EUFORIE
European Futures for Energy Efficiency

Consumers and energy efficiency

(Workpackage 5)

Country Report for Latvia

An inventory of policies, business and civil society initiatives focusing on heating & hot water and the use of electricity

December, 2015

This project is supported by the European Commission
Horizon2020 Research and Innovation Programme

www.euforie-h2020.eu

Methodological notes:

This report has been compiled as a result of desktop search into:

i) data on energy consumption in the household sector in Latvia, and

ii) policies, business and civil society initiatives mainly at the national level to promote energy efficiency in the household sector in Latvia.

The report focuses on the use of energy in the household sector for the purposes of heating and the use of hot water, as well as on the use of electricity. Transport-related use of energy is excluded.

The data analysis on energy consumption is based on the ODYSSEE database on energy efficiency indicators and data (http://www.odyssee-mure.eu), using the most recent data available.

The scope of information presented in the report in the case of policies at the national level is mainly on governmental measures in effect. In the case of business and civil society initiatives the main objective of the report is to illustrate diversity and not to provide a complete overview or an exhaustive list of all existing initiatives. An attempt was made to introduce the better-known campaigns and programmes as well as to indicate the variety of the actions.

The collection of information was concluded by end of November 2015.

Please cite as:

Brizga, Janis, Trotta, Gianluca and Lorek, Sylvia (2015). Consumers and Energy Efficiency – Country Report Latvia. An inventory of policies, business and civil society initiatives, focusing on heating, hot water and the use of electricity. *EUFORIE – European Futures for Energy Efficiency*

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Abbreviations

CCFI - Climate Change Financial Instrument

CHP – Combined Heat and Power

CF – Cohesion Fund

CFB - Compact fluorescent bulbs

EE – Energy Efficiency

EES - Energy Efficiency Services

EIB - European Investment Bank

ERDF - European Regional Development Fund

EPC - Energy Performance Contracting

ESCO - Energy Service Company

ETS – Emission trading system

EU – European Union

OECD – Organizations for Economic Cooperation and Development

NEEAP – National Energy Efficiency Action Plan

SF – Structural Funds

1 Introduction

1.1 General socio-economic data

Energy efficiency has been put on the forefront of the EUs energy policy as an effective measure of reducing dependency on energy imports and stimulating internal economic growth. Energy efficiency has a fundamental role to play in the transition towards a more competitive, secure and sustainable energy system with an in thermal energy market at its core. While energy powers our societies and economies, future growth must be driven with less energy and lower costs.

According to the Energy Efficiency Communication of July 2014, the EU is expected to achieve energy savings of 18%-19% by 2020 compared with 1990 levels – missing the 20% target by 1%-2%. However, if EU countries implement all of the existing legislation on energy efficiency, the 20% target can be reached without additional measures. [1]

Table 1 General socio-economic data

SOCIO-ECONOMIC				
Item	**Unit**	**1995**	**2005**	**2012**
GDP at exchange rate	M€2005	6.593,36	12.806,34	13.679,50
GDP at 2005 PPP	M€2005p	12.824,84	24.909,78	26.608,16
Population	k	2.500,58	2.249,72	2.044,81
Number of households	k	n.a.	884,60	817,00
Private consumption of household at exchange rate	M€2005	4.090,16	8.082,78	9.249,98
Private consumption of household at 2005 PPP	M€2005p	7.955,82	15.721,92	17.992,26
Value added of agriculture at exchange rate	M€2005	398,48	515,6	572,52
Value added of agriculture at 2005 PPP	M€2005p	775,09	1002,9	1113,62
Value added of industry at exchange rate	M€2005	1524,2	2738,35	2595,99
Value added of industry at 2005 PPP	M€2005p	2964,75	5326,4	5049,49
Value added of tertiary at exchange rate	M€2005	4557,85	8736,8	9553
Value added of tertiary at 2005 PPP	M€2005p	8865,53	16994,05	18581,67

Source: Odyssee database

As like the rest of the former Soviet bloc countries, Latvia over the last 20 years has significantly reduced its primary energy consumption and CO_2 emissions. This reduction has been possible mostly because of the drop in economic output (especially during 1990ies), changes in economic structure and rising prices of energy. Energy efficiency has also seen significant improvement. Latvia economy grew by 107.47% in the period 1995-2012; GDP and private consumption at 2005 PPP increased with annual average rate of 5.97% and 7%, respectively.

