme (in addition to the building upgrade programme in measure C1); e.g. regulatory, financial incentives, energy service within the framework of the ESD by energy companies	As of 01/01/2010	53 GWh [predominantly natural gas/oil]
C3	Increased promotion of energy-efficient new buildings	Expansion of the support programme for energy-efficient new buildings (low-energy, passive housing)	As of 01/01/2010	25 GWh [predominantly natural gas/oil]
C4	Electricity saving	e.g. support labelling of electrical appliances; top-runner programme; efficiency fund	As of 01/01/2010	8 GWh [electricity]]

Notes on the calculating methodology used for households

Fuel

The calculation of fuel trends in Luxembourg is based on detailed housing statistics, Three age groups and three types of housing characterised by a different specific energy demand were identified. To take account of the demographic change, a 1.3% annual growth in the number of households was assumed, resulting from the growth in population and trend towards single households.

The following Table was calculated for the aforementioned building groups by means of data relating to shares of the housing stock, building areas and the mix of energy sources within the energy demand.

Table 7-1: Energy demand for space heating (SH) and hot water (HW) in private households (baseline)

Energy source [GWh]	**2004**	**2008**	**2010**	**2016**
Natural gas	1 977	2 184	2 297	2 680
Oil	2 354	2 362	2 360	2 327
Liquid gas	59	58	57	55
Wood	63	71	77	110
Other	384	450	489	630
Electricity (heating)	205	184	172	134
Total heat (SH + HW)	**5 044**	**5 308**	**5 452**	**5 935**

In order to calculate the energy savings made by different measures, a new specific energy demand (kWh/m^2) was then determined for each of the three types of buildings and the three age categories. Using the share of the building in which the individual measures had been implemented over time, the new energy demand could then be calculated. The difference compared with the baseline thereby produces the savings effect of a measure. For example, Table 7-2 shows the energy demand in each case following the introduction of the Thermal Insulation Ordinance in 1996 for new buildings (WD1996).

Table 7-2: Energy demand for space heating (SH) and hot water (HW) in private households (following the introduction of WD1996 for new buildings)

Energy source [GWh]	**2004**	**2008**	**2010**	**2016**
Natural gas	1 905	2 022	2 085	2 292
Oil	2 298	2 255	2 229	2 128
Liquid gas	57	54	53	48
Wood	63	68	72	93
Other	373	422	450	547
Electricity (heating)	203	181	169	131
Total heat (SH + HW)	**4 899**	**5 003**	**5 058**	**5 239**

The differences compared with the values shown in Table 7-1 are savings attributable to this measure. Since a new ordinance on the energy efficiency of buildings came into force in 2008, the saving by the WD1996 has only been calculated up to this point and its value is therefore limited to a total of 295 TWh. This saving also exists in 2016, the ESD target year, since the lifetime of insulation measures is significantly longer,

Table 7-3 shows the demand data and savings potential of individual building types. It is assumed that buildings constructed after 1995 have not been sufficiently upgraded and the specific energy demand of the housing stock in this category therefore remains constant. The figures in Table 7-3 for age categories prior to 1995 must therefore be regarded as upgrade values and those for the post-1995 category as purely new building values.

Table 7-3: Demand data and savings potential of types of dwelling

Energy demand [kWh/m²]	**EFH**			**RH**			**MFH**		
	pre-70	**71 - 95**	**post-95**	**pre-70**	**71 - 95**	**post-95**	**pre-70**	**71 - 95**	**post-95**
Baseline	248	186	186	160	158	158	156	128	128
WD1996	200	160	130	165	125	88	150	100	67
WD2008	160	140	91	130	110	62	110	90	47

Table 7-4 provides an overview of the assumptions made and the impact of all measures considered,

Table 7-4: General assumptions and savings potential of all fuel-related measures in private households

Assumptions	
Annual growth in number of houses	1.3 %
Annual upgrading rate for old buildings	0.5 %
Annual new building rate	2.0 %
Saving as a result of the measure [in GWh]	**2016**
Early action	
WD1996 (old building)	35
WD1996 (new building)	260
Promotion of efficient new building/efficient heating systems (2001-2007)	76

Table 7-4 continued

New measures	
Improvement in overall energy efficiency of dwellings (WD2008) (old buildings)	34
Improvement in overall energy efficiency of dwellings (WD2008) (new buildings)	338
Old building upgrading programme	25
Promotion of more efficient new building	12
Other potential measures	
Expansion of old building upgrading programme	32
Increased promotion of more efficient new building	25
Heating renewal	53

Electricity

There are no electricity-based national early action or planned measures. The effects of labelling household electrical appliances are purely down to EU measures and are not therefore included in the national measures. A possible measure for electricity could involve greater support for the purchase of energy-efficient appliances. Equipment rates for energy-efficient appliances in Germany would be taken as the baseline and these would be adapted to the conditions prevailing in Luxembourg (greater proportion of efficient appliances compared with Germany). This produces the potential for further possible measures shown in Table 7-5.

Table 7-5: General assumptions and savings potential of all electricity-related measures in private households

Saving due to measure [in GWh]	**2016**
Other possible measures	
Support for energy-efficient appliances	8

7.4 Energy efficiency improvement measures in the tertiary sector

Table summarising all energy efficiency improvement measures in the tertiary sector:

No	Title of the EEI measure	EEI action targeted	Duration	Annual energy saving expected in 2016
A3	Ordinance of the Grand Duchy of 22 November 1995 on the thermal insulation of buildings (tertiary sector)	Improved insulation of building cavities compared with the pre-1996 standard (new buildings and conversions)	01/01/1996 - 31/12/2007	118 GWh [[predominantly natural gas/oil]
B4	Ordinance of the Grand Duchy of 30 November 2007 on improving the overall energy efficiency of buildings (regulations for non-domestic buildings)	Improved U-values for non-domestic buildings compared with the 1995 Ordinance (new buildings and conversions)	01/01/2008 - 31/12/2010	40 GWh [predominantly natural gas/oil]
C5	Extension of the Ordinance of the Grand Duchy for 2008 on improving the overall energy efficiency of buildings to non-domestic buildings in 2010	Improved overall energy efficiency of dwellings (new buildings and conversions)	as of 01/01/2010	79 GWh [predominantly natural gas/oil]
C6	Realising electricity savings potential TCS sector	Cross-cutting technologies (lighting, pumps, air-conditioning,,,); e.g. information/audits/energy services by energy distributors/incentive schemes	as of 01/01/2010	65 GWh [Electricity]

Notes on the calculating methodology used for the tertiary sector

The lack of available data makes the TCS sector difficult to illustrate. Consequently, a very aggregated approach has been taken to considering this sector. The starting point for this was electricity demand, which stands at around 1.2 TWh. There is no subdivision according to the different industries for Luxembourg. To make things simpler, it was assumed that 70% corresponds to office-like services and all other industries are represented by the remaining 30%. Since the fuel demand in the TCS sector is not known either, this was estimated based on the electricity/fuel ratio of the German TCS sector (taking account of the different industry structure), the value of which is 1 to 1.6.

This sector displays vigorous growth in Luxembourg, which was estimated at 4.5% per annum for the purposes of this observation. WD96, a possible tightening in the context of a WD10 and the more efficient use of electricity in the different cross-cutting technologies (e.g. lighting, air-conditioning) were considered as savings measures.

Table 7-6 provides an overview of the effects of the measures. However, these values only represent an estimate, due to the lack of basic data available.

Table 7-6: General assumptions and savings potential of all measures in the TCS sector

Assumptions	
Annual growth	4.5 %
Increased fuel demand	0.5 %
Increased electricity demand	1.5 %
Electricity/fuel ratio	1:1.6
Annual renovation and renewal rate	2 %
Savings potential WD1996 (compared with new building pre-WD1996)	25 %
Savings potential WD2008 (compared with new building pre-WD1996)	50 %
Overall energy efficiency savings potential (compared with new building pre-WD1996)	65 %
Electricity savings potential per cross-cutting technology	5 – 20 %
Saving due to measure [in GWh]	**2016**
Early action	
WD1996	118
New measures	
WD2008 (regulations on U-values for non-domestic buildings)	40
Other possible measures	
Improving overall energy efficiency for non-domestic buildings	79
Realising electricity saving potential TCS sector	65

Table 7-7 shows the sort of savings potential achievable for individual cross-cutting technologies in the TCS sector (lighting, power, process heat, air-conditioning/refrigeration and I&C applications such as computers, etc.). This potential has been derived from several detailed studies conducted by the Fraunhofer Institute for Systems and Innovation Research (Fraunhofer ISI) on the TCS sector in Germany. The overall electricity savings potential by 2016 is indicated in Table 7-8.

Table 7-7: Electricity savings potential in the TCS sector by 2016

Electricity savings potential	**2016**
Lighting	15%
Power	8%
Process heat	4%
Air-conditioning, refrigeration	15%
I&C	11%

Table 7-8: Electricity savings potential achievable in the TCS sector by 2016 in absolute terms (in GWh)

Overall electricity savings potential	**2016**
of which	
Lighting	67%
Power	21%
Process heat	3%
Air-conditioning, refrigeration	14%
I&C	25%

7.5 Energy efficiency improvement measures in non-ETS industry sectors

Table summarising all energy efficiency improvement measures in non-ETS industry sectors:

No	Title of the EEI measure	EEI action targeted	Duration	Annual energy saving expected in 2016
C7	Realising potential in industrial cross-cutting technologies	Improvement in the energy efficiency of industrial cross-cutting technologies (electric motors, compressors,,,,,); e.g. information/audits/energy tables/ voluntary measures by industry/incentive schemes	as of 01/01/2010	99 GWh [electricity]

Notes on the calculating methodology used for industry

A major proportion of industrial electricity consumption (60%) is excluded due to emissions trading. As a result, only electricity-based measures were taken into account for industrial cross-cutting technologies (electric motor applications in pumps, fans, compressed air systems, etc.) in the context of the NEEAP. Data on cross-cutting technologies and their savings potential in Germany was taken as the basis, as no corresponding figures were available for Luxembourg. Any companies involved in the ETS were completely excluded from the observation.

