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

Second National Energy Efficiency Action Plan For Luxembourg

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

Luxembourg, September 2011

Contact for the National Energy Efficiency Plan:

Organisation: Le Gouvernement du Grand-Duché de Luxembourg
Ministère de l'Économie et du Commerce extérieur
Direction de l'Énergie

Postal address: 19-21, Boulevard Royal, L-2449 Luxembourg

Fax: +352 2478 4311

This Plan was created in collaboration with the Fraunhofer Institute for Systems and Innovation Research (Germany) and myenergy Luxemburg.

Table of contents

Page

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

NEEAP: National Energy Efficiency Action Plan for Luxembourg

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

This document meets Luxembourg's reporting requirements pursuant to Directive 2006/32/EC on energy end-use efficiency and energy services (ESD) for Luxembourg's overall saving target (Article 4), as well complying with reporting about the provisions on the exemplary role of the public sector and about the provision of information and advice to final customers set out in Articles 5(1) and 7(2) of the ESD respectively.

In compliance with ESD requirements, the second National Energy Efficiency Action Plan for Luxembourg (NEEAP) includes:

- an accurate analysis and assessment of the preceding first NEEAP;
- a list of results pertaining to the likely achievement of energy saving targets set out in Article 4(1) and (2) of the ESD;
- plans for□□ and information on the anticipated effects of additional measures addressing any existing or expected shortfall in relation to the target;

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 ESD, 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 can also help to meet the requirements of the NEEAP.

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

- The national saving target is 9 %, equivalent to a saving of around 1 769 TWh. The interim target for Luxembourg by the end of 2010 is 3 %, equivalent to a saving of 590 TWh. (Table 1-1). Compared to the first NEEAP, this target has increased slightly due to changes to the statistical basis for 2001-2005;
- Luxembourg can presumably exceed the 9 % target for 2016 through national efforts (approx. 14.1 %). (Table 1-2);

- The relevant contributions come from 'Early Action' measures[1] (A) (5.9 % including 'Early Action CHP', new measures (B) (6.0 %) and planned/possible measures (C) (up to 2.2 %). (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 TCS sector (trade, commerce, services), 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 ESD target value in Luxembourg[2].

Domestic EE consumption *)	Savings target
GWh/a	GWh/a
19 654	**1 769**

*) EE: End-use energy consumption under the ESD

Table 1-2: Meeting the 2010 interim target and the 2016 savings target in Luxembourg

	Meeting target by 2010	Meeting target by 2016
	%	%
	7.59 %	**14.06 %**
Target value	**3.00 %**	**9.00 %**

1 Measures that were adopted between 1995 and 2007 in Luxembourg and whose effects will still be felt in 2016.

2 Compared to the first NEEAP, this target has increased slightly due to changes to the statistical basis for 2001-2005.

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 new measures (B)*	TOTAL planned/potential measures (C)*	TOTAL A+B+C
GWh/a	GWh/a	GWh/a	GWh/a
1 153 5.87 %	1 177 5.99 %	434 2.21 %	**2 764** **14.06 %**

* excluding transit traffic

The interim target envisaged for 2010 (590 GWh) corresponds to a third of the total target (1 769 GWh). On the basis of current knowledge, if all C measures are fully implemented, approx. 14 % can be achieved by 2016. According to current estimates, A and B measures, together, exceed the 9 % target with a value of almost 12 %, whereas B measures alone contribute 6 % by 2016.

Table 1.4 summarises the expected effects of the measures for the interim year 2010 and the target year 2016 for the aforesaid groups. 2010 values are still based on short-term forecasts (statistical data are available up to 2009), but they nonetheless indicate that the interim target is likely to be achieved. The final target for 2016 should also be met, on the basis of current knowledge.

Compared to the first NEEAP, forecasts in the second NEEAP set higher targets for 2016, due to the following factors:

- greater effectiveness of individual measures compared to the initial estimate of the first NEEAP;
- operationalisation of previously planned measures in the second NEEAP and consequent reduction of the uncertainty surrounding their implementation. In the first NEEAP, this uncertainty was taken into account using reduction coefficients;
- Such uncertainty was reduced through the implementation into B measures and subsequently corrected in the second NEEAP;
- Addition of the voluntary agreement with industry to the list of measures;
- Adaptation of economic and demographic underlying data such as changes to the statistical data basis since the first NEEAP, particularly as far as housing is concerned. The adaptations include the integration of the latest population and traffic development forecasts, as well as improved built environment data based on scientific studies. Data pertaining to the actual implementation of individual

measures are available. In the transport sector, data about the impact of through traffic, which is very important overall, are much more detailed than in NEEAP I.

These differences are explained in the following sector-specific sections.

Table 1-1-4: Overview of the effects of measures in Luxembourg[3]

			2010		2016	
			GWh/a	Beitrag zum Einsparziel	GWh/a	Beitrag zum Einsparziel
Inländischer EndE-Verbrauch Referenzperiode			19.654		19.654	
Einsparziel			590	3%	1.769	9%
Early Action (A)	A1 - WD1996 Altbausanierung und Neubau	HH	385	1,96%	385	1,96%
	A2 - Förderung eff. Neubau und Heizsysteme	HH	90	0,46%	90	0,46%
	A3 - WD1996 Altbausanierung und Neubau	GHD	171	0,87%	171	0,87%
	A6 - Freiwillige Vereinbarung	IND	254	1,29%	254	1,29%
	A5 - Förderung dezentraler KWK	KWK	206	1,05%	206	1,05%
	A4 - Förderung dezentraler EE (ohne Biomasse)	EE	31	0,16%	31	0,16%
	A4 - Förderung dezentraler EE (Biomasse)	EE	16	0,08%	16	0,08%
Neue Maßnahmen (B)	B1 - WD2008 Altbausanierung	HH	15	0,08%	53	0,27%
	B1 - WD2008 Neubau	HH	31	0,16%	295	1,50%
	B2 - Förderung Altbausanierung	HH	10	0,05%	19	0,10%
	B3 - Förderung eff. Neubau	HH	6	0,03%	15	0,08%
	B11 - Förderung der Heizungserneuerung	HH	6	0,03%	12	0,06%
	B12 - Förderung von A++ Kühlgeräten	HH	2	0,01%	2	0,01%
	B4 - WD2008 Altbausanierung und Neubau	GHD	58	0,29%	89	0,45%
	B14 - WD2011 Altbausanierung und Neubau	GHD	0	0,00%	193	0,98%
	B7 - Kyoto Cent	V	38	0,19%	104	0,53%
	B8 - CO_2 Kfz-Steuer	V	41	0,21%	122	0,62%
	B9 - Förderung CO_2 armer PKW	V	47	0,24%	71	0,36%
	B10 - Support des Effizienzlabellings	HH	0	0,00%	13	0,07%
	B5 - Förderung dezentraler EE (ohne Biomasse)	EE	13	0,07%	13	0,07%
	B5 - Förderung dezentraler EE (Biomasse)	EE	27	0,14%	27	0,14%
	B15 - Freiwillige Vereinbarung	IND	47	0,24%	47	0,24%
	B16 - Fortführung Freiwillige Vereinbarung	IND	0	0,00%	102	0,52%

[3] The hatched measures in the second column were classified as category C in the first NEEAP, but they have been implemented since then and, therefore, allocated to category B.

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

			NEEAP II			
			2010		2016	
			GWh/a	Beitrag zum Einsparziel	GWh/a	Beitrag zum Einsparziel
Inländischer EndE-Verbrauch Referenzperiode			19.654		19.654	
Einsparziel			590	3%	1.769	9%
Geplante/ mögliche Maßnahmen (C)	C1 - Aufstockung der Förderung Altbausanierung	HH	0	0,00%	31	0,16%
	C3 - Aufstockung der Förderung eff. Neubau	HH	0	0,00%	6	0,03%
	C4 - WD2012 Altbausanierung	HH	0	0,00%	12	0,06%
	C4 - WD2012 Neubau	HH	0	0,00%	50	0,25%
	C6 - Einsparpotentiale Strom	GHD	0	0,00%	106	0,54%
	C7 - Einsparpotentiale Querschnittstechnologien	IND	0	0,00%	55	0,28%
	C8 - Aufstockung der Förderung dezentraler EE (ohne Biomasse)	EE	0	0,00%	102	0,52%
	C8 - Aufstockung der Förderung dezentraler EE (Biomasse)	EE	0	0,00%	62	0,32%
	C10 - Förderung der Heizungserneuerung	HH	0	0,00%	11	0,06%
Summe	Haushalte	HH	544	2,77%	992	5,05%
	Gewerbe, Handel, Dienstl.	GHD	229	1,17%	560	2,85%
	Kraft-Wärme-Kopplung	KWK	206	1,05%	206	1,05%
	Erneuerbare Energien	EE	87	0,45%	252	1,28%
	Verkehr	V	125	0,64%	297	1,51%
	Industrie	IND	301	1,53%	458	2,33%
Summe	Summe Early Action (A)		1.153	5,87%	1.153	5,87%
	Summe Maßnahmen (B)		339	1,73%	1.177	5,99%
	Summe geplante/mögliche		0	0,00%	434	2,21%
			1.493	7,59%	2.764	14,06%
Zielerfüllung			**253%**		**156%**	

2 General targets of the ESD

The aim of the ESD[4] 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 ESD 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[5] of 9 % to be reached by way of energy services and other energy efficiency improvement measures and they shall endeavour to achieve this target.

The ESD sets out various reporting requirements. Member States must submit to the Commission the following National Energy Efficiency Action Plans (NEEAPs):

- a first NEEAP in 2007;
- a second NEEAP in 2011;
- a third NEEAP in 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 NEEAPs:

- include an accurate analysis and assessment of the previous first NEEAP;
- include the final results with regard to the fulfilment of the energy savings targets set out in Article 4(1) and (2);
- include plans for □□and information on the anticipated effects of additional measures addressing any existing or expected shortfall in relation to the target;
- are based on available data, supplemented with estimates.

4 Article 1 ESD

5 Energy saving indicative value means that reaching the target is not obligatory, but endeavouring to reach it is.

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 The ESD and its incorporation into other energy policy and climate change objectives.

Directive 2006/32/EC on energy end-use efficiency and energy services and its 9 % savings target for 2016 constitutes 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 formulated and detailed in various European Union documents.