According to the Ministry of Economics 2013 report, only 33.1% of total energy consumption is produced locally, while even in 2011 the local energy resources covered 35.9% of total energy consumption. The latest data shows that from the year 2000 to the year 2011, the total primary energy consumption grew by 15.2% and was 188.7 PJ. It could be concluded that the demand and as a result the import of energy is growing. The Final consumption of energy in 2011 was 170.7 PJ, which is 22.5% higher in comparison with the year 2000.

According to the latest statistical data, the gross inland energy consumption in Latvia has increased from 4.37 Mtoe in 2003 to 4.47 Mtoe in 2013, demonstrating that energy efficiency measures has not been enough to decreasing energy consumption. Latvia's final residential energy consumption in 2012 amounted to 1.38 Mtoe – a 13.75% decrease compared to 1995 – reaching its peak in 1996,

with 1.69 Mtoe. The household sector accounted for 34.6% of Latvia's total energy end-use in 2012, and the residential final energy consumption per capita was 0.67 Toe per inhabitant.

1.2 Residential Sector

The amount of energy used in Latvia per household varies widely depending on the income and the age and type of dwelling. Still, the average household in Latvia uses 220-250 kWh/m2/per year. National Energy Guidelines urge that this number should be decreased till 195 kWh/m2/per year by 2016 and later till 150 kWh/m2/per year by 2020 (Energy Development Guidelines 2007 – 2016, 2006).

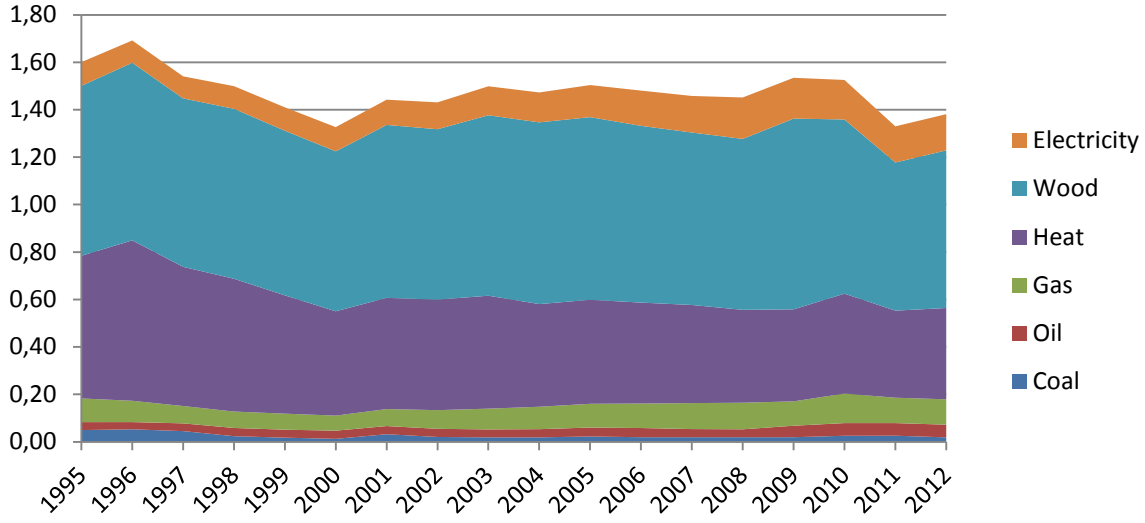
Table 2 Data related residential energy consumption