Table 7-9: General assumptions and savings potential of all measures in industry

Assumptions	
Annual growth in steel, cement, glass (predominantly ETS)	0.5 %
Annual miscellaneous growth	3.5 %
Increase in fuel demand	0.0 % (0.5 % misc.)
Increase in electricity demand	0.5% (1.5 % misc.)
Saving due to measure [in GWh]	**2016**
Other possible measures (electricity)	
Realising the potential of industrial cross-cutting technologies	99

The savings potential for the individual cross-cutting technologies is indicated in Table 7-10. This was derived from detailed investigations in Germany and other European countries (see below). Luxembourg does not have its own investigation into this.

Table 7-10: Electricity saving potential in the industry sector (excluding ETS) by 2016

Cross-cutting technologies	Savings potential by 2016
Lighting	11%
Process technology	0%
Compressed air	13%
Cooling	8%
Fans	14%
Pumps	17%
Other motor applications	9%

When it comes to the type of instrument used to implement the measures, there are various options available:

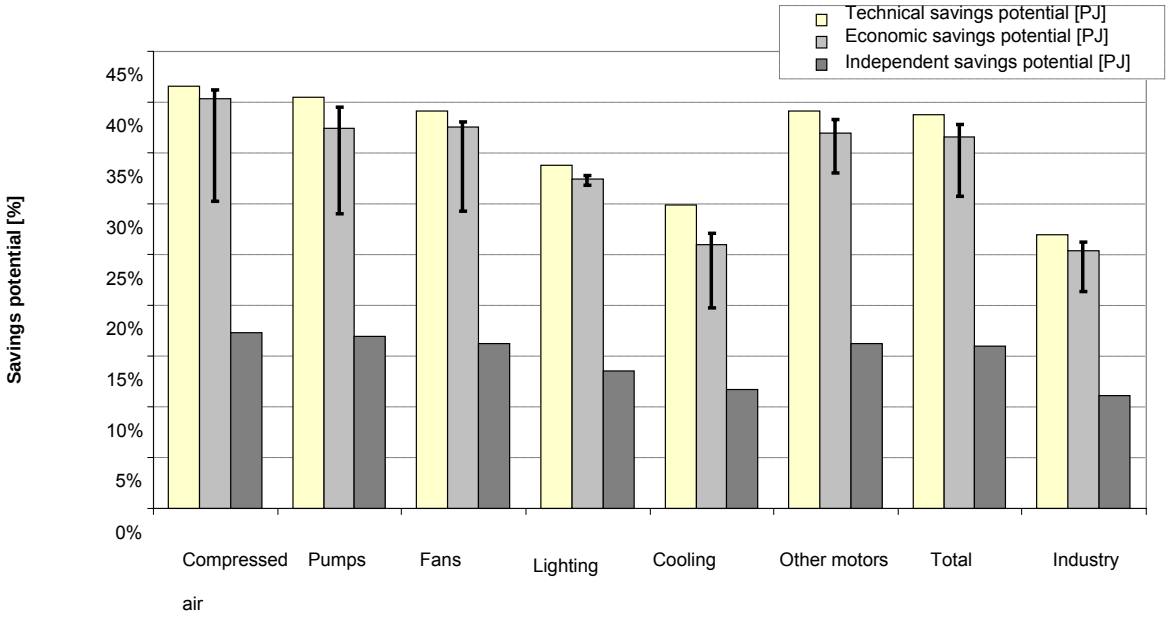
- Informational measures by FEDIL and other protagonists on electricity savings potential for individual cross-cutting technologies.
- Audits on cross-cutting technologies in companies, possibly involving the generation of a benchmarking tool and other instruments to support the companies in their choice of technologies (see, for example, the “Efficiency of compressed air” campaign run by dena and the Fraunhofer ISI in Germany at www.druckluft-effizient.de).
- Energy services provided by energy distributors to support the implementation of savings measures.
- Incentive schemes / energy saving fund.

Additional notes on potential to be found in industrial cross-cutting technologies

There are currently no investigations into the savings potential of industrial cross-cutting technologies in Luxembourg. However, a number of EU Member States have experience of this, which was tested in various EU projects, particularly in Germany. The result of all this research was the savings potential depicted in the following (Fig. 7-1) for cross-cutting technologies. This shows the technical, financial and independently achievable savings potential by 2035 for the individual cross-cutting

technologies. In this case, the percentage savings relate to the individual cross-cutting application. A relatively significant proportion of this savings potential can be mobilised by 2016.

Fig. 7-1: Long-term saving potential by cross-cutting technology (by 2035)



Source: Fraunhofer ISI (2006)

7.6 Energy efficiency improvement measures in the transport sector

Table summarising all energy efficiency improvement measures in the transport sector:

No	Title of the EEI measure	EEI action targeted	Duration	Annual energy saving expected in 2016
B2	Rise in the price of domestic fuel consumption	Driving habits aimed at low fuel consumption (short-term); purchasing decisions in favour of more economical vehicles (longer term)	as of 01/01/2007 or 01/01/2008	61 GWh [fuel]
B8	Ordinance of the Grand Duchy of 22 December 2006 […] on the definition of special measures in the area of social and environmental policy (CO2-related vehicle tax)	Impact of purchasing decisions on more economical vehicles	as of 01/01/2007	86 GWh [fuel]
B9	Ordinance of the Grand Duchy of 5 December 2007 guaranteeing financial support for least-polluting cars	Impact of purchasing decisions on more economical vehicles	as of 01/01/2008	75 GWh [fuel]

Notes on the calculating methodology used for transport

The stock of vehicles registered in Luxembourg was divided into three groups: Cars, Heavy Goods Vehicles and Other. The Cars and Other categories were further subdivided into those with petrol or diesel engines. A 23% growth in the car stock by 2016 was assumed, while this figure was 11% for the other groups. A constant efficiency per km was assumed for the baseline. In the car category, it was assumed that there would be a slight drop in annual kilometrage (-7 % by 2016); for the other two groups a slight rise in kilometrage (+4-5 % by 2016) was assumed. The short-term price elasticity is around 0.5%, the long-term figure around 1% for petrol and 1.6% for diesel. The difference in the long-term observation lies in the greater proportion of commercial traffic among diesel vehicles. This reacts more sensitively to price changes.

Table 7-11: General assumptions and savings potential of all measures in the transport sector (Luxembourg vehicles)

Assumptions	
Car stock	+23 % by 2016
Stock of HGVs and Others	+11 % by 2016
Distance travelled by cars	-7 % by 2016
Distance travelled by HGVs and Others	+4-5 % by 2016
Fuel efficiency per km	constant (baseline)
Increase in fuel prices	2 €ct/l (petrol); 2,5 €ct/l (diesel)
Short-term price elasticity	0.4 – 0.6 %
Long-term price elasticity	1 – 1.6 %
Saving due to measure [in GWh]	**2016**
New measures	
Reduction in fuel consumption by increase in fuel prices	61
CO_2-related vehicle tax	86
Support for least-polluting cars	75

7.7 Cross-cutting measures and renewables

Table summarising all cross-cutting energy efficiency improvement measures:

No	Title of the EEI measure	EEI action targeted	Duration	Annual energy saving expected in 2016
A4	Promotion of decentralised renewables in the building sector by 2007	Greater market penetration by renewables (solar panels, PV, biomass in households)	01/01/1996 - 31/12/2007	48 GWh [natural gas/oil/ electricity]
A5	Ordinance of the Grand Duchy of 30 May 1994 for the production of electrical energy based on renewables and CHP	Greater market penetration by small CHP plants	1998-2007	167 GWh [natural gas]
B5	Ordinance of the Grand Duchy of 21 December 2007 on the promotion of rational energy use and renewables	Promotion of decentralised renewables (PV, solar thermal energy, excluding biomass)	01/01/2008 – 31/12/2012	12 GWh [predominantly natural gas/oil/ electricity]
B6	Ordinance of the Grand Duchy of 21 December 2007 on the promotion of rational energy use and renewables	Realising the potential of decentralised renewables in the building sector (use of biomass in households, e.g. pellet heating)	01/01/2008 – 31/12/2012	45 GWh [predominantly natural gas/oil]
C8	Continuation and expansion of support for decentralised renewables (solar thermal installations; PV installations)	Middle development path: Greater efforts for renewables, excluding biomass. Installation of solar panels for domestic water use and PV installations to produce electricity in the household sector.	as of 01/01/2010	23 GWh [predominantly natural gas/oil/ Electricity]
C9	Expansion in household biomass use	Middle development path: Greater efforts for renewables, solid biomass (e.g. pellet heating)	as of 01/01/2010	11 GWh [predominantly natural gas/oil]

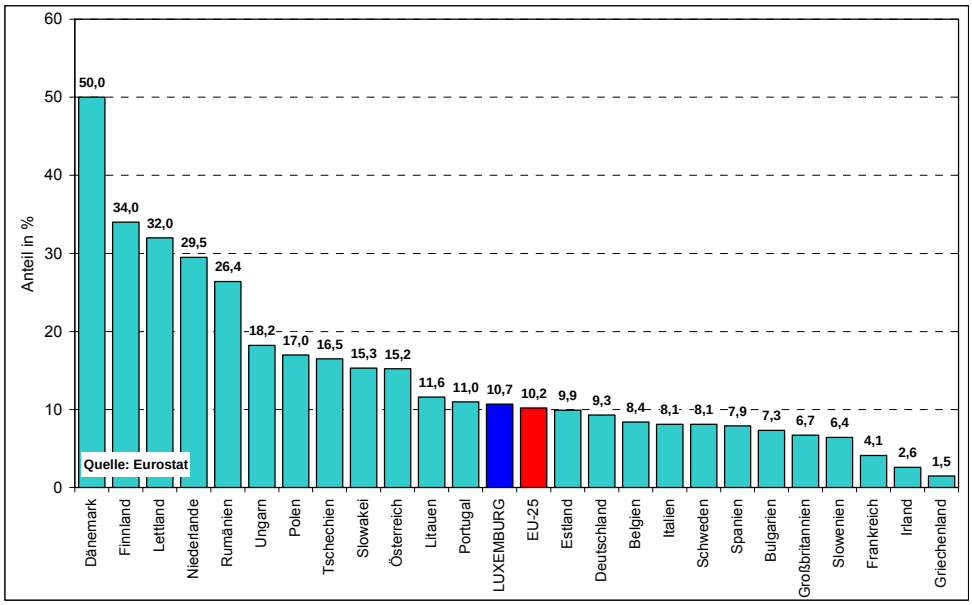
Notes on the calculating methodology used in relation to cross-cutting measures and renewables

According to Eurostat figures, the proportion of electricity generation accounted for by CHP in Luxembourg was 10.7% in 2004, which is slightly higher than the European average of 10.2% (Fig. 7-2).