- A **20 % energy saving target for 2020**. At the moment, this target is formulated in the Directive on Energy Saving [6] in draft format. It is important to notice that:
  - this is a primary energy target;
  - the 20 % saving, compared to 9 % target of the ESD (measured on the basis of a set historical period – 2001-2005 in Luxembourg) must be calculated against a future baseline in 2020 and does not include any 'Early Actions'[7];
  - 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 plants;
  - possible savings through EU Emissions Trading are included in the target (unlike in the Energy Efficiency Directive);
  - new instruments such as white certificates or equivalent measures shall play an important part;
- the **2012 Kyoto target for Luxembourg** (-28 % from 1990 to 2008/2012 or approximately 3 600 kt CO_2eq);
- The 2020 **Luxembourg target from the EU Effort Sharing Decision for the non-ETS sectors** (a 20 % CO_2 emissions reduction over 2005, or approx. 2 000 kt CO_2eq.), which can be evinced from the current 20 % general EU CO_2 target for 2020. There is an effort sharing also between Member States, which means that countries such as Bulgaria can post an increase of up to 20 %.

[6] Proposal for a Directive of the European Parliament and of the Council on Energy Efficiency and repealing Directives 2004/8/EC and 2006/32/EC, SEC(2011) 779 final / SEC(2011) 780 final, Brussels, 22.6.2011, COM(2011) 370 final, 2011/0172 (COD)

[7] the 20 % primary energy target is defined with respect to a baseline up to 2020, and at any rate to a fixed baseline based on 2007 PRIMES estimates issued before the financial and economic crisis. From this, the Commission extrapolates an absolute energy consumption for 2020 to be attained (1 474 Mtoe of primary energy without non-energy consumption of energy sources; p. 8 of the Draft Directive). Consequently, Article 3 of the Draft Directive also details absolute energy savings targets for Member States, which in total should equate to 1 274 Mtoe of primary energy consumption in 2020: „Member States shall set a national energy efficiency target expressed as an absolute level of primary energy consumption in 2020. When setting these targets, they shall take into account the Union's target of 20 % energy savings';

Thanks to the distribution of the effort of an average of 10 % to Member States, Luxembourg achieves the 20 % CO_2 reduction target for non-ETS sectors. Depending on international participation in achieving the target, the European Union also envisages a 25 % or 30 % CO_2 reduction target for 2020 with possible impacts on effort sharing and ETS targets;

- A **21 % CO_2 reduction target** for emission trading companies, applicable throughout Europe without differentiation depending on Member States;
- A **legally binding 20 % renewables target for 2020**, which is also to be broken down between individual EU Member States. This target and the underlying measures were described in Luxembourg within the framework of the Luxembourg Action Plan for Renewable Energy (NREAP)[8]

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.

[8] Luxembourg Action Plan for Renewable Energy within the framework of Directive 2009/28/EC of the European Parliament and the Council of 23 April 2009 about the promotion of the use of energy from renewable sources, Luxembourg July 2010
http://www.eco.public.lu/documentation/rapports/Luxemburger_Aktionsplan_f__r_erneuerbare_Energie.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.

The following developments are particularly remarkable:

- Contrary to most EU States, the population of Luxembourg grew in a linear way, by about 22 %, between 1995 and 2009. In the same period, neighbouring countries grew between 0 % and 8 % (Germany: 0 %, Belgium: 7 % and France: 8 %).
- The gross domestic product increased by about 76 % between 1995 and 2009. In the same period, neighbouring countries grew between 16 % and 28 % (Germany: 16 %, Belgium: 29 % and France: 28 %).
- In the period 1995-2009 primary energy use grew by about 30 %, whereas final energy consumption increased by 20 %. Since approx. 2004/2005, primary and final energy use has stabilised, regardless of the economy-driven 2009 slump.

It will be noted that population development and GDP growth are two main drivers for energy consumption in Luxembourg and that both parameters are remarkably different from developments in neighbouring countries.

4.1.1 Sectoral consumption development

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.

Generally speaking, final energy consumption has had a distinctive development from 1995: there was a clear downturn in the first half of the 1990s, particularly due to the shift from coal-based steel production to electric furnaces, followed by another growth in consumption from the end of the 1990s (Table 4—1).

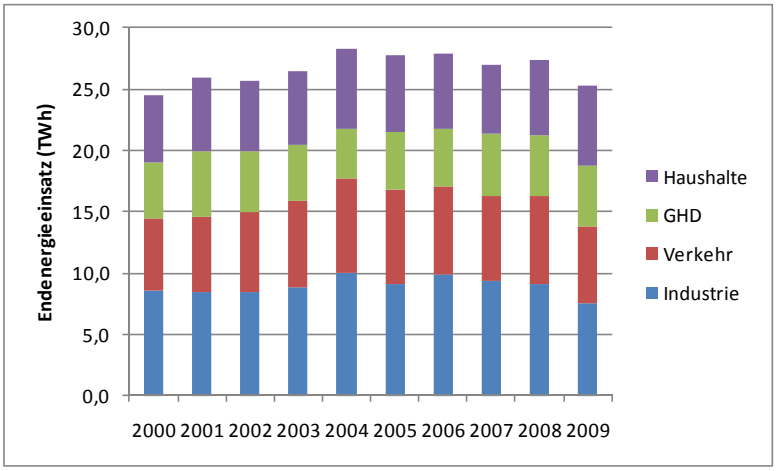
Table 4-1 Sectoral final energy consumption development in Luxembourg from 1995 to 2005 (excluding transit traffic and air traffic)

	Unit	**1995**	**2000**	**2005**	**2006**	**2007**	**2008**	**2009**
Industrial:	TWh	15.5	8.5	9.1	9.9	9.4	9.1	7.5
Households	TWh		5.6	6.3	6.2	5.7	6.1	6.6
TCS	TWh		4.6	4.6	4.6	5.0	4.9	4.9
Households and TCS	TWh	7.0						
Traffic (excluding transit traffic and air traffic)	TWh	4.4	5.9	7.7	7.2	6.9	7.2	6.3

Amended methodology and sectoral differentiation since 2009

Transport-related final energy consumption in Luxembourg (including transit traffic) has increased the most by far. In 2009 it was almost 50 % higher than in 1995. At any rate, national energy consumption for the transport sector has stabilised in recent years.

Figure 4-1 Sectoral final energy consumption in Luxembourg from 2009 to 2009 in TWh [9]



Key to above graphics:

Endenergieeinsatz (TWh) = Final energy use (TWh)
Haushalte = Households
GHD = TCS
Vekehr = Traffic
Industrie = Industry

[9] Data according to Statec A4302 and A4303, Industry including approx 65 % ETS quota, without transit and air traffic

4.1.2 Development of energy consumption by energy source

The most important primary energy source is liquid fuel, particularly due to its role in the transport sector, as well as natural gas and electricity. Even the importance of biomass is gradually increasing. On the other hand, the importance of solid energy sources is decreasing. However, the main change since 2009 has been determined by structural changes in the iron/steel industry.

Table 4-2 Final energy consumption according to sectors and energy sources from 2000- to 2009[10]

Total:	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**
Sum	**24.5**	**25.9**	**25.7**	**26.5**	**28.2**	**27.8**	**27.9**	**27.0**	**27.3**	**25.3**
Solid fuel	1.2	1.4	0.8	0.6	0.9	0.9	1.1	0.9	0.9	0.8
Natural gas	8.0	8.1	8.4	8.5	9.0	8.8	9.1	8.8	9.0	8.5
Electricity	5.3	5.8	5.9	6.1	6.3	6.1	6.6	6.7	6.6	6.1
Heat	0.1	0.1	0.1	0.2	0.2	0.2	0.3	0.2	0.3	0.3
Liquid fuels	9.7	10.4	10.3	10.8	11.6	11.3	10.5	10.0	10.2	9.2
Biomass	0.2	0.2	0.2	0.2	0.2	0.4	0.4	0.4	0.5	0.4

Industrial:	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**
Sum	**8.5**	**8.5**	**8.5**	**8.8**	**10.0**	**9.1**	**9.9**	**9.4**	**9.1**	**7.5**
Solid fuel	1.2	1.3	0.8	0.6	0.9	0.9	1.1	0.9	0.8	0.8
Natural gas	4.1	3.8	3.9	4.3	4.9	4.6	4.6	4.6	4.4	3.3
Electricity	2.8	3.0	3.4	3.6	3.9	3.2	3.9	3.6	3.5	3.2
Liquid fuels	0.3	0.4	0.3	0.3	0.3	0.2	0.1	0.1	0.0	0.0
Biomass						0.3	0.2	0.3	0.3	0.2

Transport	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**
Sum	**5.9**	**6.1**	**6.5**	**7.1**	**7.8**	**7.7**	**7.2**	**6.9**	**7.2**	**6.3**
Electricity	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Liquid fuels	5.8	6.1	6.4	7.0	7.7	7.6	7.1	6.8	7.1	6.2
Biomass								0.0	0.0	0.0

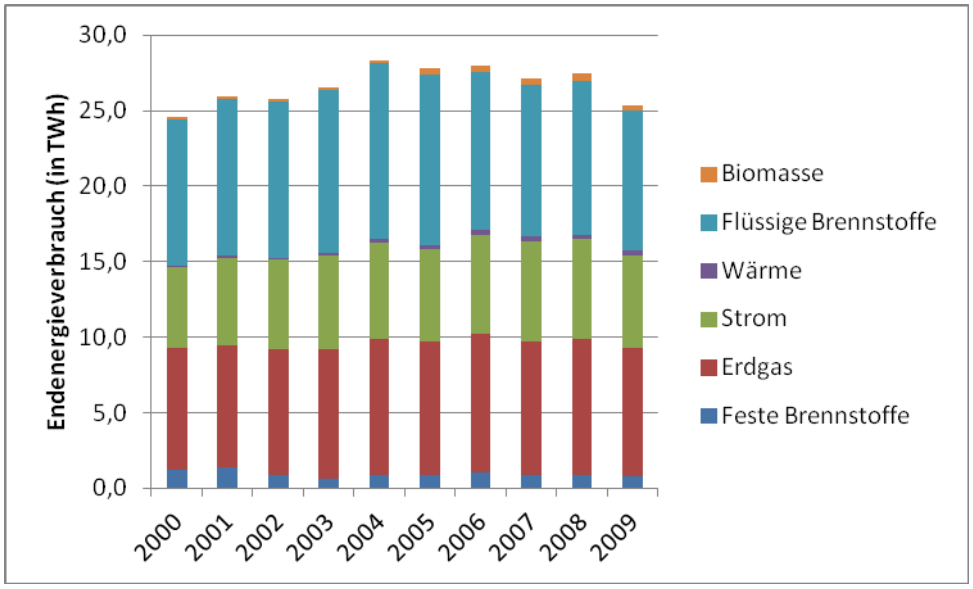
TCS	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**
Sum	**4.6**	**5.3**	**4.9**	**4.6**	**4.1**	**4.6**	**4.6**	**5.0**	**4.9**	**4.9**
Natural gas	1.9	2.0	2.2	1.8	1.4	1.6	2.1	2.1	2.4	2.6
Electricity	1.6	2.0	1.6	1.7	1.6	2.0	1.8	2.1	2.1	1.9
Heat	0.1	0.1	0.1	0.2	0.2	0.2	0.2	0.2	0.3	0.3
Liquid fuels	1.0	1.2	1.0	0.9	0.9	0.8	0.5	0.5	0.2	0.1

Households	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**
Sum	**5.6**	**6.0**	**5.8**	**6.1**	**6.4**	**6.3**	**6.2**	**5.7**	**6.1**	**6.6**
Solid fuel	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Natural gas	2.0	2.2	2.3	2.4	2.6	2.6	2.4	2.1	2.2	2.6
Electricity	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.9	0.9

[10] Data according to Statec A4302 and A4302, including industry ETS, excluding transit and air traffic

Heat	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Liquid fuels	2.6	2.8	2.6	2.6	2.8	2.7	2.7	2.5	2.8	2.9
Biomass	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2

Figure 4-2: Final energy consumption in Luxembourg according to energy sources from 2000 to 2009 [11]



Key to above graphics:

Endenergieverbrauch (TWh) = Final energy consumption (TWh)
Biomasse = Biomass
Fluessige Brennstoffe = Fluid fuels
Waerme = Heating
Strom = Electricity
Erdgas = Natural gas
Feste Brenstoffe = Solid fuels

4.1.3 Energy industry indicators

The main drivers behind the trend in the energy industry were the sharp rise in population figures (by 22 % or 88 000 inhabitants from 1995 to 2009) and a 76 % GDP growth in the same period.