ENERGY				
Item	**Unit**	**1995**	**2005**	**2012**
Final consumption of residential (with climate correction)	Mtoe	1,65	1,52	1,36
Final consumption of residential	Mtoe	1,60	1,50	1,38
➢ Coal	Mtoe	0,05	0,02	0,02
➢ Oil	Mtoe	0,03	0,04	0,05
➢ Gas	Mtoe	0,10	0,10	0,11
➢ Heat	Mtoe	0,60	0,44	0,38
➢ Wood	Mtoe	0,72	0,77	0,66
➢ Electricity	Mtoe	0,10	0,14	0,15
Space heating	Mtoe	n.a.	1,07	0,93
Water heating	Mtoe	n.a.	0,24	0,25
Cooking	Mtoe	n.a.	0,10	0,09
Air cooling	Mtoe	n.a.	n.a.	0,01
Electrical appliances and lighting	Mtoe	n.a.	0,09	0,10
Electricity consumption of captive electricity	TWh	n.a.	n.a.	n.a.
Total stock of dwellings	k	n.a.	997,82	1.018,00
Stock of dwellings permanently occupied	k	n.a.	902,53	808,00
Total construction of dwellings	k	n.a.	3,81	2,09
Floor area of dwellings (average)	m2	n.a.	57,25	62,50
Stock of refrigerators	k	n.a.	842,15	792,49
➢ Unit consumption	kWh/year	n.a.	n.a.	384,00
➢ Rate of equipment ownership	%	n.a.	95,20	97,10
Stock of freezers	k	n.a.	70,81	61,28
➢ Unit consumption	kWh/year	n.a.	n.a.	310,00
➢ Rate of equipment ownership	%	n.a.	8,01	7,70
Stock of washing machines	k	n.a.	736,48	686,28
➢ Unit consumption	kWh/year	n.a.	n.a.	179,00
➢ Rate of equipment ownership	%	n.a.	83,26	85,70
Stock of dishwashers	k	n.a.	31,55	53,92
➢ Unit consumption	kWh/year	n.a.	n.a.	153,00
➢ Rate of equipment ownership	%	n.a.	3,57	6,60
Stock of TV	k	n.a.	849,60	758,99
➢ Unit consumption	kWh/year	n.a.	n.a.	95,00
➢ Rate of equipment ownership	%	n.a.	96,63	96,80

Source: Odyssee database

Even though the contribution of wood to the household final energy consumption decreased by 8.33% in the period 1995-2012, it was the principal source of energy in 2012 (48.1%). Oil, gas and coal, represented all together the 13% share of the total final consumption in 2012, while electricity accounted for the 10.8% (see Fig.1.). Heat declined from 1995 to 2012 of 36.67%, but it still was the second source of energy in 2012 (27.5%).

Figure 1 Latvia's final residential energy consumption by source 1995 – 2012 (Mtoe)



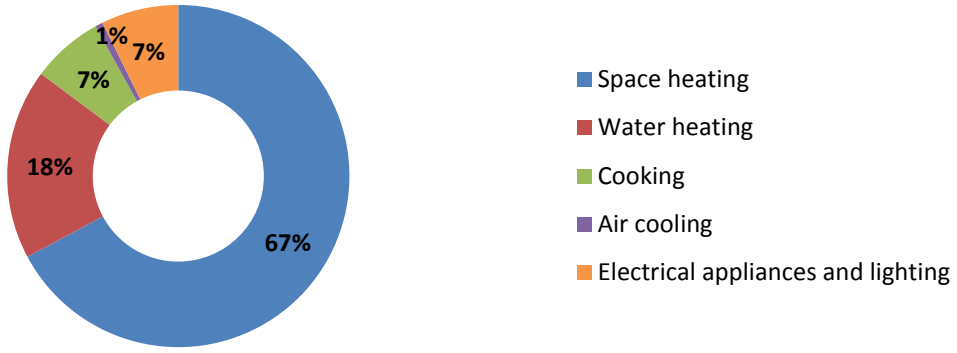
Source: Trotta based on Odyssee database

Approximately 67% of energy in the residential sector was used for space heating, roughly 18% for water heating, about 7% for both cooking and electricity for appliances and lighting, and 1% for air cooling. Figure 2 illustrates the composition of the energy end-use in the residential sector in 2012.