Fig. 7-2 Proportion of total electricity generation accounted for by CHP throughout the EU in 2004

%proportion

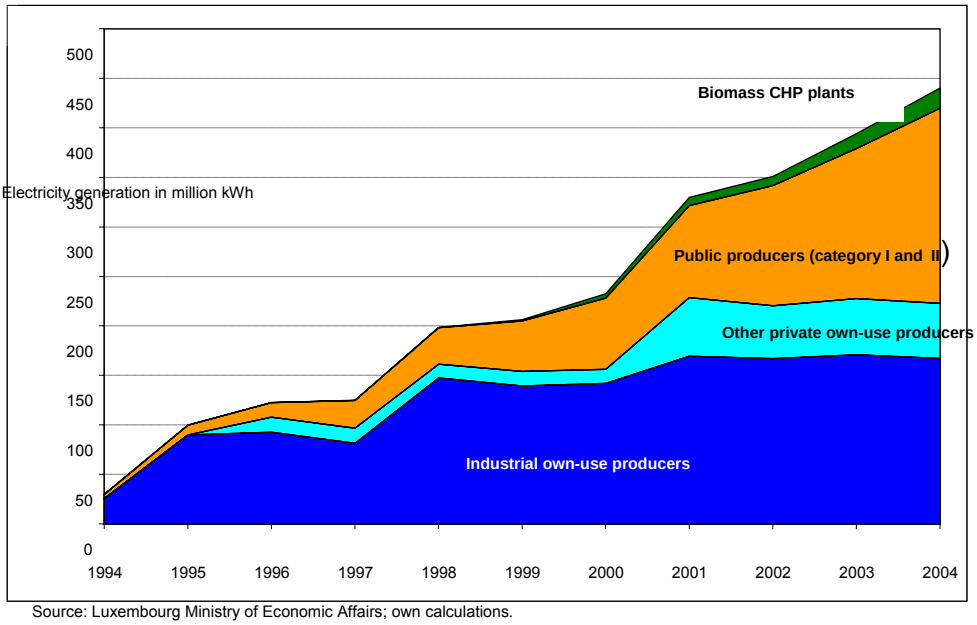
Source:Eurostat



Denmark/Finland/Latvia/Netherlands/Romania/Hungary/Poland/Czech Republic/Slovakia/Austria/Lithuania/Portugal/Luxembourg/EU-25/Estonia/ Germany/Belgium/ Italy/Sweden/Spain/Bulgaria/Great Britain/Slovenia/France/Ireland/Greece

CHP electricity generation has increased significantly in Luxembourg in recent years. Whilst only around 30m kWh of CHP electricity was produced in 1994, by 2004 this figure had risen to roughly 440m kWh. CHP plants on the public supply network played a major part in this rise, their share of the total CHP electricity generation rising from around 14 % (1994) to around 45 % (2004) (Fig. 7-3).

Fig. 7-3 Trend in CHP electricity generation in Luxembourg 1994-2004



Source: Luxembourg Ministry of Economic Affairs; own calculations.

The current promotion of CHP falls under early action, However, only part of the CHP electricity generation shown in Fig. 7-3 falls under the ESD, namely plants that are not subject to emissions trading, These include some public electricity producers and other private, own-use producers.

Table 7-12 shows the technical parameters assumed for CHP.

Table 7-12: General assumptions and savings potential of all measures (fuel-related) for CHP

Assumptions	
Separate electricity generation efficiency - gas-steam power plant	55%
Separate electricity generation efficiency - other	35%
Separate electricity generation proportion – gas-steam power plant	30%
Separate electricity generation proportion - other	70%
Separate heat generation efficiency	90%
CHP electricity proportion	35%
CHP heat proportion	65%
CHP overall efficiency	80%
Annual growth (increased promotion)	4 %
Saving due to measure [in GWh]	**2016**
Early action	
Promotion of small-scale CHP	167

The assumptions in relation to renewables and biomass are borrowed from the Fraunhofer ISI study entitled “Determining potential and developing strategies for the increased use of renewable energy in Luxembourg”.

8 Additional measures to be reported in the NEEAP 2007[7]

This section contains a report on the provisions relating to the exemplary function of the public sector in accordance with Article 5(1) of the ESD and on the supply of information and advice to final customers in accordance with Article 7(2). These two points contain the following:

8.1 Exemplary role of the public sector

Directive 2006/32/EC defines particular goals for the public sector[8], in order for it to meet its exemplary function. Member States must fulfil the following duties in particular:

- They must ensure that the public sector take energy-efficiency measures, focussing on cost-effective measures: These may consist of legislative initiatives and/or voluntary agreements, as referred to in Article 6(2)(b), or other schemes with an equivalent effect. To this end, and without prejudice to the national and Community public procurement legislation, at least two measures must be used from the list set out in Annex VI[9] of the Directive. These measures must be described in the National Energy Efficiency Action Plan (NEEAP) (see below), but need not be quantified. Member States should facilitate the process by publishing guidelines on energy efficiency and energy savings as a possible assessment criterion in competitive tendering for public contracts.
- They must assign to one or more new or existing organisations the administrative, management and implementing responsibility for the special role of the public sector in energy efficiency.
- They must facilitate and enable the exchange of best practices between public sector bodies, for example on energy-efficient public procurement practices, both at national and international level.

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7 The measures contained in Articles 6 and 8-13 need not be reported until 17 May 2008.

8 Article 5, Directive 2006/32/EC

9 The following are mentioned in Annex VI:

a) Requirements concerning the use of financial instruments for energy savings;
b) Requirements to draw up lists of different product categories, enabling a corresponding choice of energy-efficient products to be made, also taking account of different operating modes such as stand-by;
c) Requirements to purchase equipment that has low energy consumption in all modes;
d) Requirements to replace or retrofit existing equipment and vehicles with the equipment listed in points b and c;
e) Requirements to use energy audits and implement the resulting cost-effective recommendations;
f) Requirements to purchase or rent energy-efficient buildings or parts thereof or requirements to replace or retrofit purchased or rented buildings or parts thereof, in order to render them more energy-efficient.

- They must communicate effectively the exemplary role and actions of the public sector to citizens and/or companies, as appropriate.

Planned action

The Luxembourg government has either initiated or is planning to initiate the following action. These measures are also important elements of Luxembourg's Climate Change Programme. Also shown in brackets are figures from Annex VI of the Energy Efficiency Directive, corresponding to the aforementioned measures.

(1) Public buildings (element 6 Climate Change Programme) (requirement f in Annex VI of the ESD)

New buildings: The aim of this measure is for the government to play a pioneering role in new buildings, where the focus is to be on achieving the greatest possible energy efficiency. The planning of public buildings therefore involves developing an energy concept and the possibility of connecting to CHP plants and/or using renewables in the building is also appraised.

Existing buildings: Luxembourg has published an upgrading programme for public buildings. 1 500 buildings are state-owned, 30% are outdated, from the 1970s when there was no talk of energy saving or good insulation. Around €30m have been made available from the Kyoto fund for the gradual upgrading of old building stock involving energy measures. In the coming years, every building is to have its own energy balance sheet.

(2) Ministerial fleet (element 4 Climate Change Programme) (requirement d in Annex VI of the ESD)

The 15 cars belonging to the ministerial fleet currently lie within the range 238 g CO_2/km to 286 CO_2 g/km. The government intends to gradually replace its vehicles with cars lying within the region of 200 g CO_2/ km or hybrid cars. As an initial measure, hybrid cars are being purchased for two ministers.

(3) Government and local-authority fleets (element 4 Climate Change Programme) (requirement d in Annex VI of the ESD)

The Ministry of the Environment, in conjunction with the Ministry for Building, is drawing up criteria for the government and local authorities to ensure they also use fuel-efficient cars.

8.2 Article 7 on the supply of information

Article 7 of the ESD requires Member States to ensure

- that information on energy-efficiency mechanisms and financial and legal frameworks adopted with the aim of reaching the national indicative energy

savings target is transparent and widely disseminated to the relevant market actors (**government's duty to provide information**).

- that greater efforts are made to promote energy end-use efficiency. They shall establish appropriate conditions and incentives for market operators to provide more information and advice to final customers on energy end-use efficiency (**information supplied by market operators**).

Planned actions

For the supply of information, the following actions have either been taken or are being planned and these also constitute an important element of the Luxembourg government's Climate Change Programme,

(1) Energy savings campaign (element 1 Climate Change Programme)

- 2006: Awareness campaign as part of the European Climate Change Campaign
- 2007: Information campaign on the subject of energy conservation.

Aim: To raise awareness within the population of the need for climate protection, to address the issue of important energy concerns and raise awareness of energy conservation.

Main channels: Communications (TV, radio, newspapers, internet) and local action. Also raising awareness in schools in collaboration with the Ministère de l'Education Nationale.

(2) Top ten sustainable products (element 1 Climate Change Programme)

The OekoTopten project is being implemented by the Ministry for the Environment in conjunction with the Mouvement Ecologique and the OekoZenter Luxembourg. A homepage gives users the opportunity to acquire information on energy-efficient electrical appliances.

This measure should provide better support for those leading the way in the production and marketing of ecological products. A market incentive is to be created, so that retailers are able to include more and more of the "best" products in their ranges.