It was only the marked improvement in energy productivity (primary and final energy) compared to the 1990s (cf. in this respect the 1995 value) that allowed final energy consumption to be reduced to start off with (also thanks to the redevelopment of the steel industry) and its growth to be mitigated (cf. Table 4-3 and Figure 4-3). It is also to

[11] Data according to Statec A4302 and A4302, industry including approx 65 % ETS quota, without transit and air traffic

be noted that the declining energy productivity trend from the beginning of the century up to 2005 did not continue in the following years, and that the 2000 level has been either exceeded again or missed only in a marginal way as far as energy productivity is concerned. An uncoupling of energy consumption from economic development was thus achieved at least in part.

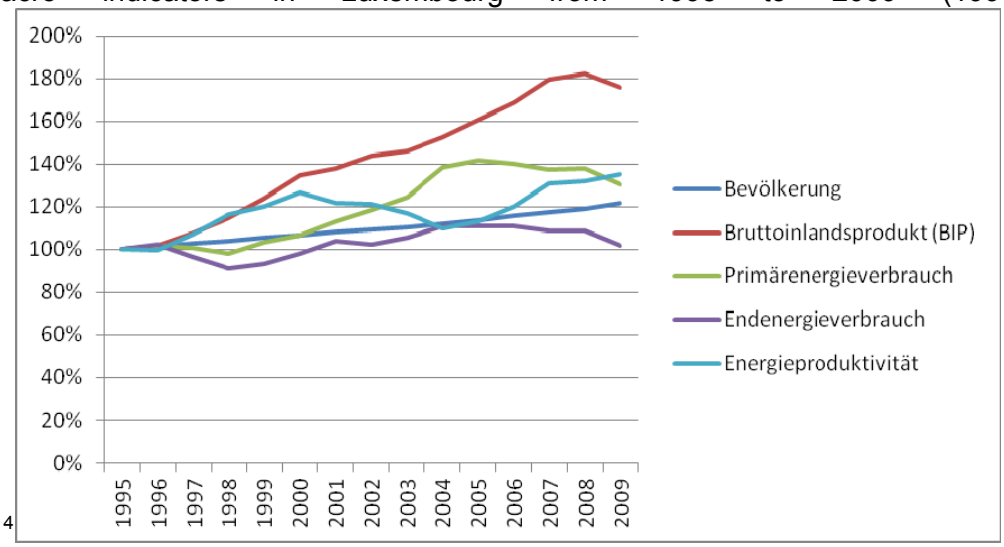
Table 4-3 Indicators of the trend in Luxembourg's energy industry from 1995 to 2009[12]

	Unit	**1995**	**2000**	**2005**	**2006**	**2007**	**2008**	**2009**
Population	Thousand	406	434	461	469	476	484	494
Gross Domestic Product (GDP)	M EUR_{2000}[13]	16	22	26	28	29	30	29
Primary energy consumption (excluding transit and air traffic)	TWh	39	41	55	54	53	54	51
Final energy consumption, (excluding transit and air traffic)	TWh	23	20	30	30	29	29	27
Primary energy productivity	EUR_{2000}/MWh	0.41	0.54	0.47	0.52	0.55	0.56	0.57
Final energy productivity	EUR_{2000}/MWh	0.70	1.10	0.87	0.93	1.00	1.03	1.07

[12] Data according to Statec A4100, E2101, B1100, industry including approx. 65 % ETS quota

[13] Gross Domestic Product as chain index based on the year 2000

Figure 4-3 Macroeconomic energy productivity (primary energy productivity) as well as macro indicators in Luxembourg from 1995 to 2009 (1995= 100 %)[14]



Key to above graphics:

Bevoelkerung = Population
Bruttoinlandsprodukt (BIP) = Gross domestic product (GDP)
Primaerenergieverbrauch = Primary energy consumption
Endenergieverbrauch = Final energy consumption
Energieproduktivitaet = Energy productivity

[14] Data according to Statec A4100, A40302, E2101, B1100, industry including approx. 65 % ETS quota

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. At the time of the first NEEAP, this was the period 2001-2005. The relevant values are shown in Table 5-1. Domestic final energy consumption excluding transit and air traffic was approx. 20 TWh in 2005. The indicative energy saving target for Luxembourg determined in this way is 1 769 TWh. Compared to the first NEEAP, this is slightly higher due to a change in the statistical basis for the years in question. Specifically, the availability of detailed information about transit traffic and built environment resulted in various economic and demographical framework data to be adapted, thus allowing a more accurate estimate.

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 (excluding aviation fuel)	**38 477**	**38 815**	**41 016**	**45 258**	**45 947**
of which, electricity	5 843	5 906	6 176	6 383	6 145
of which ETS companies	7 408	7 355	6 866	7 294	7 214
Transport in total (excluding aviation fuel)	18 512	19 389	21 433	24 589	25 691
of which transit traffic	12 507	13 047	14 487	16 955	18 111
Transit traffic percentage	68 %	67 %	68 %	69 %	70 %
Final energy consumption energy balance (excluding aviation fuel, ETS companies and transit traffic)	18 563	18 413	19 662	21 008	20 622

5 year average final energy (GWh)	***19 654***
9 % Target final energy (GWh) *(Savings target up to 2016)*	***1 769***
3 % Target final energy (GWh) *(Savings target up to 2010)*	***590***

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 30 % (cf. Table 5-1) 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

Directive 2003/87/EC of the European Parliament and the Council of 13 October 2003 establishes the European Emissions Trading Scheme (EU ETS)[15]. Companies involved in this scheme are explicitly excluded from the target calculation in the ESD (Article 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 do not allow this either.

However, the influence of emissions trading companies is significantly greater. Roughly 65 % of 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 final 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[16], 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.

---

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

16 Installations up to 1 MW electrical.

The following conversion factors were used for fuel (Table 5-2). 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 5-2: Conversion factors used for individual fuel types

Facteurs de conversion énergétique

		Facteurs nationaux		Facteur de l'Annexe II de la Directive		
	Unité	GJ		Unité	GJ	t/m3
		PCI	PCS		PCI	Densité calculée
Charbon industriel	t	28		t	17,2-30,7	
briquette de lignite	t	20		t	20	
coke	t	28,5		t	28,5	
essence-moteur	t	44		t	44	
carburéacteur	t	43		t		
gasoil, fueloil	t	42,3	45,2	t	42,3	
GPL	t	45,8		t	46	
gaz naturel	10^3 m^3	37,8	41,8	t	47,2	0,80
bois [1]	m^3	7,15		t	13,8	0,52
déchets	t	11,96		t	7,4-10,7	
biodiesel	t	36,9		t		
électricité	GWh	$3,6 \cdot 10^3$		GWh	$3,6 \cdot 10^3$	

[1] Ster = 0,7 Festmeter

Key to above graphics:

Facteurs de conversion energetique = Conversion factors used for individual fuels
Facteurs nationaux = National factors
Facteur de l'Annexe II de la Directive = Factor, Annex II to Directive
Unite' = Unit
GJ = GJ
Unite' = Unit
GJ = GJ
t/m3 = t/m3
PCI = PCI
PCS = PCS
PCI = PCI
Densite' calculee = Calculated density
Charbon industriel = Industrial coal
Briquette de lignite = Lignite briquette
Coke = Coke
Essence-moteur = Petrol
Carbureacteur = Jet fuel
Gasoil, fueloil = Diesel, fuel oil
GPL = LPG
Gaz naturel = Natural gas
Bois1 = Wood
Dechets = Waste
Biodiesel = Biodiesel
Electricite' = Electricity

6 Methodology for quantifying measures

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

- Luxembourg's energy balance sheets for the period 1995-2009;
- 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, where available, e.g. the 'Projections socio-économiques 2010-2060 (Bulletin du Statec n°5-2010)';
- Where structures were missing, such data were 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 an evaluation and forecast framework developed at the Fraunhofer ISI;
- The third stage, following on from the work for the first NEEAP, involved the classification and screening of efficiency measures for the second NEEAP 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 parameterisation of measures hat had already been set out in the first NEEAP was revised. The most important parameters for individual measures are described in the Annex.

In the first NEEAP the measures were assessed with the help of a bottom-up model, which evaluates which quantitative effects each measure had or will have. This approach is used also for the second NEEAP.

In the bottom-up model, individual measures are identified within a specific time frame (e.g. Building Energy Efficiency Ordinance, restructuring programmes for old buildings,

incentive programmes for particularly efficient new build etc.). Each measure is then assessed on the basis of activity size (e.g. number of buildings) and specific parameters (kWh/m^2). Only measure-specific parameters are considered in each case. Overlapping with other measures, which affect the same target, is taken into account. |The bottom-up approach does not specifically consider energy efficiency measures of individual households determined by changes of energy prices on world markets or, for instance, by behavioural changes.

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 individual measures in the different sectors, as well as the relevant main assumptions, are described below. There are three categories of measures. These are:

- **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 ESD, where appropriate[17].
- **New measures (B):** Measures that are being implemented, but will only take effect as of 2008.
- **New planned/potential measures (C):** Measures that can also help to meet the requirements of the NEEAP.

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[18]:

[17] The ESD mentions: 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.

[18] the numbering follows the one adopted in NEEAP I. Where measures were moved to a different group, a new number was allocated.