Total use of energy for space heating amounted to 0.93 Mtoe in 2012. Of this, wood was the predominant source accounting for 0.56 Mtoe (60.2%), heat 0.28 Mtoe, gas 0.06 Mtoe, coal 0.02 Mtoe, and 0.1 Mtoe for both oil and electricity. While fossil fuels had a high drop since 1995, the consumption of wood has been stable. District heating was the main source of energy used for water heating in 2012; it represented the 40% of the total energy share of water heating in 2012, followed by wood (32%), electricity (12%) and gas (12%). The composition of the energy consumed for cooking in 2012 was: 33.3% wood, 33.3% gas, 22.2% oil and 11.1% electricity.

The State Land Service Cadastre Information System contains data about 1.35 million buildings with a total area of 198 billion m^2, including different types of auxiliary buildings. Approximately 400,000 of these buildings are equipped with heating systems, of which 352,400 are residential houses. Most of these (~300,000 or 85%) are detached buildings although they only account for 39% of the floor space.

Figure 2 Latvia's final residential energy consumption by end-use 2012 (%)



Source: Trotta based on Odyssee database

Multi-apartment buildings account for more than 60% of the floor space. In the capital Riga multi-apartment buildings account for 85% of the flats. Most of these buildings were constructed during the Soviet times. Cheap and available energy did not provide much incentive for energy efficiency. Most of the buildings were built between 1961 and –1989.

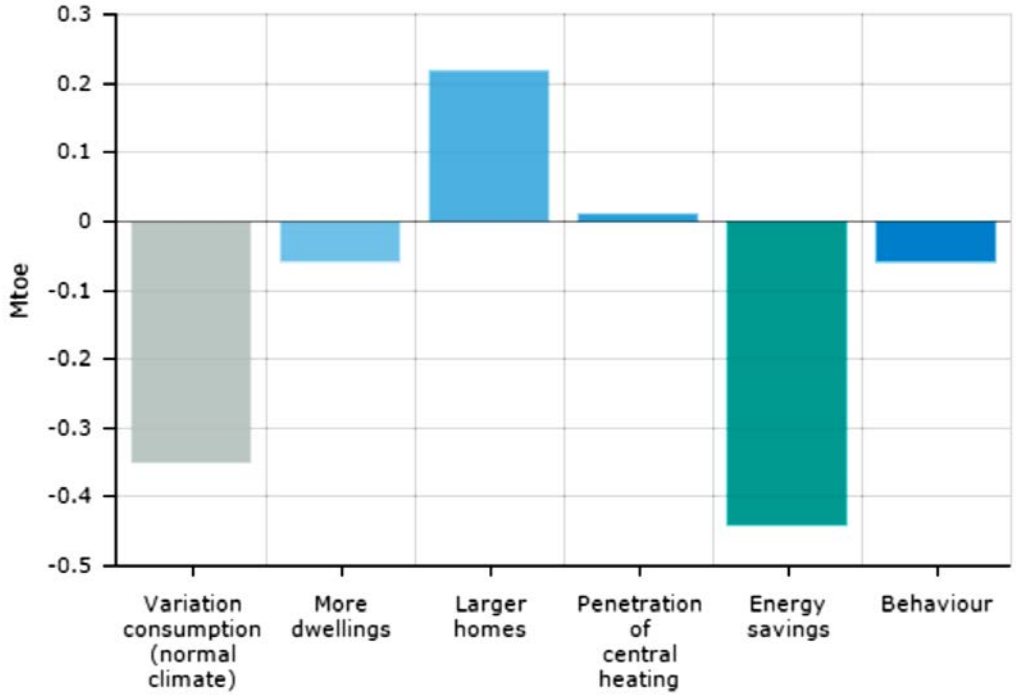
Heating standards for building envelopes in the Soviet Union were two times lower than in Germany and the UK, and five times lower than in Sweden which is in a similar climate. In addition, the heat resistance of typical housing was even lower because of the poor quality of the construction materials and works. Only after September 1991 Latvia significantly raised requirements for the building envelope.