Targets: Consumers who are frequently put off finding out more about sustainable products and thereby creating a basis for reducing resource consumption and increasing energy efficiency by the multitude of labels.

(3) Awareness campaign for low-emission cars (element 4 Climate Change Programme)

In the run-up to the 2008 Autofestival, the Ministry for the Environment in conjunction with the Fédération des Garagistes (Fegarlux) and the Association des distributeurs-automobiles luxembourgeois (Adal) will conduct an awareness campaign on low-emission vehicles.

(4) Information campaigns on heat technology (element 7 Climate Change Programme)

Information campaigns will be run promoting the use of heat technologies based on renewable sources of energy (wood energy, heat pumps, solar thermal energy).

(5) Advice structure: Better advice, growth in awareness and information (element 2 Climate Change Programme)

The national Kyoto Actions Plan for Luxembourg envisages the creation of a central information, training and advice structure in the field of energy efficiency and renewables, the aim of which should be the creation of a national network with local authorities and energy advisory structures. Active players in the market should be also be increasingly integrated into these structures where possible, so that they can provide final customers with information on energy efficiency. The Energy Agency's 2008 budget is being increased for this purpose.

Main aims: Nationwide coordination of the content and structure of the advice. All regions and citizens should receive equally good advice and information, advice as a cost-effective measure for achieving energy efficiency. The advice on offer is being considerably expanded.

(6) Energy management (element 9 Climate Change Programme)

In collaboration with the Centre de Ressources des Technologies pour l'Environnement (CRTE), the level of awareness and advice offered to SMEs is to be raised and this is also to focus on the energy audit as an instrument.

Annexes to the NEEAP

Annex 1

Detailed description of measures in the household sector

Title of the energy efficiency improvement (EEI) measure	***A1) Ordinance of the Grand Duchy of 22 November 1995 on the thermal insulation of buildings (dwellings)***
Category	*Regulatory* *1.1 Thermal building standard and update*
Regional application	*Effective nationwide*
Target group	*Final energy consumption for heating in the household sector (new buildings and major conversions of existing buildings): 5.0 TWh in 2004 or 29% of the final energy consumption addressed by the ESD (including electricity for heating and hot water)*
EEI action targeted	*Improved cavity wall insulation compared with pre-1996 standard (new buildings and conversions)*
Effectiveness	*Evidence of thermal insulation is provided by two methods: Method 1: Evidence by means of the building cavity's mean U-value. Takes account of solar radiation, the geometric shape of the building and the building's mean internal temperature. Relates to buildings with a heated living area starting at 200 m^2, $U_{M,perm,} = C_0 * C_1 * C_2$ [W/m2K] where $U_M \leq U_{M,perm,}$. Threshold C_0: 0.65 [W/m2K], recommended target value C_0: 0.55 [W/m2K], C_1: shape factor, C_2: ambient air temperature factor. Method 2: Evidence by means of U-values of the individual components for buildings with a heated living area of under 200 m^2* *Follow-up measure B1: Ordinance of the Grand Duchy of 30 November 2007 on improving the overall energy efficiency of buildings (dwellings) (WD2008)*
Expected annual energy savings in 2010 and 2016	*295 GWh (2016) All savings from the period 1995-2007 (thereafter savings due to the 2008 Thermal Insulation Ordinance). Approx. 96% is fuel, 4% electricity for heating. Measure evaluation using building stock model.* *Important assumptions made for calculation:* ➢ *Household growth factor 1.3%/a on average until 2020* ➢ *Based on figures for the building stock and building areas by age category (3 age groups and 3 dwelling types)* ➢ *Upgrading rate for old buildings under WD1996: 0.5%/a, New building rate 2%/a. Savings on old buildings: up to 19 %, on new buildings up to 47% (depending on the age and type of building)* ➢ *Taking account of 15% non-compliance in new buildings and rebound effects.*
Implementation status and exact timeframe	*EEI measure implemented no earlier than 1995 and still effective in 2010 and 2016.* *Start/end of the measure: 01/01/1996 – 31/12/2007*
Information	*http://www.legilux.public.lu/leg/a/archives/1995/0992712/index.html*

Title of the energy efficiency improvement (EEI) measure	***A2) Promotion of efficient new building/more efficient heating systems (2001-2007) (Ordinances of the Grand Duchy of 17 July 2001 and 3 August 2005 on the promotion of rational energy usage and renewables)***
Category	*Financial instrument* *3.1 Subsidies*
Regional application	*Effective nationwide*
Target group	*Final energy consumption for heating in the household sector (new buildings and major conversions of existing buildings): 5.0 TWh in 2004 or 29% of the final energy consumption addressed by the ESD (including electricity for heating and hot water)*
EEI action targeted	*Promotion of efficient new building (new building compared with WD1996: low-energy housing, passive housing) and more efficient heating systems (condensing boilers)*
Effectiveness	*Ordinances of the Grand Duchy of 3 August 2005* *Art. 7. Condensation boiler: Existing house with adjustable power output: €100; apartment building: amount multiplied by number of apartments, but not exceeding €600.*
Art. 11, New, high-energy-efficiency buildings *'Low-energy' house / 'passive' house* ➢ *Detached single-family house / terraced single-family house (net area S_n <150 m²): €77/m^2 / €140/m^2 per house;* ➢ *Apartment block (S_n <500 m^2): €70/m^2 / €130/m^2 per apartment (S_n <80 m^2);* ➢ *Apartment block (S_n 501-1000 m^2): €60/m^2 / €110/m^2 per apartment (S_n <80 m^2);* ➢ *Apartment block (S_n 1001-5000 m^2): €50/m^2 / €90/m^2 per apartment (S_n <80 m^2);* ➢ *Apartment block (S_n > 5000 m^2): €45/m^2 / €70/m^2 per apartment S_n <80 m^2);* *Under these rules the maximum eligible number is 500 dwellings (200 single-family houses / terraced single-family houses, 300 apartments).* *Follow-on measure B3: Promotion of efficient new building (new building compared with WD2008)*	
Expected annual energy savings in 2010 and 2016	*76 GWh (2016). All savings from the period 2001-2007 (thereafter savings due to the 2008 Thermal Insulation Ordinance). Approx. 96% is heat, 4% electricity for heating. Measure evaluation using building stock model.* *Important assumptions made for calculation:* ➢ *Figures on delivery volumes and delivered units for efficient new buildings and condensing boilers*
Implementation status and exact timeframe	*EEI measure implemented no earlier than 1995 and still effective in 2010 and 2016; no major adaptations planned – early action* *Start/end of the measure: Programme I (2001-2004) and Programme II (2005-2007)*
Information	*http://www.legilux.public.lu/leg/a/archives/2001/0852307/index.html* *http://www.legilux.public.lu/leg/a/archives/2005/1362308/index.html*

<table>
<tr><th>Title of the energy efficiency improvement (EEI) measure</th><th>B1) Ordinance of the Grand Duchy of 30 November 2007 on improving the overall energy efficiency of buildings (dwellings) (WD2008)</th></tr>
<tr><td>Category</td><td>Regulatory
1.1 Thermal building standard and update</td></tr>
<tr><td>Regional application</td><td>Effective nationwide</td></tr>
<tr><td>Target group</td><td>Final energy consumption for heating in the household sector (new buildings and major conversions of existing buildings): 5.0 TWh in 2004 or 29% of the final energy consumption addressed by the ESD (including electricity for heating and hot water)</td></tr>
<tr><td>EEI action targeted</td><td>Improved cavity wall insulation compared with pre-1996 standard (new buildings and conversions)</td></tr>
<tr><td>Effectiveness</td><td>The 2008 Energy Efficiency Ordinance implements European Buildings Directive 2002/91/EC for dwellings. At the same time, the requirements are raised by around 30% compared with the 1996 Thermal Insulation Ordinance. It lays down the following minimum requirements, among other things:
1) Requirements in relation to heat transmission coefficients
Maximum values of individual heat transmission coefficients Umax in W/(m2K)
<table>
<tr><th>Structural element</th><th>To outside air</th><th>To rooms with low-level heating</th><th>Areas to ground or unheated rooms</th></tr>
<tr><td>Wall and horizontal lower end of building</td><td>0.30</td><td>0.50</td><td>0.40</td></tr>
<tr><td>Roof and horizontal upper end of building</td><td>0.25</td><td>0.35</td><td>0.30</td></tr>
<tr><td>Window or French door, including frame</td><td>1.5</td><td>2.0</td><td>2.0</td></tr>
<tr><td>Door, including frame</td><td>2.0</td><td>2.5</td><td>2.5</td></tr>
</table>
2) Requirements in relation to the specific thermal heat requirement, q_H
<table>
<tr><th>Building category</th><th>$q_{H,max}$ [kWh/m²a] $0,2 < A/V_e < 0,8$</th><th>$q_{H,max}$ [kWh/m²a] $A/V_e \leq 0,2$</th><th>$q_{H,max}$ [kWh/m²a] $A/V_e \geq 0,8$</th></tr>
<tr><td>1. Multi-family housing</td><td>21+93(A/Ve)</td><td>39.6</td><td>95.4</td></tr>
<tr><td>2.Single-family housing</td><td>30+73(A/Ve)</td><td>53.6</td><td>97.4</td></tr>
</table>
3) Requirements in relation to the overall primary energy index, Q_P
<table>
<tr><th>Building category</th><th>$Q_{P,max}$ [kWh/m²a] $0,2 < A/V_e < 0,8$</th><th>$Q_{P,max}$ [kWh/m²a] $A/V_e \leq 0,2$</th><th>$Q_{P,max}$ [kWh/m²a] $A/V_e \geq 0,8$</th></tr>
<tr><td>1. Multi-family housing</td><td>53+130(A/Ve)</td><td>79.0</td><td>157.0</td></tr>
<tr><td>2.Single-family housing</td><td>71+102(A/Ve)</td><td>91.4</td><td>152.6</td></tr>
</table></td></tr>
<tr><td>Expected annual energy savings in 2010 and 2016</td><td>372 GWh (2016). Values include savings that would result if the 1996 Thermal Insulation Ordinance were continued. Approx. 96% is fuel, 4% electricity for heating.
Important assumptions made for calculation:
Improvement factor WD08 compared with WD96: 30% for new building, compared with new building pre-1995: up to 63%
Improvement compared with stock of existing buildings: up to 36%
Other assumptions as for measure A1</td></tr>
<tr><td>Implementation status and exact timeframe</td><td>New energy efficiency improvement measure, implementation process started
Start of measure: as of 01/01/2008</td></tr>
<tr><td>Information</td><td>http://www.legilux.public.lu/leg/a/archives/2007/2211412/index.html</td></tr>
</table>