Early action measures (A):

A1 – Thermal Insulation Ordinance 1996 (WD1996) new and old buildings	Households
A2 – Promotion of energy efficiency in new homes/efficient heating systems	Households
A3 – Improvement of total energy efficiency for non-residential buildings (WD1996) new and old buildings	TCS
A4 – Promotion of decentralised renewables	Renewables
A5 - Promotion of decentralised CHP (outside emissions trading)	CHP
A6 – Voluntary agreement	Industry

New measures (B):

B1 – Improvement in the overall energy efficiency of private dwellings (WD2008) new and old buildings	Households
B2 – Promotion of old building upgrade programme	Households
B3 – Promotion of energy-efficient new buildings	Households
B4 – Improvement in the overall energy efficiency of non-domestic buildings (WD2008) new and old buildings	TCS
B5 – Promotion of decentralised renewables	Renewables
B7 – Reduction in fuel consumption through the increase of fuel prices (Kyoto Cent)	Transport
B8 - CO_2 dependant motor vehicle tax	Transport
B9 – Promotion of least-polluting cars	Transport
B10 – Promotion of efficiency labelling	Households
B11 – Promotion of heating upgrade programme	Households
B12 – Promotion of A++ refrigerators	Households
B14 – Improvement in the overall energy efficiency of non-domestic buildings (WD2011) new and old buildings	TCS
B15 – Voluntary agreement	Industry
B16 – Continuation of voluntary agreement	Industry

New planned/potential measures (C):

C1 – Increase in the old building upgrade programmes	Households
C3 – Increase in energy-efficient new build programmes	Households
C4 – Improvement in the overall energy efficiency of private dwellings (WD2012) new and old buildings	Households
C6 – Electricity savings potential	TCS
C7 – Cross-cutting technologies savings potential	Industry
C8 – Increase of the promotion of decentralised renewables	Renewables
C10 – Promotion of heating upgrade programme	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 energy efficiency of dwellings (WD1996) new and old buildings** compared to pre-1996 levels	01/01/1996 - 31/12/2007	385
A2	Ordinance of the Grand Duchy of 17 July 2001 and 3 August 2005 on the promotion of rational energy use and renewables	**Promotion of energy-efficient new homes** (new building compared with WD1996: low energy housing, passive housing) **and efficient heating systems** (condensing boilers)	Programme I (2001-2004) and Programme II (2005-2007)	90
B1	Ordinance of the Grand Duchy of 30 November 2007 on improving the overall energy efficiency of buildings (dwellings)	**Improved energy efficiency of dwellings (WD2008) old buildings** compared to pre-2008 levels	From 1 January 2008	53
		Improved energy efficiency of dwellings (WD2008) old buildings compared to pre-2008 levels		295
B2	Building upgrading programme for old buildings (Ordinance of the Grand Duchy of 21 December 2007 and 20 April 2009 for on promoting rational energy use and renewables)	Promotion of the upgrading of old buildings – improved cavity insulation in old buildings based on the Ordinance on improving the overall energy efficiency of dwellings	01/01/2008 – 31/12/2012	19
B3	Promotion programme for energy-efficient new buildings (Ordinance of the Grand Duchy of 21 December 2007 and 20 April 2009 for on promoting rational energy use and renewables)	**Promotion of energy-efficient new buildings** through the promotion of low-energy housing and passive housing	01/01/2008 – 31/12/2012	15
B10	Promotion of efficiency labelling	**Promotion of efficiency labelling** through the promotion of particularly efficient electrical appliances through customer awareness and information campaigns	From 1 January 2012	13
B11	Promotion of heating upgrade programme	**Promotion of heating upgrade** through the renewal of the oldest heating systems	01/01/2008 – 31/12/2012	12
B12	Ordinance of the Grand Duchy of 19 December 2008 on the introduction of financial incentives for A++ refrigeration appliances (renewed on 11 December 2009 and 17 December 2010)	**Promotion of A++ refrigerators** appliances to influence buying decisions in favour of energy-efficient refrigerators	01/10/2008 – 31/07/2011	2
C1	Increase in the old building upgrade programmes	**Enhanced promotion of the upgrading of old buildings** for improved cavity insulation in old buildings, based on the Ordinance on improving the overall energy efficiency of dwellings	From 1 January 2013	31
C3	Increase in energy-efficient new build programmes	**Promotion of energy-efficient new buildings** through the promotion of low-energy housing and passive housing	From 1 January 2013	6
C4	Tightening of the Ordinance of the Grand Duchy of 30 November 2007 on improving the overall energy efficiency of buildings (dwellings)	**Improved energy efficiency of dwellings (WD2011) old buildings** compared to pre-2012levels	From 1 July 2012	12
		Improved energy efficiency of dwellings (WD2011) old buildings compared to pre-2012 levels	From 1 July 2012	50
C10	Promotion of heating upgrade programme	Promotion of heating upgrade programme through the continuation of the heating	From 1 January 2013	11

		upgrade programme and the promotion of condensing boilers.		

Table 7-1: Results of the bottom-up evaluation in the household sector (second NEEAP compared to the evaluation in the first NEEAP)

		NEAAP II				NEAP I	Changes in NEAAP II compared with NEAAP I
		2010		2016		2016	
		GWh/a	Contribution to savings target	GWh/a	Contribution to savings target	GWh/a	
A1 - WD1996 Old building upgrade programme and new buildings	HH	385	1.96%	385	1.96%	295	Building stock data, demographic parameters
A2 - WD 1996 - Promotion of energy efficiency in new homes/efficient heating systems	HH	90	0.46%	90	0.46%	76	Building stock data, demographic parameters, promotion rate
B1 - WD2008 Promotion of old building upgrade programme	HH	15	0.08%	53	0.27%	372	Building stock data, demographic parameters
B1 - WD2008 New buildings	HH	31	0.16%	295	1.50%	37	
Promotion of old building upgrade programme	HH	10	0.05%	19	0.10%	53	Building stock data, demographic parameters, promotion rate
B3 - Promotion of energy-efficient new buildings	HH	6	0.03%	15	0.08%		
B11 - Promotion of heating upgrade programme	HH	6	0.03%	12	0.06%	8	Building stock data, promotion rate
B12 Promotion of A++ refrigerators	HH	2	0.01%	2	0.01%	57	
B10 – Promotion of efficiency labelling	HH	0	0.00%	13	0.07%		Weighting coefficient
C1 – Increase in the old building upgrade programme	HH	0	0.00%	31	0.16%		Building stock data, demographic parameters, promotion rate
C1 – Increase in energy-efficient new building programme	HH	0	0.00%	6	0.03%		
C4 – WD2012 Old building upgrade programme	HH	0	0.00%	12	0.06%		
C4 – WD2012 New buildings	HH	0	0.00%	50	0.25%		
C10 - Promotion of heating upgrade programme	HH	0	0.00%	11	0.06%		
Households	HH	544	2.77%	992	5.05%	897	

Note: Measures that are hatched in a dark colour in the second last column (NEEAP I), have just been added to the list. Measures that were category C in the first NEEAP and have been brought forward are now included in the relevant category B.

In the household sector, effective measures in the building area are focused on the progressive tightening of building regulations. This applies in particular for Early Action measures) in this case, the Thermal Insulation Ordinance of 1996), as well as to the Building Energy Efficiency Ordinance of 2008, which entered into effect during the first NEEAP. The planned further tightening of indicative values of the current Building Energy Efficiency Ordinance should increase this effect.

Like all other building-related measures, the tightening up of building regulation requires a longer time frame, particularly as far as old buildings are concerned, in order to be fully effective, since renovation rates without supporting measures are comparatively low. In order to assess the effectiveness of measures, a renovation rate of 0.5 % per year of the existing building stock was considered, which corresponds to approximately to 1 000 housing units per year. Measures that stimulate a quicker penetration of efficiency measures in the existing building stock through financial incentives can be very effective in this area. This applies in particular to improvement programmes that support the introduction of tighter threshold values for the energy efficiency of buildings.

The impact of measures in the electrical appliance area is comparatively low. In this space, a lot has been achieved through the EU-wide minimum standards introduced within the framework of the Directive for energy-relevant products, which is not included here.

Changes to the evaluation in the household sector were determined primarily by an improved data framework for the existing building stock, as well as by the inclusion of further measures (HH WD2012) that had not yet been reported in the first NEEAP. Because of this, the anticipated effect of measures in the household sector is 95 GWh higher than in the first NEEAP.

Notes on the calculation 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 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 7-2: Energy demand for space heating (SH) and hot water (HW) in private households (baseline)

Energieträger [GWh]	2004	2008	2010	2016
Erdgas	2171	2370	2477	2837
Öl	2482	2433	2405	2305
Flüssiggas	64	62	61	57
Holz	67	73	79	110
Sonstige	415	479	516	650
Strom (Heizung)	223	193	178	132
Summe Wärme (RW + WW)	**5.423**	**5.609**	**5.716**	**6.092**

Text for above table

Energietraeger [GWh] = Energy source [GWh]
Erdgas = Natural gas
Oel = Oil
Fluessiggas = Liquid gas
Holz = Wood
Sonstige = Other
Strom (Heizung) = Electricity (heating)
Summe Waerme (RW +WW) = Total heat (SW + HW)

In order to calculate the reduction in energy consumption achieved through 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 with the baseline, therefore, indicates the savings effect of a measure. For example, Table 7-3 shows the energy demand in each case following the introduction of the Thermal Insulation Ordinance for new buildings (WD1996) in 1996.

Table 7-3: Energy demand for space heating (SH) and hot water (HW) in private households (after the introduction of WD1996 for new buildings)

Energieträger [GWh]	2004	2008	2010	2016
Erdgas	2.095	2.157	2.193	2.322
Öl	2.426	2.306	2.247	2.067
Flüssiggas	62	57	54	48
Holz	67	70	73	91
Sonstige	403	442	464	543
Strom (Heizung)	221	189	174	129
Summe Wärme (RW + WW)	**5.274**	**5.220**	**5.204**	**5.200**

Text for above table

Energietraeger [GWh] = Energy source [GWh]
Erdgas = Natural gas
Oel = Oil
Fluessiggas = Liquid gas
Holz = Wood
Sonstige = Other
Strom (Heizung) = Electricity (heating)
Summe Waerme (RW +WW) = Total heat (SW + HW)

The differences compared with the values shown in Table 7-2 are savings attributable to this measure. Since a new ordinance on the energy efficiency of buildings came into force in 2008, the saving achieved by WD1996 has only been calculated up to this point and its value is therefore limited to a total of 331 GWh. This saving also exists in 2016, the ESD target year, since the lifetime of insulation measures is significantly longer.