However, condition of the multi-apartment building stock built during the Soviet era continues to rapidly deteriorate due to weather conditions and lack of proper maintenance. The only solution of this situation is renovation and insulation of the buildings, but the major obstacles why no active renovation and insulation of multi-apartment buildings is carried out is difficulties of residents to take a collective decision for renovation. Practice shows that individual owners are inadequately organized to manage their collective property. Combined with a lack of awareness and technical knowledge, limited availability of funding, high risk perception and reluctance for debt financing, the barriers overwhelm most people.

The average household size in Latvia is decreasing and in 2012 reached 2.4 people per household (EU28 – 2.4). However, people have some of the highest rates in the EU for living in overcrowded dwellings with high intensity of housing deprivation [48]. Most of the people live in flats: 66% of population in Latvia.

Household energy consumption does not show any significant increase but some fuel shift is observable. Demand for electricity and natural gas is growing, but share of district heating in final energy consumption is decreasing. Latvia has not encountered significant changes in energy consumption but the figure is the highest amongst the Baltic States – 1.67 toe/dwelling. At the same time as dwelling size increased household energy consumption per m² for space heating (normal climate) decreased by 35% in Latvia (17.9 koe/m^2).

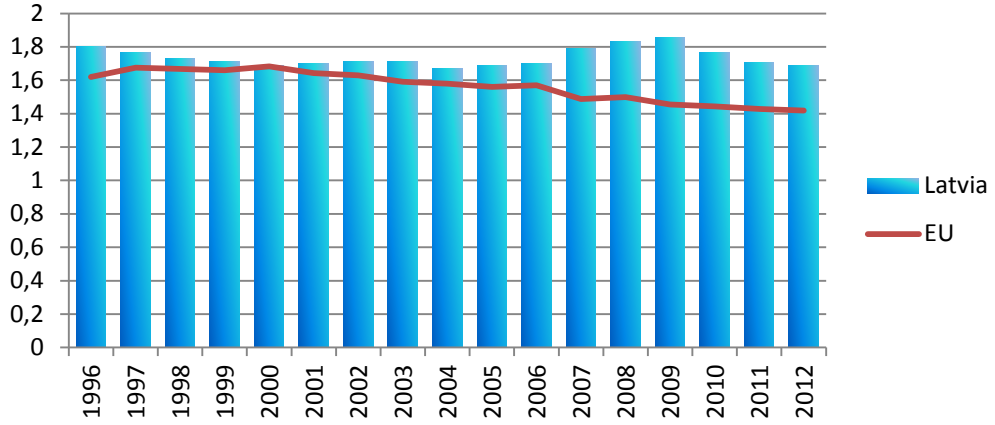
Figure 3 decomposition of influences on space heating in Latvia (2000-2012)



Source: Odyssee database

In 2012, the average floor area of dwellings was about 62.5 m^2, still much smaller than the average of the European Member States (87.81 m^2). Energy consumption of households per permanently occupied dwellings (calculated at normal climate), was 1.68 toe/dwelling (the average of the European Member States was 1.41 toe/dwelling). Figure 3 shows the household consumption per dwelling of Latvia compared to the average of the European Member States over the period 1995-2012.