<table>
<tr><td>Title of the energy efficiency improvement (EEI) measure</td><td>B2) Upgrading programme for old buildings (Ordinance of the Grand Duchy of 21 December 2007 on promoting rational energy use and renewables)</td></tr>
<tr><td>Category</td><td>Financial instrument
3.1 Subsidies</td></tr>
<tr><td>Regional application</td><td>Effective nationwide</td></tr>
<tr><td>Target group</td><td>Final energy consumption for heating in the household sector (new buildings and major conversions of existing buildings): 5.0 TWh in 2004 or 29% of the final energy consumptions addressed by the ESD (including electricity for heating and hot water)</td></tr>
<tr><td>EEI action targeted</td><td>Improved cavity wall insulation in existing buildings according to the Ordinance on improving the overall energy efficiency of dwellings.</td></tr>
<tr><td>Effectiveness</td><td>Ordinance of the Grand Duchy of 21 December 2007:
1. Financial aid to improve the energy efficiency of an existing dwelling (>10 years), complying with the necessary quality requirements; the Minister may grant aid equivalent to the amounts in the table on condition that an energy consultant has been involved in the upgrading, ….</td></tr>
<tr><td colspan="2">3. For the thermal envelope structural elements, allocated amounts are to be calculated on the basis of the upgraded area. More specifically, the area of the upgraded element is multiplied by the respective special financial aid detailed in the table below:
<table>
<tr><th></th><th>Eligible element</th><th>Special financial aid [€/m^2 upgraded]</th></tr>
<tr><td>1</td><td>Insulating facade and/or insulating block and/or wooden element of a front wall</td><td>15</td></tr>
<tr><td>2</td><td>Thermal insulation of the inner surface of a front wall</td><td>15</td></tr>
<tr><td>3</td><td>Thermal insulation of a ground wall or unheated zone</td><td>10</td></tr>
<tr><td>4</td><td>Thermal insulation of a pitched roof</td><td>15</td></tr>
<tr><td>5</td><td>Thermal insulation of a flat roof</td><td>13</td></tr>
<tr><td>6</td><td>Thermal insulation of floor of unheated loft</td><td>10</td></tr>
<tr><td>7</td><td>Insulation of ceiling of unheated basement or of ground platform</td><td>8</td></tr>
<tr><td>8</td><td>Replacement of windows with double glazing</td><td>12</td></tr>
<tr><td>9</td><td>Replacement of windows with triple glazing</td><td>30</td></tr>
</table>
</td></tr>
<tr><td colspan="2">Art. 11. Condensation boiler: For replacement of a central heating boiler with a condensation boiler with adjustable power output intended to supply heat to an existing house, the Minister may grant financial aid of €100. If the installation is placed in an apartment block the above amount may be multiplied by the number of apartments, but may not exceed €600 or 10% of the actual cost.</td></tr>
<tr><td>Expected annual energy savings in 2010 and 2016</td><td>25 GWh (2016). Approx. 96% is fuel, 4% electricity for heating. Measure evaluation using building stock model.
Important assumptions made for calculation:
➢ Figures on delivery volumes and delivered units for old buildings</td></tr>
<tr><td>Implementation status and exact timeframe</td><td>New energy efficiency improvement measure, implementation status started
Start/end of the measure: 01/01/2008 to 31/12/2012</td></tr>
<tr><td>Information</td><td>http://www.legilux.public.lu/leg/a/archives/2007/2473112/index.html</td></tr>
</table>

<table>
<tr><td>Title of the energy efficiency improvement measure (EEI)</td><td>B3) Support for efficient new building (new building compared with WD2008) (Ordinance of the Grand Duchy of 21 December 2007 on promoting rational energy use and renewables)</td></tr>
<tr><td>Category</td><td>Financial instrument
3.1 Subsidies</td></tr>
<tr><td>Regional application</td><td>Effective nationwide</td></tr>
<tr><td>Target group</td><td>Final energy consumption for heating in the household sector (new buildings and major conversions of existing buildings): 5.0 TWh in 2004 or 29% of the final energy consumption addressed by the ESD (including electricity for heating and hot water)</td></tr>
<tr><td>EEI action targeted</td><td>Promotion of low-energy housing, passive housing</td></tr>
<tr><td>Effectiveness</td><td>Ordinance of the Grand Duchy of 21 December 2007:
For construction of a new ‘low-energy’ or ‘passive’ house complying with the required quality requirements, the Minister may grant financial aid of the amount detailed below. The allocated amounts are to be calculated on the basis of the eligible reference energy area given on the energy-performance certificate drawn up in accordance with the Ordinance of the Grand-Duchy of 30 November 2007 on the energy performance of houses. …</td></tr>
<tr><td colspan="2">
<table>
<tr><td colspan="2">Eligible area A_n [m²]</td><td>Financial aid [euro / m^2]</td></tr>
<tr><td colspan="3">Single-family house</td></tr>
<tr><td>I</td><td>Up to 150</td><td>45 / 160</td></tr>
<tr><td>II</td><td>Between 150 and 200</td><td>27 /105</td></tr>
<tr><td colspan="3">Apartment which is part of an apartment block with a total area ≤ 1,000 m²</td></tr>
<tr><td>I</td><td>Up to 80</td><td>40 / 139</td></tr>
<tr><td>II</td><td>between 80 and 120</td><td>25 / 87</td></tr>
<tr><td colspan="3">Apartment which is part of an apartment block with a total area > 1,000 m²</td></tr>
<tr><td>I</td><td>Up to 80</td><td>34 / 99</td></tr>
<tr><td>II</td><td>between 80 and 120</td><td>21 / 57</td></tr>
</table>
A_n = reference energy area stated on the energy performance certificate,
I: A_n <= 150 m2 for a single-family house or <= 80 m2 for an apartment,
II: A_n > 150 m2 for a single-family house or > 80 m2 for an apartment,
</td></tr>
<tr><td>Expected annual energy savings in 2010 and 2016</td><td>12 GWh (2016). Approx. 96% is fuel, 4% electricity for heating. Measuring evaluation using building stock model.
Important assumptions made for calculation:
➢ Figures on delivery volumes and delivered units in efficient new buildings</td></tr>
<tr><td>Implementation status and exact timeframe</td><td>New energy efficiency improvement measure, implementation process started
Start/end of measure: 01/01/2008 to 31/12/2012</td></tr>
<tr><td>Information</td><td>http://www.legilux.public.lu/leg/a/archives/2007/2473112/index.html</td></tr>
</table>

Title of the energy efficiency improvement measure (EEI)	***C1) Expansion of the upgrading programme for old buildings***
Category	*Financial instrument* *3.1 Subsidies* *5 Energy services for energy savings* *6.1 Obligations on energy companies to offer energy savings; white certificates* *6.2 Voluntary agreements with energy producers and distributors* *6.3 Energy efficiency fund*
Regional application	*Effective nationwide*
Target group	*Final energy consumption for heating in the household sector (new buildings and major conversions of existing buildings): 5.0 TWh in 2004 or 29% of the final energy consumption addressed by the ESD (including heating and hot water)*
EEI action targeted	*Improved cavity wall insulation in old buildings according to the Ordinance on improving the overall energy efficiency of dwellings.*
Effectiveness	*Details of the measure are not yet available. Action mechanisms similar to measure B2.*
Expected annual energy saving in 2010 and 2016	*32 GWh (2016). Approx. 96% is fuel, 4% electricity for heating. Measure evaluation using building stock model.* *Important assumptions made for calculation:* ➢ *Renovation rate 0,5%/year (approx. 1000 dwellings a year). Rate of saving 43-53% compared with the state before upgrading.*
Implementation status and exact timeframe	*New energy efficiency improvement measure, implementation process not yet started* *Start of measure: 01/01/2010*
Information	-

Title of the energy efficiency improvements measure (EEI)	***C2) Renewal of oldest heating systems***
Category	*Regulatory* *1.2 Minimum standards* *Financial instrument* *3.1 Subsidies* *5 Energy services for energy savings* *6.1 Obligations on energy companies to offer energy savings; white certificates* *6.2 Voluntary agreements with energy producers and distributors* *6.3 Energy efficiency fund*
Regional application	*Effective nationwide*
Target group	*Final energy consumption for heating in the household sector (new buildings and major conversions of existing buildings): 5.0 TWh in 2004 or 29% of the final energy consumption addressed by the ESD (including electricity for heating and hot water)*
EEI action targeted	*Renewal of the oldest heating systems (in addition to the building upgrade programme in measure C1)*
Effectiveness	*Details of the measure have not yet been finalised.*
Expected annual energy savings in 2010 and 2016	*53 GWh (2016). Approx. 96% is fuel, 4% electricity for heating. Measure evaluation using building stock model.* *Important assumptions made for calculation:* ➢ *Substitution rate [%/a]: 5%/a* ➢ *Proportion of participants: 85%* ➢ *Fuel saving: 10%*
Implementation status and exact timeframe	*New energy efficiency improvement measure, implementation process not yet started* *Start of measure: 01/01/2010*
Information	-