Table 7-4**.** Shows the expected development of the housing stock

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

Number of households				
	2004	**2008**	**2010**	**2016**
Number of households	182 800	192 493	197 530	213. 447

Extrapolation based on population forecast with assumptions about occupancy

Percentage of buildings				
	2004	**2008**	**2010**	**2016**
Single-family housing (EFH)				
Before 1970	25 %	22 %	20 %	16 %
1971 to 1995	25 %	22 %	21 %	18 %
After 1995	5 %	9 %	10 %	15 %
Total single-family housing	**55 %**	**53 %**	**52 %**	**49 %**
Terraced houses (RH)				
Before 1970	17 %	15 %	14 %	11 %
1971 to 1995	4 %	4 %	3 %	3 %
After 1995	1 %	3 %	5 %	8 %
Total terraced houses	**22 %**	**22 %**	**22 %**	**22 %**
Multi-story dwellings (MFH)				
Before 1970	10 %	8 %	7 %	5 %
1971 to 1995	10 %	9 %	9 %	8 %
After 1995	3 %	8 %	10 %	16 %
Total multi-story dwellings	**23 %**	**25 %**	**26 %**	**29 %**
Total all types of buildings	**100 %**	**100 %**	**100 %**	**100 %**

Extrapolation based on national and other statistical data

Table 7-5**.** 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 7-5 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 7-5: Demand data and savings potential of building types

Energy de-	**EFH**	**RH**	**MFH**

mand [kWh/m²]	Before 70	71 - 95	After 95	Before 70	71 - 95	After 95	Before 70	71 - 95	After 95
'Baseline'	250	184	137	215	172	129	179	160	120
WD1996	200	160	130	165	125	88	150	100	67
WD2008	160	140	91	130	110	62	110	90	47
WD2011	112	98	64	91	77	43	77	63	33

Table 7-6**.** Provides an overview of the assumptions made and the effect of all measures considered

Table 7-6: General assumptions of all fuel-related measures in private households

Assumptions	
Annual growth in number of households	1.3 %
Annual upgrading rate for old buildings	0.5 %
Annual new building rate	2.0 %

Table 7-7: Assumptions about improvement measures in private households

Parameter measure B2			
Specific space heating requirements and renovation rate			
	EFH	**RH**	**MFH**
Pre-1970 space heating requirements after renovation (kWh/m²a)	120	90	75
Pre-1970 space heating requirements after renovation (kWh/m²a)	100	75	60
Promoted WE per year up to 2008 [19]	40		
Promoted WE per year up to 2010	90		
Promoted WE per year up to 2016	110		
Space heating requirement: calculated on the basis of the Thermal Insulation Ordinance			
Requirements: Data of the promotion programme pursuant to the first NEEAP			

[19] The number of funded housing units has been taken from data of promotion programmes established on the basis of the first NEEAP. It is assumed that each subsidised housing unit has undergone a full refurbishment. The number of actually implemented refurbishments can be higher, if only partial refurbishments were undertaken. Moreover, refurbishments listed in Table 7-7 were based on the implementation of stretch refurbishment targets, which are significantly greater than the requirements of the current Building Energy Efficiency Ordinance. Therefore, it is anticipated that the financial means made available within the promotion programme will allow savings corresponding to the aforementioned number of total refurbishments and the aforementioned level.

Parameter measure B3			
Specific heating requirements and funding rate			
New buildings:	**EFH**	**RH**	**MFH**
Space heating requirements low energy (kWh/m²a)	50	40	35
Space heating requirements passive (kWh/m²a)	25	20	17.5
Promoted WE per year up to 2008	40		
Promoted WE per year up to 2010	147		
Promoted WE per year up to 2016	234		
Space heating requirement: calculated on the basis of the Thermal Insulation Ordinance			
Requirements: Data of the promotion programme pursuant to the first NEEAP			

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 energy efficiency of non-domestic buildings (WD1996) new and old buildings** compared to pre-1996 levels	01/01/1996 - 31/12/2007	171
B4	Ordinance of the Grand Duchy of 30 November 2007 on improving the overall energy efficiency of buildings (provisions for non-domestic buildings)	**Improved energy efficiency of non-domestic buildings (WD2008) new and old buildings** compared to pre-2008 levels	01/01/2008 - 31/12/2010	89
B14	Ordinance of the Grand Duchy of 31 August 2010 on improving the overall efficiency of non-domestic buildings	**Improved energy efficiency of non-domestic buildings (WD2011) new and old buildings** compared to pre-2011 levels	From 1 January 2012	193
C6	Development of electricity savings potential	Development of electricity savings potential in the area of cross-cutting technologies (lighting, pumps, air conditioning…), particularly information and communication technologies (computers, servers, etc), for instance: information/audit/energy services through energy distributor incentive schemes	From 1 January 2012	106

Table 7-8: Results of the bottom-up evaluation in the tertiary sector (second NEEAP compared to the evaluation in the first NEEAP)

		NEAAP II				NEAP I	Changes in NEAAP II compared with NEAAP I
		2010		2016		2016	
		GWh/a	Contribution to savings target	GWh/a	Contribution to savings target	GWh/a	
A3 – WD1996 Old building upgrade and new buildings	TCS	171	0.87%	171	0.87%	118	Building stock data, demographic parameters
WD2008 Promotion of old building upgrade programme and new buildings	TCS	58	0.29%	89	0.45%	40	Energy data, economic parameters
B14 – WD2011 Promotion of old building upgrade programme and new buildings	TCS	0	0.00%	193	0.98%	79	Energy data, weighting coefficient, economic parameters
C6- Electricity savings potential	TCS	0	0.00%	106	54.00%	65	Energy data, economic parameters
Trade, Commerce and Services		229	1.17%	560	2.85%	301	

Note: Measures that were category C in the first NEEAP and have been brought forward are now included in the relevant category B.

As for the household sector, built environment measures have a great impact also for the tertiary sector. Here, however, there is also a vast potential for electrical appliances. Because of the strong service orientation of this sector in Luxembourg, there is

also a significant potential for the use of more efficient information and communication technology, which is relatively quick to implement.

Changes in the evaluation in the tertiary sector are determined by a better data framework with respect to energy statistics, as well as by the fact that C measures in the first NEEAP were assessed as having a lower impact using reduction coefficients because of the uncertainty of their implementation. Such uncertainty was reduced through the implementation into B measures and subsequently corrected in the second NEEAP; Because of this, the anticipated effect of measures in the tertiary sector is approx. 260 GWh higher that in the first NEEAP.

Notes on the calculation 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 and fuel demand, which stood at around 2.1 TWh (electricity) and 2.9 TWH (fuels) for 2008. 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 %. The same applies to fuel demand.

Despite the aforementioned difficulties, it was possible to achieve an improvement in data quality with respect to the first NEEAP, because there are sufficient internal statistical data about the energy demand of the TCS sector.

This sector displays vigorous growth in Luxembourg, which was estimated at 4.5 % per annum for the purposes of this observation. WD1996, a possible tightening in the context of a WD2010 and the more efficient use of electricity in the different cross-cutting technologies (e.g. lighting, air-conditioning) were considered as savings measures. Table 7-9 gives an overview of the effects of such measures. However, these values only represent an estimate, due to the lack of basic data available.

Table 7-9: General assumptions about all measures in the TCS sector

Assumptions	
Annual growth	4,5 %
Increased fuel demand	0,5 %
Increased electricity demand	1,5 %
Annual refurbishment and upgrading rate	2 %
Savings potential WD 1996 (compared to new buildings pre-WD1996)	25 %
Savings potential WD 2008 (compared to new buildings pre-WD1996)	50 %
Savings potential WD 2010 (compared to new buildings pre-WD1996)	65 %

Electricity savings potential per cross-cutting technology	5 – 20 %

Value creation increase TCS sector				
	2004	**2008**	**2010**	**2016**
Value creation (baseline year 2004=1)	1.0	1.2	1.3	1.7

Extrapolation of growth trend

Final energy consumption				
	2004	**2008**	**2010**	**2016**
Electricity (TWh)	1.6	2.1	2.1	2.3
Heat (TWh)	2.5	2.9	2.9	3.0

Extrapolation on the basis of national energy statistics

Electricity consumption per application field				
	2004	**2008**	**2010**	**2016**
Lighting (TWh)	0.6	0.8	0.8	0.9
Power (TWh)	0.4	0.5	0.5	0.6
Process heat (TWh)	0.1	0.1	0.1	0.1
Refrigeration/Air-conditioning (TWh)	0.1	0.2	0.2	0.2
Information and communication (TWh)	0.3	0.4	0.4	0.5
Space heating (TWh)	0,0	0.1	0.1	0.1
Total	**1.6**	**2.1**	**2.1**	**2.3**

Extrapolation on the basis of national energy statistics and own calculations

Table 7-10 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 7-11. Because of the high degree of uncertainty about the implementation of this measure, a 50 % reduction coefficient is applied.

Table 7-10: Savings potential for electricity in the TCS sector up to 2016

Einsparpotentiale Strom	2016
Beleuchtung	15%
Kraft	8%
Prozesswärme	4%
Klima, Kälte	15%
IuK	11%

Text to above table

Einsparpotentiale Strom = Electricity savings potential
Beleuchtung = Lighting
Kraft = Power
Prozesswaerme = Process heat
Klima, Kaelte = Air-conditioning, refrigeration
Luk = I&C

Table 7-11: Electricity savings achievable in the TSC sector up to 2016 in absolute terms (in GWh)[20]

Gesamtes Stromeinsparpotenzial [GWh]		2016
Gesamt		**212**
davon		
	Beleuchtung	109
	Kraft	35
	Prozesswärme	4
	Kälte/Klima	22
	IuK	42

Text to above table

Gesamtes Stromeinsparpotential [GWh] = Overall electricity savings potential [GWh]
Gesamt = Total
Davon = of which
Beleuchtung = Lighting
Kraft = Power
Prozesswaerme = Process heat
Klima, Kaelte = Air-conditioning, refrigeration
Luk = I&C

[20] Because of changes in the data available for the TCS, such savings differ markedly from those identified in the first NEEAP

7.5 *Energy efficiency improvement measures in non-ETS industry sectors*

Overview table of 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
A6	Voluntary agreement between the Luxembourg Government and FEDIL on improving energy efficiency in the industrial sector	**Voluntary agreement** on improving energy efficiency in the industrial sector by 1 % per year	1996-2007	254
B15	Voluntary agreement between the Luxembourg Government and FEDIL on improving energy efficiency in the industrial sector	**Voluntary agreement** on improving energy efficiency in the industrial sector by 1 % per year	2008-2010	47
B16	Voluntary agreement between the Luxembourg Government and FEDIL on improving energy efficiency in the industrial sector	**Voluntary agreement** on improving energy efficiency in the industrial sector by 1 % per year	01/01/2011 – 31/12/2016	102
C7	Realising potential in industrial cross-cutting technologies	Improvement of energy efficiency by tapping into the **savings potential** of industrial **cross-cutting technologies** (electric motors, compressors...); e.g. information/audits/incentive schemes	From 1 January 2012	55

Table 7-12: Results of the bottom-up evaluation in the industrial sector (second NEEAP compared to the evaluation in the first NEEAP)

		NEAAP II				NEAP I	Changes in NEAAP II compared with NEAAP I
		2010		2016		2016	
		GWh/a	Contribution to savings target	GWh/a	Contribution to savings target	GWh/a	
A6 – Voluntary Agreement	IND	254	0.29%	254	0.29%		
B15 - Voluntary Agreement	IND	47	0.24%	47	0.24%		
B16 - Continuation Voluntary agreement	IND	0	0.00%	102	0.52%		
C7 – Cross-cutting technologies savings potential	IND	0	0.00%	55	0.28%	99	Economic parameters
Industry	IND	301	1.53%	458	2.33%	99	

Note: Measures that are hatched in a dark colour in the second last column (NEEAP I), have just been added to the list.