Title of the energy efficiency improvement measure (EEI)	***C3) Promotion of efficient new building (new building compared with WD2008) (Ordinance of the Grand Duchy of 21 December 2007 on promoting rational energy use and renewables)***
Category	*Financial instrument* *3.1 subsidies*
Regional application	*Effective nationwide*
Target group	*Final energy consumption for heating in the household sector (new buildings and major conversions of existing buildings): 5.0 TWh in 2004 or 29% of the final energy consumption targeted by the ESD (including electricity for heating and hot water)*
EEI action targeted	*Promotion of low-energy housing, passive housing*
Effectiveness	*Details of the measure have not yet been finalised. Action mechanisms similar to measure B3.*
Expected annual energy savings in 2010 and 2016	*25 GWh (2016). Approx. 96% is fuel, 4% electricity for heating. Measure evaluations using building stock model.* *Important assumptions made for calculation:* ➢ *Rate of particularly efficient new building: 0.5% of new buildings each year* ➢ *Savings 70% compared with pre-1995 new buildings (40-60 kWh/m2 depending on building type).*
Implementation status and exact timeframe	*New energy efficiency improvement measure, implementation process not started* *Start of the measure: 01/01/2010*
Information	-

Title of the energy efficiency improvement measure (EEI)	***C4) Electricity savings in electrical appliances***
Category	*2.1 Focused information campaigns* *Financial instruments - 3.1 Subsidies* *5 Energy services for energy savings* *6.1 Obligations on energy companies to offer energy savings; white certificates* *6.2 Voluntary agreements with energy producers and distributors* *6.3 Energy efficiency fund*
Regional application	*Effective nationwide*
Target group	*Electricity consumption (for electrical appliances) in the household sector: 0.5 TWh or 3% of the final energy consumption addressed by the ESD.*
EEI action targeted	*Promotion of particularly efficient electrical appliances*
Effectiveness	*Details of the measure have not yet been finalised.*
Expected annual energy savings in 2010 and 2016	*8 GWh (2016).* *Important assumptions made for calculation:* ➢ *No own data on equipment rates of households with electrical appliances and energy efficiency categories in Luxembourg. Rates assumed to be similar to Germany, Alignment with the electricity balance sheet in Luxembourg.* ➢ *Depending on household appliance, approx. 5-20% lower consumption by purchased appliances than standard.*
Implementation status and exact timeframe	*New energy efficiency improvement measure, implementation process not yet started* *Start of measure: 01/01/2010*
Information	-

Annex 2

Detailed description of measures in the tertiary sector (including agriculture)

Title of the energy efficiency improvement measure (EEI)	***A3) Ordinance of the Grand Duchy of 22 November 1995 on the thermal insulation of buildings (tertiary sector)***
Category	*Regulatory* *1.1 Thermal building standard and update*
Regional application	*Effective nationwide*
Target group	*Final energy consumption for heating in the tertiary sector (new buildings and major conversions of existing buildings): 2.4 TWh in 2004 or 14% of the final energy consumption addressed by the ESD (including hot water)*
EEI action targeted	*Improved cavity wall insulation compared with the pre-1996 standard (new buildings and conversions)*
Effectiveness	*See measure A1 for description* *In the tertiary sector, evidence of thermal insulation must be included with the application for planning permission for the following buildings: office and administrative buildings, schools and libraries, buildings for sports and meeting purposes, hospitals and care homes, buildings involved in the catering industry, department stores and other shops…* *Follow-up measure B4: Improvement in the U-values of non-domestic buildings (WD2008)*
Expected annual energy savings in 2010 and 2016	*118 GWh (2016). 100% is thermal for heating. Measure evaluation by assessing the energy application purposes in the tertiary sector (predominantly office-type buildings), taking account of investigations conducted on similar buildings in Germany.* *Important assumptions made for calculation:* ➢ *Tricky data situation. No division into different industries: assumed 70% office-like services.* ➢ *Growth factor TCS 4.5%/a on average by 2020* ➢ *Renovation and renewal rate below WD1996: 2%/a. Savings 25% compared with the pre-1996 situation*
Implementation status and exact timeframe	*Energy efficiency improvement measure from 1995 onwards, which is still taking effect in 2010 and 2016; no major adjustments planned – early action.* *Start/end of measure: 01/01/1996 – 31/12/2007*
Information	*http://www.legilux.public.lu/leg/a/archives/1995/0992712/index.html*

<table>
<tr><td>Title of the energy efficiency improvement measure (EEI)</td><td>B4) Improvement in the U-values of non-domestic buildings (WD2008)</td></tr>
<tr><td>Category</td><td>Regulatory
1.1 Thermal building standard and update</td></tr>
<tr><td>Regional application</td><td>Effective nationwide</td></tr>
<tr><td>Target group</td><td>Final energy consumption for heating in the tertiary sector (new buildings and major conversions of existing buildings): 2.4 TWh in 2004 or 14% of the final energy consumption addressed by the ESD (including hot water)</td></tr>
<tr><td>EEI action targeted</td><td>Improved wall cavity insulation compared with the pre-1996 level (new buildings and conversions)</td></tr>
<tr><td>Effectiveness</td><td>Art. 15. Ordinance of the Grand-Duchy of 22 November 1995 on the thermal insulation of buildings is amended as follows:</td></tr>
<tr><td colspan="2">1. Article 1 is supplemented with the following:
“This Ordinance of the Grand-Duchy covers buildings not falling within the scope of Ordinance of the Grand-Duchy of 30 November 2007 on the energy performance of houses.”
2. “Annex 1”, paragraph 3(b) of the Annex thereto is amended as follows: The phrase “Threshold value: C0 = 0.65” is replaced by “Threshold value: C0 = 0.45”. The phrase “Target: C0 = 0.55” is replaced by “Target: C0 = 0.40”.
3. The text and table of “Annex 2” to the Annex to the above Ordinance of the Grand-Duchy are replaced by the following: “Requirements in relation to heat transmission coefficients for individual structural elements: The heat transmission coefficients must not exceed the values shown in the following table.
<table>
<tr><td rowspan="2">Structural elements</td><td colspan="2">Max. heat transmission coefficients [W/m^{2}K]</td></tr>
<tr><td>in relation to outside air</td><td>in relation to unheated rooms or ground</td></tr>
<tr><td>External walls</td><td>0.32</td><td>0.40</td></tr>
<tr><td>Windows including frame</td><td>1.50</td><td>2.00</td></tr>
<tr><td>Doors including frame</td><td>2.00</td><td>2.50</td></tr>
<tr><td>Pitched/flat roof, loft</td><td>0.25</td><td>0.30</td></tr>
<tr><td>Floors, cellar ceiling</td><td>0.30</td><td>0.40</td></tr>
</table>
Follow-up measure C5) Expansion of Ordinance of the Grand Duchy of 2008 on improving the overall energy efficiency of buildings to non-domestic buildings in 2010</td></tr>
<tr><td>Expected annual energy savings in 2010 and 2016</td><td>40 GWh (2016). 100% is thermal for heating. Measure evaluation by assessing the energy application purposes in the tertiary sector (predominantly office-type buildings), taking account of investigations conducted on similar buildings in Germany.
Important assumptions made for calculation:
Renewal rate: 2%/a. Savings 50% compared with the pre-1996 situation, 25% compared with WD1996.
Other assumptions as for measure A2</td></tr>
<tr><td>Implementation status and exact timeframe</td><td>New planned energy efficiency improvement measure, implementation process started
Start/end of measure: 01/01/2008 – 31/12/2009</td></tr>
<tr><td>Information</td><td>http://www.legilux.public.lu/leg/a/archives/2007/2211412/index.html</td></tr>
</table>

Title of the energy efficiency improvement measure (EEI)	***C5) Expansion of the Ordinance of the Grand Duchy for 2008 on improving the overall energy efficiency of buildings to non-domestic buildings in 2010***
Category	*Regulatory* *1.1 Thermal building standard and update*
Regional application	*Effective nationwide*
Target group	*Final energy consumption for heating in the tertiary sector (new building and major conversions of existing buildings): 1.9 TWh in 2004 or 11% of the final energy consumption addressed by the ESD (including hot water)*
EEI action targeted	*Improved cavity wall insulation compared with the pre-1996 level (new buildings and conversions)*
Effectiveness	*Details of the measure have not yet been finalised. Action mechanisms similar to measure B1. It is planned to introduce the measure in 2010. Savings of 50% are expected compared with pre-1996 buildings and of 25% compared with buildings covered by the Thermal Insulation Ordinance of 1996.*
Expected annual energy savings in 2010 and 2016	*79 GWh (2016). Values include savings that would result if the Thermal Insulation Ordinance of 1996 were to be continued. 100% is thermal for heating, Measure evaluation by assessing the energy application purposes in the tertiary sector (predominantly office-type buildings), taking account of investigations conducted on similar buildings in Germany.* *Important assumptions made for calculation:* ➢ *Further 15% saving compared with the U-values of non-domestic buildings stipulated in the 2007 Ordinance of the Grand Duchy.* ➢ *Other assumptions as for measures A2 and B5.*
Implementation status and exact timeframe	*New planned energy efficiency improvement measure, implementation process not yet started* *Planned start of measure: as of 01/01/2010*
Information	-

Title of the energy efficiency improvement measure (EEI)	***C6) Realising electricity savings potential in the TCS sector***
Category	*e.g. Information/audits/energy services by energy distributors/incentive schemes* *2.1 Focussed information campaigns* *2.4 Energy audits* *2.7 Exemplary role of the public sector* *3.1 Subsidies* *4 Voluntary agreements and cooperative instruments* *5 Energy services for energy savings* *6.1 Obligations on energy companies to offer energy savings; white certificates* *6.2 Voluntary agreements with energy producers and distributors* *6.3 Energy efficiency fund*
Regional application	*Effective nationwide*
Target group	*Electricity consumption in the tertiary sector: 1.2 TWh in 2004 or 7% of the final energy consumption addressed by the ESD*
EEI action targeted	*Measure aims to realise electricity savings potential in the TCS sector: Cross-cutting technologies (lighting, pumps, air-conditioning…), particularly I&C technologies (computers, servers…).*
Effectiveness	*Details of the measure have not yet been finalised. The measure could be introduced as of 2010.*
Expected annual energy savings in 2010 and 2016	*65 GWh (2016).* *Important assumptions made for calculation:* ➢ *Technical information from various European studies/ projects on cross-cutting technologies* ➢ *Information from sectoral analyses in Germany on office-type buildings*
Implementation status and exact timeframe	*New planned energy efficiency improvement measure, implementation process not yet started,* *Planned start of measure: as of 01/01/2010*
Information	-

Annex 3

Detailed description of measures in industry excluding ETS

Title of the energy efficiency improvement measure (EEI)	***C7) Realising electricity savings potential of industrial cross-cutting technologies***
Category	*e.g. Information/audits/energy tables/voluntary measures for industry/energy services by energy distributors/incentive schemes* *2.1 Focussed information campaigns* *2.4 Energy audits* *2.7 Exemplary role of the public sector* *3.1 Subsidies* *4 Voluntary agreements and cooperative instruments* *5 Energy services for energy savings* *6.1 Obligations on energy companies to offer energy savings; white certificates* *6.2 Voluntary agreements with energy producers and distributors* *6.3 Energy efficiency fund*
Regional application	*Effective nationwide*
Target group	*Electricity consumption in the industrial sector (excl, ETS): 2,2 TWh in 2004 or 13% of the final energy consumption targeted by the ESD*
EEI action targeted	*Measure aimed at achieving electricity savings potentials in industry (excl, ETS), In addition to cross-cutting technologies (compressed air systems, pumps, fans, industrial cooling, electric motors, lighting, room heating), process technologies were also taken into account in summary.*
Effectiveness	*Details of the measure have not yet been finalised, implementation process not yet started.*
Expected annual energy savings in 2010 and 2016	*99 GWh (2016),* *Important assumptions made for calculation:* ➢ *Technical information from various European studies/ projects on cross-cutting technologies (e.g. Germany: "Efficiency of compressed air"* ➢ *Not for companies/plants in the European CO_2 certificate trade* ➢ *Focal points are in engine and process technologies*
Implementation status and exact timeframe	*New planned energy efficiency improvement measure, implementation process not yet started* *Planned start of the measure: as of 01/01/2010*
Information	*http://www.druckluft-effizient.de*

Annex 4

Detailed descriptions of measures in the transport sector (including agriculture)

Title of the energy efficiency improvement measure (EEI)	***B7) Reducing fuel consumption by raising fuel prices***
Category	*Fiscal instrument* *3.2 Taxes on fuel*
Regional application	*Effective nationwide*
Target group	*Final energy consumption for individuals and goods transport (petrol/diesel): 4 TWh in 2004 or 22% of the final energy consumption addressed by the ESD (excluding transit traffic)*
EEI action targeted	*Driving behaviour aimed at low fuel consumption (short-term); purchasing decisions in favour of more economical vehicles (long-term)*
Effectiveness	*Increase in oil tax through an additional "Kyoto cent". The tax on petrol is raised by 2 cent/l on 1 January 2007, the tax on diesel in two stages on 1 January 2007 and on 1 January 2008, by 1.25 cent/l each time.*
Expected annual energy savings in 2010 and 2016	*61 GWh (2016). Measure evaluation by applying short-term and long-term price elasticities.* *Important assumptions made for calculation:* ➢ *Strong growth in diesel consumption (40%) in the reference trend, petrol constant* ➢ *Calculation rests on assumptions (based on empirical investigations by FIFO) in relation to price elasticities, although these are expected to be small (roughly 0.5% in the short term, up to 1.6% in the long term)*
Implementation status and exact timeframe	*New energy efficiency improvement measure, implementation process started* *Start of measure: 01/01/2007 and 01/01/2008*
Information	

Title of the energy efficiency improvement measure (EEI)	***B8) Ordinance of the Grand Duchy of 22 December 2006 on the implementation of the law of 22 December 2006 supporting employment and defining special measures in the area of social and environmental policy (CO_2-related vehicle taxes)***
Category	*Fiscal instrument* *3.2 Vehicle taxes*
Regional application	*Effective nationwide*
Target group	*Final energy consumption for individuals and goods transport (petrol/diesel): 4 TWh in 2004 or 22% of the final energy consumption addressed by the ESD (excluding transit traffic)*
EEI action targeted	*Purchasing decisions in favour of more economical vehicles (longer term).*
Effectiveness	

*1) For vehicles registered from 1 January 2001 (cat. M1) the calculation formula is: tax (in euro) = a*b*c*

a = CO_2 emission in g/km (information supplied by constructor on the European conformity certificate),

b = a coefficient: 0.9 for vehicles with a diesel engine; 0.6 for vehicles with an engine other than diesel,

c = represents a factor of 0.5 for vehicles with CO_2 emissions of less than 90 g/km increasing by 0.10 for each extra 10 g or part thereof,

If diesel engine particulate emissions are less than or equal to 10 mg/km a maximum reduction of €50 will be granted (valid every year).

2) For vehicles registered prior to 1 January 2001 (cat. M1)

Cc:	*Fuel other than diesel:*	*Diesel:*
1 to 1600 cc	*6*	*6*
1601 to 2000 cc	*7*	*7*
2001 to 3000 cc	*9.50*	*10.50*
3001 to 4000 cc	*11.50*	*13.50*
Over 4000 cc	*12.50*	*15*

Expected annual energy savings in 2010 and 2016	*86 GWh (2016. Measure evaluation by applying longer-term price elasticities.* *Important assumptions made for calculation:* ➢ *Calculation based on price elasticity assumptions. Savings approx. 5.5% for petrol, 3.4% for diesel* ➢ *Investigation of the effects in an EU-wide study*
Implementation status and exact timeframe	*New energy efficiency improvement measure, implementing process started* *Start of measure: 01/01/2007*
Information	*http://www.legilux.public.lu/leg/a/archives/2006/2442912/index.html*

Title of the energy efficiency improvement	***B9) Ordinance of the Grand Duchy of 5 December 2007 guaranteeing financial support for least-polluting cars.***

measure (EEI)	
Category	*Financial instrument* *3.1 Subsidies*
Regional application	*Effective nationwide*
Target group	*Final energy consumption for individuals and goods transport (petrol/diesel): 4 TWh in 2004 or 22% of the final energy consumption addressed by the ESD (excluding transit traffic)*
EEI action targeted	*Purchasing decisions in favour of more economical vehicles (longer term)*
Effectiveness	➢ *Financial aid of €750 granted to physical persons owning a passenger car* ➢ *Car registered in the Grand-Duchy and put on the road for the first time between 1 June 2007 and 31 December 2009* ➢ *Car with CO_2 emissions not exceeding :* • *120g CO_2/km (equivalent to 5 litres petrol per 100 km or 4.5 litres diesel per 100 km);* • *160g CO_2/km for vehicles with six seats or more; vehicle-owner is part of a household of at least 6 persons;* • *160g CO_2/km for hybrid- or LNG-fuelled vehicles.*
Expected annual energy savings in 2010 and 2016	*75 GWh (2016). Measure evaluation by applying longer-term price elasticities.* *Important assumptions made for calculation:* ➢ *Assumptions on the number of cars with lower CO2 emissions: approx. 5% more least-polluting cars a year in the new vehicle fleet (approx. 10% today)*
Implementation status and exact timeframe	*New energy efficiency improvement measure, implementation process started* *Start of measure: 01/01/2008*
Information	*http://www.legilux.public.lu/leg/a/archives/2007/2221412/index.html* *http://www.environnement.public.lu/actualites/2007/12/ Aides_financieres/conf__rence_de_presse_28_janvier_2008.pdf*

Annex 5

Detailed description of cross-cutting measures

Title of the energy efficiency improvement measure (EEI)	***A4) Promotion of decentralised renewables in the building sector by 2007 (solar thermal plants; PV plants, decentralised) (various Ordinances of the Grand Duchy, see information)***
Category	*Financial instrument* *3.1 Subsidies*
Regional application	*Effective nationwide*
Target group	*Final energy consumption for hot water and heating in the household sector: 5.0 TWh in 2004 or 29% of the final energy consumption addressed by the ESD. Electricity consumption (for electrical appliances) in the household sector: 0.54 TWh or 3% of the final energy consumption addressed by the ESD.*
EEI action targeted	*Installation of solar panels for domestic water use/heating, PV installations to produce electricity and modern biomass heating in the household sector.*
Effectiveness	*For solar thermal installations: Investment cost subsidies of 50% of the attributable costs, up to a maximum of 3 000€/5 000€ for thermal solar installations with/without heating support, and also 38 000 € for multiple family houses. Minimum specific output: 525 kWh/m2 a. The financial support programme is enhanced by information campaigns and the possibility of obtaining technical advice. Support is based on the Ordinance of the Grand Duchy of 3 August 2005 on the introduction of a programme promoting rational energy use and the upgrading of renewables for private individuals.* *PV installations for private individuals with an output not exceeding 30 KW_p, the construction of which is promoted by the Ordinance of 3.8.05, receive a supply remuneration of 0.56 €/kWh. PV installations operated by local authorities receive 0.28 €/kWh. The support is based on the Ordinance of 14 October 2005, which contains the currently applicable provision on supply tariffs for electricity from renewables.* *Follow-up measures: B5 (promotion of decentralised renewables) and B6 (biomass use in households, e.g. pellet heating)*
Expected annual energy savings in 2010 and 2016	*48 GWh (2016). All savings from the period 1995-2007. The energy produced by solar and PV installations and also biomass heating is evaluated as an overall saving in the building sector.*
Implementation status and exact timeframe	***Energy efficiency improvement measure as of 1995, which is still taking effect in 2010 and 2016.*** ***Start/end of the measure: Various measures 01/01/1996 - 31/12/2007, recently 03/08/2005 and 14/10/2005 – 31/12/2007***
Information	***http://www.eco.public.lu/documentation/etudes/2007/03/Endbericht_RES-Lux_26_03_07_final.pdf*** ***http://www.legilux.public.lu/leg/a/archives/2005/1362308/index.html*** ***http://www.legilux.public.lu/leg/a/archives/2005/1811411/index.html***