In the industrial area too (excluding emission management plans), there is untapped potential for cross-cutting technologies such as electrical motors, pumps, compressed air.

Moreover, industry has committed to savings in a self-regulatory regime since the mid 1990s, which should contribute to the full utilisation of the aforementioned potentials as

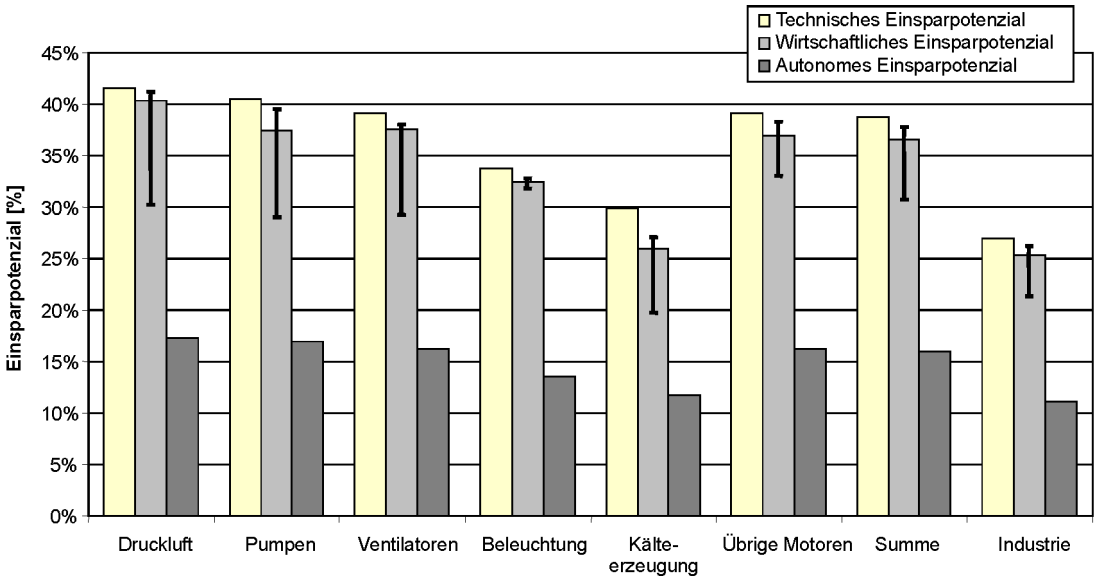
well as to using further possibilities for improving energy efficiency. These measures were also included in the second NEEAP.

All in all, the effects of the measures are markedly higher than those for of first NEEAP for this sector, due to the fact that voluntary agreements have just been included.

Notes on the calculation methodology used for industry

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. The result of all this research was the savings potential depicted in the following chart (Figure 7-1)) for cross-cutting technologies.

Table 7-1:Long-term savings potential by cross-cutting technology (by 2035)



Source: Fraunhofer ISI (2006)

Key to above graphics

Technisches Einsprapotenzial = Technical savings potential
Wirtschaftliches Einsparpotenzial = Economic savings potential
Autonomes Einsparpotenzial = Independent savings potential
Einsparpotenzial [%]
Druckluft = Compressed air
Pumpen = Pumps
Ventilatoren = Fans
Beleuchtung = Lighting
Kaelteerzeugung = Cooling
Uebrige Motoren = Other motors
Summe = Total
Industrie = Industry

This shows the technical, financial and independently[21] 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.

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 second NEEAP. E.g. 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 7-13: General assumptions in industry

Assumptions	
Annual growth for steel, cement, glass (mainly ETS)	0.5 %
Annual growth Miscellaneous[22]	2.5 %
Increased fuel demand	0.0 % (0.5 % Other)
Increased electricity demand	0.5 % (1.5 % Other)

Industry self-regulation has set the reduction of industry's energy intensity by 1 % per year as its target. In this respect, FEDIL regularly publishes and energy efficiency index, based on industrial energy intensity (www.fedil.lu), which decreased by 28 % between 1990 and 2009. This is twice as high as the value of 1 % per year. At any rate, this value includes both independently achievable energy efficiency improvements as well as structural changes - also with respect to energy-intensive ETS companies. Therefore, for the purposes of the assessment, the assumption that 1 % of the voluntary agreement must be achieved in addition to independently achievable improvements was made. By comparing statistical values, it is possible to determine an independently achievable savings potential of 1 % per year for electricity and 2 % per year for fuels for non-ETS companies, which is in line with that of other countries. A comparison of the voluntary agreement with Germany shows that, in the period 2000-2007 (e.g. before the economic crisis and after the end of the fundamental structural change

[21] The technical savings potential applies to all measures that can be implemented in line with the state of the art and under consideration of realistic market penetration rates.

The financial savings potential includes all measure that also have financial effects during their life time, i.e. where savings achievable through reduced energy consumption refinance investment costs. The independently achievable savings potential includes all measures that can be implemented without further regulatory interventions

[22] The value was adapted compared to the first NEEAP due to economic development

in the steel industry), value creation for the industrial sector in Luxembourg grew by about 2 % per year, against approx. 1.4 % per year in Germany. Nonetheless, energy consumption grew at the same pace as in Germany, whilst fuel consumption grew in Germany and decreased in Luxembourg. This comparison does include ETS companies as well, but it shows that industry in Luxembourg managed to achieve greater efficiency improvements than in Germany during the period in question. In order to make provisions for uncertainty in these estimates (estimate of independently achievable improvements and of the emissions trading quota), the relevant uncertainty was corrected by applying reduction factors at the implementation stage.

Savings that are attributable to self-regulation contribute to realising in full the energy efficiency potential of industrial cross-section technologies (e.g. electrical motors and relevant applications), which is also the aim of measure C7. Therefore, the effect of this measure is reduced by a relevant amount with respect to the first NEEAP.

The savings potential for individual cross-cutting technologies is indicated in Table 7-14. This was derived from detailed investigations in Germany and other European countries (see below). Luxembourg does not have its own investigation into this.

Table 7-14: Electricity savings potential in the industry sector (excluding ETS) by 2016

Querschnittstechnologien	Einsparpotenzial bis 2016
Beleuchtung	11%
Prozesstechnologie	0%
Druckluft	13%
Kälteerzeugung	8%
Ventilatoren	14%
Pumpen	17%
Andere Motoranwendungen	9%

Key to above tables:

Querschnittstechnologien = Cross-cutting technologies
Einsparpotenzial bis 2016 = Savings potential by 2016
Beleuchtung = Lighting
Prozesstechnologie = Process technology
Druckluft = Compressed air
Kaelteerzeugung = Cooling
Ventilatoren = Fans
Pumpen = Pumps Andere Motoranwendungen = Other motor applications

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, such as myenergy, 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.

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
B7	Rise in the price of domestic fuel	Reduction of fuel consumption through the increase of fuel prices (Tokyo Cent) to achieve driving behaviours focused on lower fuel consumption (in the short term), as well as buying decisions in favour of more fuel-efficient vehicles (in the long term)	From 1 January 2007 and/or 1 January 2008	104
B8	Ordinance of the Grand Duchy of 22 December 2006 […] on the definition of special measures in the field of social and environmental policy CO^2-dependant motor vehicle tax)	**Introduction of a CO_2-dependent motor vehicle tax** to influence purchasing decisions in favour of more fuel-efficient vehicles	From 1 January 2007	122
B9	Ordinance of the Grand Duchy of 5 December 2007 for the granting of financial support to low CO^2 emissions vehicles	**Promotion of low CO^2 emissions vehicles to influence purchasing decisions in favour of fuel-efficient vehicles**	From 1 January 2008	71

Table 7-15: Results of the bottom-up evaluation in the transport sector (second NEEAP compared to the evaluation in the first NEEAP)

		NEAAP II				NEAP I	Changes in NEAAP II compared with NEAAP I
		2010		2016		2016	
		GWh/a	Contribution to savings target	GWh/a	Contribution to savings target	GWh/a	
B7 – Kyoto Cent	T	38	0.19%	104	0.53%	61	Energy data
B8 - CO2 dependant motor vehicle tax	T	41	0.21%	122	0.62%	86	Energy data
B9 – Promotion of least-polluting cars	T	47	0.24%	71	0.36%	75	Energy data, subsidy rates
Traffic	T	125	0.64%	297	1.51%	222	

Transit traffic, which dominates the transport sector, is not part of NEEAP's efficiency measures. With respect to the reasons of this limitation, see the first NEEAP. Measure

B7 (the Kyoto Cent), which is aimed at a reduction of domestic fuel consumption, however, also has a considerable impact on transit traffic. Such effect, however, is not considered in the following. Fuel price adaptation through the introduction of the Kyoto Cent, however, also leads to a reduction of fuel consumption in domestic traffic.

Furthermore, measures aimed at increasing the share of vehicles with low CO^2 emissions through the relevant reduction in consumption of the domestic vehicle stock, increase efficiency gains in the transport sector.

The effects of measures B7 and B8 increase due to a change in the calculation method for fuel consumption compared to the first NEEAP (the share of domestic transport in the transport sector's total energy usage has grown somewhat as a result of the recalculation). The measure for the promotion of vehicles with lower CO^2 emissions (B9) was calculated using a different method compared to the one adopted in the first NEEAP and the savings value determined is lower as a result.

Because of this, the anticipated effect of measures in the transport sector is approx. 75 GWh higher than in the first NEEAP.

Notes on the calculation 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 growth of 20 % by 2016 was anticipated for the Car stock, against 28 % for both other categories.[23] In the car category, it was assumed that there would be a slight drop in annual kilometrage (-9 % by 2016); for the other two groups a slight rise in kilometrage (+6 % 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.

[23] Stock development is based on a Statec projection updated versus the first NEEAP. Detailed data about kilometrage for each vehicle categories are shown below.