Title of the energy efficiency improvement measure (EEI)	***A5) Ordinance of the Grand Duchy of 30 May 1994 for the production of electrical energy based on renewables and CHP[14]***
Category	*Financial instrument* *3.1 Subsidies*
Regional classification	*Effective nationwide*
Target group	*Predominantly: Final energy consumption for heating in the tertiary sector: 1.9 TWh in 2004 or 11% of the final energy consumption addressed by the ESD; electricity consumption in the tertiary sector: 1.2 TWh in 2004 or 7% of the final energy consumption addressed by the ESD.*
EEI action targeted	*Accelerated expansion of decentralised CHP.*
Effectiveness	*Remuneration for electrical energy supplied to the grid ("Amended Ordiancne of the Grand-Duchy of 30 May 1994"),* ➢ *1 ≤ rated electrical power (kW) ≤ 150: tariff 0.0731 (0.65+0.35 (I6m/I0)) (€/kWh)* ➢ *151 ≤ rated electrical power (kW) ≤ 1500: tariff power 111.55 x R (€/kW); daytime energy 0.0570 x R (€/kWh); night-time energy: 0.0297 x R (€/kWh)* *Annual use efficiency ≥ 80%, annual full load hours ≥ 2 500 for both power ratings* I_{6m}: *Consumer price index in the accounting month, 6-month average consumer price index, relating to a reference value of 1 January 1948 (as at January 2004: 656.94)* I_0: *Reference value January 1993: 529.21* R = $0.45+0.55 (I_{6m}/I_0)+0.30 (G/G_0)$ G: *Price of natural gas for the city of Luxembourg (as at 1st quarter 2004: 0.2407 €/Nm^3)* G_0: *Reference value January 1993: 0.176 €/Nm^3* *Remuneration for the power depends on participation in covering peak load needs on the grid (average contribution based on the 3 peak values).*
Expected annual energy savings in 2010 and 2016	*167 GWh (2016). All savings from the period 1998-2007. Important note :* ➢ *Electricity production from CHP <150 kWel: 0.9 GWh/a Electricity production from CHP >150 kWel: 160 GWh/a (excl. ETS)* ➢ *CHP plants included in ETS not taken into account* ➢ *Primary energy evaluation*
Implementation status and exact timeframe	*Energy efficiency improvement measure as of 1995, still taking effect in 2010 and 2016; no major adjustments planned - early action* *Start/end of measure: Effective since 1998*
Information	*http://www.legilux.public.lu/leg/a/archives/1994/0621207/index.html* *http://www.ael.lu/cms/upload/downloads/home/dienstleistungen/gemeinden/Circulaire050420-FPE.pdf*

[14] Amended by Ordinance of the Grand-Duchy of 14 October 2005 1) on the supply of electrical energy based on renewables, and 2) amending Ordinance of the Grand-Duchy of 30 May 1994 on the production of electrical energy based on renewables or on cogeneration and Ordinance of the Grand-Duchy of 22 May 2001 on the introduction of a compensation fund as part of the organisation of the electricity market.)

Title of the energy efficiency improvement measure (EEI)	***B5) Realising the potential for decentralised renewables in the building sector (solar thermal installations, PV, excluding biomass, heat pumps) according to the Ordinance of the Grand Duchy of 21 December 2007 on promoting rational energy use and renewables.***
Category	*Financial instrument* *3.1 Subsidies*
Regional application	*Effective nationwide*
Target group	*Final energy consumption for hot water and heating in the household sector: 5.0 TWh in 2004 or 29% of the final energy consumption targeted by the ESD. Electricity consumption (for electrical appliances) in the household sector: 0.5 TWh or 3% of the final energy consumption targeted by the ESD.*
EEI action targeted	*Installation of solar panels and heat pumps for domestic water preparation/heating and of PV installations to generate electricity in the household sector.*
Effectiveness	*Art. 7. Solar heat installation: Financial aid of 50% of actual cost (maximum of €3 000 for domestic hot water production and €5 000 for domestic hot water and auxiliary central heating. For an apartment block the amounts are to be multiplied by the number of apartments (maximum €15 000 and 50% of actual cost).* *Art. 8. Photovoltaic solar installation: 1. Financial aid of 30% for installing an individual photovoltaic installation on the roof or facade or integrated into a building's envelope, with a maximum aid of €1 650 per peak kW (maximum eligible power 30 kWpeak),* *Art. 9. Heat pump: For a geothermal-source heat pump, i.e. with horizontal or vertical collectors / for an air-source heat pump: 40% (€6 000/€3 000 maximum) in a single-family house; 40% (€4 000/€2 000 maximum) for an apartment which is part of an apartment block. There is a ceiling of €20 000/€10 000 per apartment block.*
Expected annual energy savings in 2010 and 2016	*12 GWh (2016). All savings from the period 2008-2012. The energy generated by solar and PV installations and also the renewable share of energy produced by heat pumps is evaluated as an overall saving in the building sector.* *Important assumptions made for calculation:* ➢ *Figures on delivery volumes for solar thermal and PV installations and also for heat pumps*
Implementation status and exact timeframe	*New planned energy efficiency improvement measure, implementation process started* *Start/end of measure: 01/01/2008 to 31/12/2012*
Information	*http://www.eco.public.lu/documentation/etudes/2007/03/Endbericht_RES-Lux_26_03_07_final.pdf* *http://www.legilux.public.lu/leg/a/archives/2007/2473112/index.html*

Title of the energy	***B6) Use of biomass in households (e.g. pellet heating) according to the Ordinance of the Grand Duchy of 21 December***

efficiency improvement measure (EEI)	***2007 on promoting rational energy use and renewables.***
Category	*Financial instrument* *3.1 Subsidies*
Regional application	*Effective nationwide*
Target group	*Final energy consumption for hot water and heating in the household sector: 5.0 TWh in 2004 or 29% of the final energy consumption addressed by the ESD.*
EEI action targeted	*Realising the potential of decentralised renewables in the building sector (use of biomass in households, e.g. pellet heating)*
Effectiveness	*Art. 10. Biomass boiler* *Financial aid for installing a central heating plant or a stove forming part of the central heating installation (staged-combustion boiler for logs, boiler fed with wood chips or pellets, or a straw boiler complying with the criteria specified in Annex II.* *Woodchip or pellet-fired central heating or straw-fired central heating: 30% (maximum €4 000) for a single-family house; 30% for an apartment block. The above ceiling of €4 000 will be multiplied by the number of apartments (maximum €20 000).* *Wood pellet stove: 30% (maximum €2 500) for a single-family house.* *Biomass boiler together with a solar heat installation for domestic hot water production: lump-sum aid of €300.* *Log-fired staged-combustion boiler: 25% (maximum €2 500) for a single-family house; ceiling of €2 000 per apartment in an apapartment block. In the latter case the above ceiling is multiplied by the number of apartments, but with a maximum of €10 000.*
Expected annual energy savings in 2010 and 2016	*45 GWh (2016). All savings from the period 2008-2012. Energy produced by modern biomass heating is evaluated as an overall saving in the building sector.* *Important assumptions made for calculation:* ➢ *Figures on delivery volumes for decentralised biomass use.*
Implementation status and exact timeframe	*New planned energy efficiency improvement measure, implementation process started* *Start/end of measure: 01/01/2008 to 31/12/2012*
Information	*http://www.eco.public.lu/documentation/etudes/2007/03/ Endbericht_RES-Lux_26_03_07_final.pdf* *http://www.legilux.public.lu/leg/a/archives/2007/2473112/index.html*

Title of the energy efficiency improvement measure (EEI)	***C8) Further realising of potential for decentralised renewables (excluding biomass)***
Category	*Financial instrument* *3.1 Subsidies*

Regional application	*Effective nationwide*
Target group	*Final energy consumption for hot water and heating in the household sector: 5.0 TWh in 2004 or 29% of the final energy consumption addressed by the ESD. Electricity consumption (for electrical appliances) in the household sector: 0.5 TWh or 3% of the final energy consumption addressed by the ESD.*
EEI action targeted	*Installation of solar panels and heat pumps for domestic water preparation/heating and PV installations to generate electricity in the household sector.*
Effectiveness	*Middle development path from the Fraunhofer study "Determining potential and developing strategies to increase the use of renewables in Luxembourg“: Greater efforts towards renewables without biomass.*
Expected annual energy savings in 2010 and 2016	*23 GWh (2016), All savings from the period 2008-2012, The energy generated by solar and PV installations and also the renewable share of energy produced by heat pumps is evaluated as an overall saving in the building sector.* *Important assumptions made for calculation:* ➢ *For assumptions, see Fraunhofer study entitled "Determining potential and developing strategies to increase the use of renewables in Luxembourg“*
Implementation status and exact timeframe	*New planned energy efficiency improvement measure, implementation process not yet started* *Start of measure: as of 01/01/2010*
Information	*http://www.eco.public.lu/documentation/etudes/2007/03/ Endbericht_RES-Lux_26_03_07_final.pdf*

Title of the energy efficiency improvement measure (EEI)	***C9) Further expansion of decentralised biomass use***
Category	*Financial instrument* *3.1 Subsidies*
Regional application	*Effective nationwide*
Target group	*Final energy consumption for hot water and heating in the household sector: 5/0 TWh in 2004 or 29% of the final energy consumption addressed by the ESD.*
EEI action targeted	*Realising potential for decentralised renewables in the building sector (use of biomass in households, e.g. pellet heating)*
Effectiveness	*Middle development path Fraunhofer study entitled "Determining potential and developing strategies to increase the use of renewables in Luxembourg": Greater efforts towards renewables (solid biomass)*
Expected annual energy savings in 2010 and 2016	*11 GWh (2016). All savings from the period 2008-2012. The energy generated by modern biomass heating is evaluated as an overall saving in the building sector.* *Important assumptions made for calculation:* ➢ *For assumptions, see Fraunhofer study "Determining potential and developing strategies to increase the use of renewables in Luxembourg"*
Implementation status and exact timeframe	*New planned energy efficiency improvement measure, implementation process not yet started* *Start of measure: as of 01/01/2010*
Information	*http://www.eco.public.lu/documentation/etudes/2007/03/ Endbericht_RES-Lux_26_03_07_final.pdf*