Table 7-16: General assumptions in the transport sector (Luxembourg vehicles)

Vehicle stock				
	2004	**2008**	**2010**	**2016**
Cars (1 000 units)	296	328	336	357
Other (1 000 units)	84	91	95	108
HGVs (1 000 units)	10	11	11	12
TOTAL	389	430	442	477

Extrapolation on the basis of national statistics and projections

Vehicle consumption				
	2004	**2008**	**2010**	**2016**
Cars petrol (l/100 km)	8.0	7.5	7.2	6.5
Cars diesel (l/100 km)	6.4	6.0	5.8	5.2
Other petrol (l/100 km)	4.0	3.7	3.6	3.2
Other diesel (l/100 km)	17.1	16.0	15.5	13.9
HGVs (l/100 km)	27.3	25.0	23.9	20.9

Extrapolation on the basis of national statistics

Kilometrage				
	2004	**2008**	**2010**	**2016**
Cars petrol (l/100 km)	21.7	21.0	20.7	19.8
Cars diesel (l/100 km)	20.9	20.3	20.0	19.0
Other petrol	3.3	3.4	3.4	3.5
Other diesel (l/100 km)	17.5	17.9	18.1	18.6
HGVs diesel (l/100 km)	86.7	88.5	89.4	92.0

Extrapolation on the basis of national statistics

Fuel consumption and transit traffic				
	2004	**2008**	**2010**	**2016**
Percentage (from statistics)	69 %	72 %	72 %	72 %
Total (TWh)	170	18.1	17.5	17.5

Extrapolation on the basis of national statistics

7.7 Cross-cutting measures and renewables

Table summarising all cross-cutting 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	**Promotion of decentralised renewables** for the increased penetration of renewables (solar collectors, PV, heat pumps)	01/01/1996 - 31/12/2007	31
		Promotion of decentralised renewables for the increased penetration of renewables (biomass in households)		16
A5	Ordinance of the Grand Duchy of 30 May 1994 for the production of electrical energy based on renewables and CHP	**Promotion of decentralised CHP (excluding emissions trading)** for the increased penetration of small CHP plants	1998-2007	206
B5	Ordinance of the Grand Duchy of 21 December 2007 on the promotion of rational energy use and renewables	**Promotion of decentralised renewables** for the increased penetration of renewables (solar collectors, PV, heat pumps)	01/01/2008 – 31/12/2012	13
		Promotion of decentralised renewables for the increased penetration of renewables (biomass in households)		27
C8	Continuation and expansion of support for decentralised renewables (solar thermal installations, PV installations, biomass)	**Promotion of decentralised renewables** for the increased market penetration of renewables (solar collectors, PV, heat pumps) (Development path pursuant to the Luxembourg Action Plan for Renewables	From 1 January 2013	102
		Promotion of decentralised renewables for the increased market penetration of renewables (use of biomass in households) (Development path pursuant to the Luxembourg Action Plan for Renewables)		62

With respect with decentralised renewables (particularly solar thermal collectors) and combined heat and power (CHP), important efforts were undertaken in order to reduce the use of fossil energy sources through improved energy efficiency already in the Early Action period. In the field of renewables, this development is accelerated by the Luxembourg Action Plan for Renewables (Ministère de l'Economie et du Commerce Extérieur, 2010).

Table 7-17: Results of the bottom-up evaluation in decentralised renewables and CHP (second NEEAP compared to the evaluation in the first NEEAP)

		NEAAP II				NEAP I	Changes in NEAAP II compared with NEAAP I
		2010		2016		2016	
		GWh/a	Contribution to savings target	GWh/a	Contribution to savings target	GWh/a	
A5 - Promotion of decentralised CHP	CHP	206	0.05%	206	0.05%	167	Economic parameters
A4 - Promotion of decentralised renewables (excluding biomass)	RE	31	0.16%	31	0.16%	26	Economic parameters, subsidy rates
A4 - Promotion of decentralised renewables (including biomass)	RE	16	0.08%	16	0.08%	22	Economic parameters, subsidy rates
A4 - Promotion of decentralised renewables (excluding biomass)	RE	13	0.07%	13	0.07%	12	Economic parameters, subsidy rates
A4 - Promotion of decentralised renewables (including biomass)	RE	27	0.14%	27	0.14%	45	Economic parameters, subsidy rates
C8 - Increase of the promotion of decentralised renewables (excluding biomass)	RE	0	0.00%	102	0.52%	23	Economic parameters
C8 - Increase of the promotion of decentralised renewables (including biomass)	RE	0	0.00%	62	0.32%	11	Economic parameters
Combined heat and power	CPH	206	1.05%	206	1.05%	167	
Renewable Energy Sources	RE	87	0.45%	252	1.28%	139	

The anticipated effects of measures for the Early Action period are similar to those in the first NEEAP. Furthermore, the development corresponds to the goal path expected in line with the Luxembourg Action Plan for Renewables, which should lead to higher savings through decentralised renewables compared to the estimates of the first NEEAP.

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

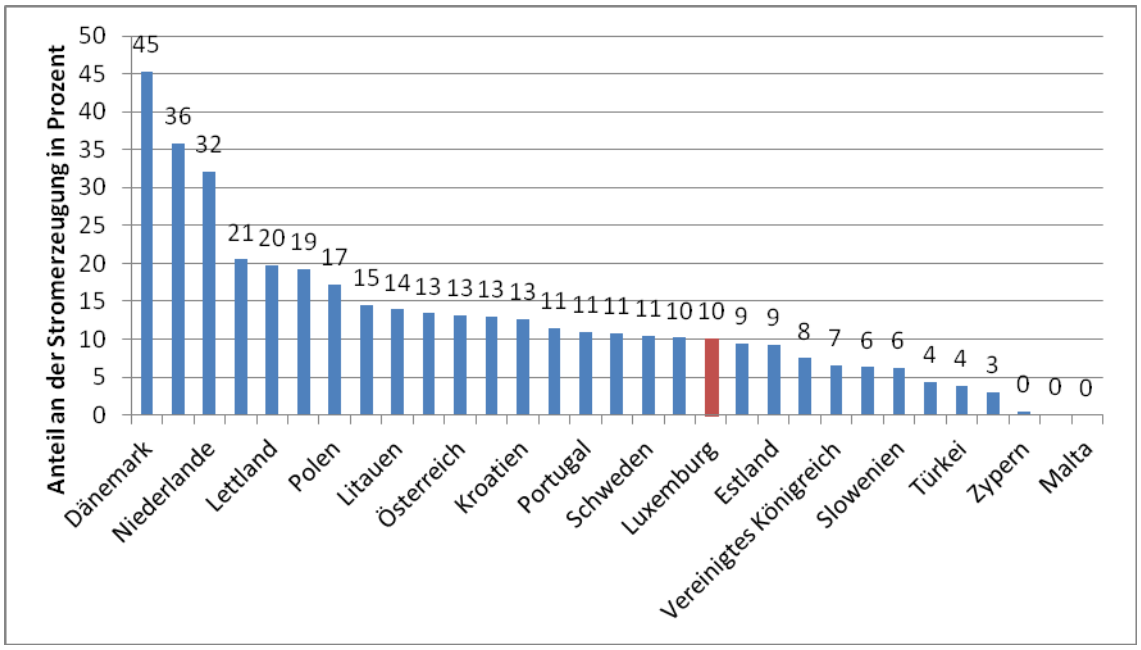
According to Eurostat figures, the proportion of electricity generation accounted for by CHP in Luxembourg was 10.1 % in 2009, which is slightly lower than the European average of 11.4 % (Figure 7-2).

CHP electricity generation in Luxembourg has grown significantly in recent years. In 1994, approx. 30 m kWh of CHP electricity was produced, whereas in 2004 the figure amounted to 44 m kWh. This increase was due primarily to public CHP installations[24],

[24] Installations that are not intended for captive energy production in the private area.

whose share of the total production of CHP electricity generation grew from about 14 % (1994) to around 45 % (2004).

Figure 7- 2 Proportion of total electricity generation accounted for by CHP throughout the EU in 2009



Source: Eurostat.

Key to above graphic:

Anteil and der Stromerzeugung in Prozent = % proportion of electricity generation
Daenemark = Denmark
Niederlande = Netherlandds
Lettland = Lettland
Polen = Poland
Litauen = Lituania
Oesterreich = Austria
Kroatien = Croatia
Portugal = Portugal
Schweden = Sweden
Luxemburg = Luxembourg
Estland = Estonia
Verignites Koenigreich = United Kingdom
Slowenien = Slovenia
Tuerkei = Turkey
Zypern = Cyprus
Malta = Malta

The current CHP promotion constitutes an ‘Early Action’. At any rate, only part of CHP electricity generation falls under the ESD, namely plants that are not subject to emissions trading. Tabelle 7-18 These include some public electricity producers and other private, own-use producers. Table 7-18 shows the technical parameters assumed for CHP.

Table 7-18: General assumptions (fuel-related) for CHP

Assumptions	
Separate electricity generation efficiency - gas-steam power plant	55 %
Separate electricity generation efficiency - other	35 %
Separate electricity generation share - gas-steam power plant	30 %
Separate electricity generation share - other	70 %
Separate heat generation efficiency	90 %
CHP electricity share	35 %
CHP heat share	65 %
CHP overall efficiency	80 %
Annual growth (increased proportion)	4 %

The assumptions about renewables and biomass are based on the Luxembourg Action Plan for Renewables.

8 Additional measures to be reported

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). Furthermore, we list existing and, where applicable, planned measures and instruments that are not prescribed by Directive 2010/31/EU on the general energy efficiency of buildings (revised version), but are nevertheless aimed at achieving the goals enshrined therein.

8.1 Energy efficiency efforts for the exemplary role of the public sector pursuant to Article 5(1) of Directive 2006/32/EC

The ESD defines particular goals for the public sector, 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 takes 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 national and Community public procurement legislation, at least two measures must be used from the list set out in Annex VI 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 practice between public sector bodies, for example energy-efficient public procurement practices, both at national and international level.
- They must communicate effectively the exemplary role and actions of the public sector to citizens and/or companies, as appropriate.

The Government of Luxembourg has initiated - or is planning to initiate -the following actions within the framework of the energy efficiency efforts for the exemplary role of the public sector pursuant to Article 5(1) of the ESD.

Public buildings (requirement f in Annex VI of the ESD):

- New buildings: The highest achievable level of energy efficiency is the goal for new buildings. Based on the Luxembourg Government Programme of 2009,

from 2010 all new state or state-subsidised administrative buildings (and other types of buildings where applicable) must comply at least with the lowest domestic energy standard. Both the state and the municipalities strive to exceed this efficiency level. Government plus-energy buildings shall be built for demonstration purposes:

- Existing buildings: Luxembourg has published an upgrading programme for public buildings. Around EUR 30m have been made available from the Kyoto fund for the gradual upgrading of old building stock involving energy measures. The climate package presented in May 2001 by the Ministry for Sustainable Development and Infrastructure and originated from the climate partnership includes the increase of public funds (Budget and Personnel) aimed at accelerating the energy upgrading of public buildings.

At the time of writing, a sample contract for public sector energy service contracts in Luxembourg (energy savings contracting) is being drafted under the auspices of the Ministry of Economy and Foreign Trade. Furthermore, this sample contract must be used in one or more pilot projects (requirement a in Annex VI of the ESD).

The Luxembourg Sustainability Plan (November 2010) has retained the objective of 'Sustainable consumption - progressive introduction of consumption and production models'. One of the measures envisaged affects the reorganisation of procurement practices of the Land and the municipalities along social and environmental public procurement lines through the introduction of sustainability criteria. Currently, a work group led by the Ministry for Sustainable Development and Infrastructure is dealing with the concrete implementation possibilities of sustainable public procurement, with respect to applying sustainability criteria when awarding public tenders (requirement b in Annex VI of the ESD).

Monitoring and communication of energy consumption for public buildings are further priority measures enshrined in the climate partnership, whereby communicating the Energy Performance Certificate to the public by means of visual display is obligatory for buildings with an energy reference area greater than 1 000 m^2 since 2011.

In order to exchange best practice within the building sector, a communication platform based on the list of climate partnership priority measures has been created in order to enable building sector players to exchange their experiences about realised and planned refurbishment and new build projects. The relevant public sector institutions can also make use of this platform.

In July 2009, the Luxembourg Government listed a pact about climate protection between State and municipalities as a priority in its Government statement. In order to design the climate package, in May 2011 the Government proposed the introduction of a European Energy Award (eea) adapted to Luxembourg - a quality management systems for municipalities with respect to energy and climate protection policy. Each par-

ticipating municipality undertakes to implement the quality management system in return for financial and technical support from the State. The mutual commitment becomes a convention between the State and municipalities, which should last until 2020. The eea is a pragmatic and comprehensive instrument developed by municipalities, which leads each municipality to achieving a sustainable energy, traffic, climate and environmental policy using a stepped approach. It includes approximately 80 measures in 6 areas: development planning and area management, municipal buildings and installations, supply and waste disposal, mobility, internal organisation as well as communication and cooperation. A large part of these measures contributes to improving energy efficiency at municipal level. The technical support includes a series of instruments (measure list of the eea, energy accounting software, guidelines for sustainable public procurement, etc.) and services (basic advice about myenergy information points, best practice exchange platform, support for the communication of the exemplary function, etc.). My energy takes over the management of the quality management system on behalf of the Ministry for Sustainable Development.

8.2 Information provision for the improvement of energy efficiency

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 they endeavour to increase their efforts to promote energy efficiency and create suitable conditions and incentives in order to persuade market participants to provide better energy efficiency information and advice to end customers (information through market participants).

The following actions have been undertaken or are being planned in order to provide information:

Increasing awareness and providing information and advice about energy efficiency and renewables was stepped up in recent years as a result and will be further strengthened in future:

- Myenergy (www.myenergy.lu) is the national institute responsible for creating awareness and providing information and advice about energy efficiency and renewables. The services it offers have been substantially increased since it was founded in 2008. It is aimed at citizens, municipalities and companies. The means used for creating awareness and providing information endeavour to inform as many consumers as possible: the participation in national exhibitions and regular presence in the media are the most important measures in order to

achieve this goal. Basic advice is available both over the phone, thanks to a free phone number, as well as face-to-face, at information centres. A further increase of the activities of myenergy and the extension to not yet completely covered target groups is being planned.

- A comprehensive network of regional and municipal advice centres (myenergy information points) is being developed in partnership with municipalities. At the beginning of 2011, information points had been created in approx. half of the municipalities. Moreover, myenergy offers different support measures such as road shows, presentations, information days and information tours within the framework of the partnership with municipalities.
- The first edition of the myenergy days trade shows took place from 29 April to 1 May 2011 and was a great success from the start, with approx. 2 500 visitors. The show, organised by myenergy with the support of many partners, gathered approx. 50 exhibitors (craft businesses, exhibitors, architects, engineers and energy advisors) around a single topic: energy-efficient retrofitting. The first myenergy days were subdivided into 3 main thematic areas: Building envelope, building services and services. Furthermore, the exhibition offered a comprehensive programme of lectures, product presentations and demonstrations.
- Furthermore, the creation of tools (including guidelines) and the implementation of awareness and acceptance campaigns are planned. In the past 5 years, more awareness and information campaigns about energy saving, Energy Certificates, low-emission vehicles, renewable energy sources and climate protection in general were carried out.
- Thanks to a website (www.oektopten.lu) funded by the Ministry for Sustainable Development and Infrastructure, interested users can access information about energy-efficient electrical appliances in the categories housing appliances, leisure, mobility and lighting. This measure should encourage the market to increase the offering of products with the best environmental profile. Furthermore, consumers should be informed about environmentally-friendly products.
- The Luxembourg administration portal (www.guichet.lu) includes information about state incentive programmes for energy efficiency and renewables.

The climate partnership confirmed the extension of the training offering in the energy efficiency and renewables area as priority measures. Based on the existing offering, the training product portfolio should be improved on a constant basis, so as to provide all target groups with adequate training and continuing education. Significant training and professional development efforts were undertaken in the past ten years, of which some examples are listed below:

- ***Chamber of Handicrafts Luxembourg (Chambre des Metiers):*** The professional development programme of the Chamber of Handicrafts **'Energie fir d'Zukunft'** covers, amongst others, the topics of retrofitting, passive house, (envelope and building services), ventilation systems, solar systems, heat pumps, internal insulation, hydraulic compensation and promotion programmes. It is intended primarily for the executives of relevant craft businesses and has been provided every year since 2001.
- ***IFSB (Institut de Formation Sectoriel du Bâtiment):*** Sustainable building is one of the cornerstones of the building sector professional development institute. The programme is aimed at planner and craftspeople – including applied training about topics such as sustainable building and retrofitting, thermal insulation, windows, timber constructions, energy balancing, thermography, air tightness tests, solar installations, heat pumps and wood heating systems.
- ***OAI (Ordre des Architectes et Ingénieurs-Conseils) and CRP Henri Tudor (Centre de Recherche Public Henri Tudor):*** Since 2003, the CRP Henri Tudor organises the training programme **'Building and energy'** in collaboration with the architects and consulting engineers' professional organisation (OAI). The advanced professional development programme deals with sustainable, energy-efficient building issues and is aimed primarily at architects and engineers. The content of the professional development programme is defined in cooperation with energieagence S.A., the Ministry for Sustainable Development and Infrastructure, the Oeko-Zenter Lëtzebuerg and the University of Luxembourg. Moreover, the CRP Henri Tudor offers further courses on the topic of energy efficiency.
- Since the publication of the ordinances about the total energy efficiency of buildings in 2007, **specialist training courses about the total energy efficiency of domestic and non-domestic buildings** are offered on behalf of the Ministry of the Economy and Foreign Trade.
- ***University of Luxembourg:*** The applied engineering course of study **'Energy and enviro**
- ***Atert-Lycée Rédange:*** This secondary school offers the course of studies 'Energy and technical building services Technician'.

The Luxembourg Eco-Innovation Cluster (www.ecoinnovationscluster.lu) is a network that supports the different players in the field of environmental technologies in Luxembourg. Its objective is that of developing new and sustainable business areas. The use of green technologies, therefore, is supported by an ambitious action plan. The members of the Luxembourg Eco-Innovation Cluster are active in different areas, such as sustainable building, environmentally-friendly product design and rational energy usage.

Thanks to stimulation and incentives for energy-efficient building, retrofitting, living and working, the energy services market experienced strong growth in the past years. The creation/appointment of an office aimed at supporting the further development of the energy service market (and also of the liaison between potential customers (including companies) and service providers, information offices for energy saving contracting, etc.) has been considered within the framework of the climate partnership.

Currently, intelligence consumption measurement systems are being tested in Luxembourg in a pilot project of the transport and distribution operators CREOS Luxembourg S.A.

8.3 List of existing and, where applicable, planned measures and instruments for the achievement of the measures set out in Directive 2010/31/EC (energy efficiency)

Pursuant to Article 10(2) of Directive 2010/31/EC about total energy efficiency of buildings (revised version), Member States issue a list of existing and, where applicable, planned measures and instruments – including financial ones – that are not set out in the aforesaid guideline but are nevertheless aimed at achieving its stated objectives.

The Luxembourg Government has either initiated or is planning to initiate the following action within this framework.

In Luxembourg, both households and companies and municipalities are stimulated to invest in the energy efficiency of buildings through financial aid programmes.

- Households are supported with investment subsidies for the energy retrofitting and the building of passive or low-energy housing by means of the „Règlement grand-ducal du 20 avril 2009 instituant un régime d'aides pour la promotion de l'utilisation rationnelle de l'énergie et la mise en valeur des énergies renouvelables'. Further information is available at www.myenergy.lu and www.guichet.lu;
- Companies that invest in the energy efficiency of buildings are supported with investment aid thanks to the „Loi du 18 février 2010 relative à un régime d'aides à la protection de l'environnement et à l'utilisation rationnelle des ressources naturelles', or with investment aid and subsidised interest rates thanks to the „Loi modifiée du 30 juin 2004 portant création d'un cadre général des régimes d'aides en faveur du secteur des classes moyennes'. Further information is available at www.myenergy.lu and www.guichet.lu;
- Municipalities are supported with investment aid thanks to the 'Loi du 31 mai 1999 portant institution d'un fonds pour la protection de l'environnement' for the energy retrofitting, the planning of an entire energy concept for the municipality

or the municipality's buildings as wells as the construction of new buildings that exploit solar gains. Further information is available at www.myenergy.lu.

Further financial instruments aimed at energy-efficiency dwellings were presented in April 2011 by the Ministry for Housing and, in part, in the state of the nation address:

- the tax credit for notarisation when purchasing a property is partly linked to energy efficiency criteria;
- subsidised interest rates for mortgages are also linked to energy efficiency criteria;
- introduction of an interest-free loan to finance energy retrofitting of low-income households;
- introduction of an accelerated tax depreciation for tenants in the event of investments in energy retrofitting;
- loosening of criteria for the application of a reduced VAT rate for energy efficiency amelioration work in buildings.

Furthermore, also in the light of an initiative of the Ministry for the Environment and Foreign Trade, most banks active in mortgage lending in Luxembourg offer subsidised interest rates for loans aimed at financing passive or low-energy housing.

A master contract for energy saving contracting for the public sector in Luxembourg is being drafted at the moment (see section 8.1).

Further measures aimed at achieving the goals set out in Directive 2010/31/EC pertain to advice and training offering and are described in more detail in section 8.2.