Figure 4 Latvia's final energy consumption per dwelling 1996-2012 (toe/dwelling)



Source: Trotta based on Odyssee database

With regard to CO_2 emissions the residential sector's share of total emissions (1.06 $MtCO_2$) decreased of 50.48% from 1995 to 2012 and it was far below the average of the European Union (27.9 $MtCO_2$), decreased of 11.89% in the same period. In addition, Latvia was one of the EU countries with lower CO_2 emissions of the residential sector per capita, ranked in the twenty-seventh position in 2012 (where Estonia is in the first position being the less efficient).

Table 3. Environmental aspects of residential energy consumption

ENVIRONMENT				
Item	**Unit**	**1995**	**2005**	**2012**
CO2 emissions of households (excluded electricity)	MtCO2	0,50	0,42	0,45
Total CO2 emissions of households (included electricity)	MtCO2	2,15	1,28	1,06
CO2 emissions per dwelling	tCO2/dw	n.a.	0,47	0,56
CO2 emissions per dwelling (with climatic corrections)	tCO2/dw	n.a.	0,47	0,56
CO2 emissions per dwelling with climatic corrections (included electricity)	tCO2/dw	n.a.	1,42	1,31
CO2 emissions of space heating per dwelling	tCO2/dw	n.a.	0,28	0,27
CO2 emissions of space heating (with climatic corrections)	tCO2/dw	n.a.	0,29	0,27
CO2 emissions of space heating with climatic corrections (included electricity)	tCO2/dw	n.a.	0,72	0,53
Degree-days	degree	4.100,42	4.183,87	4.357,00

Source: Odyssee database

However, it is clear that to ensure continued decoupling of economic growth from GHG emissions energy and climate policies will clearly have to advance. The current tinkering on the margins are not enough to achieve the bold climate targets and require leadership and sophisticated strategy for moving towards a low carbon society by pursuing not only efficiency improvements but taking into account all factors driving emissions.

2 Politics effecting energy consumption in households

2.1 Policy framework

In Latvia, energy efficiency has a very high national security issue aspect, and it takes a priority place in Latvian Energy Policy. "**Latvia's long-term energy strategy 2030 - Competitive Energy for Society**" has cantered to build and develop competitive energy for society, which inevitably outlines the importance of a more effective and mature energy system. The Energy Strategy 2030 sets the following objectives of the energy policy:

- Competitive economy – balanced, efficient, economically, socially, and ecologically justified energy policy based on market principles ensuring further development of the economy, its competitiveness in the region and the world;
- Sustainable energy – reduced dependency on imported energy resources, new and efficient technologies for the use of renewable resources are encouraged, measures to improve energy efficiency are implemented;
- Secure supply – stable energy supply and developed infrastructure provided to energy users.

A mid-term vision for Latvia's energy policy has been established by the government through the adopted **Energy Development Guidelines for 2007-2016**. These Guidelines also include a commitment to promote energy efficiency as one of the key priorities for the energy sector development in Latvia and intention to support energy efficiency measures in energy end use sectors. Currently the Ministry of Economics has developed draft **Energy Development Guidelines for 2014-2020**, which links Latvia's energy policy to the EU 2030 energy package and gives good overview of the state of the art in the energy sector in Latvia and outlines future steps, including energy efficiency measures.

On November 26, 2013 the Cabinet of Ministers has adopted the **Concepcion on the Implementation of the EU EED** (available: http://polsis.mk.gov.lv/view.do?id=4572) which envisages the promotion of energy efficiency in all stages of energy supply and final consumption. The Conception foresees state support for the implementation of energy efficiency measures in public and industrial buildings and in multifamily houses. The Conception also recommend establishment of the energy efficiency obligation scheme for the energy distributors and retail energy sales companies for the first time in Latvia.

According to the requirements of EED, Latvia has submitted **the Informative Progress Report of the Indicative National Energy Performance Objective for 2014–2016** to the EC summarizing the planned energy performance measures by 2016. Latvia has also developed several Energy efficiency action plans.

The "**Second Energy Efficiency Action Plan of the Republic of Latvia**" considers household sector (heat insulation of buildings), transport sector and district heating (energy efficiency of both production and distribution sides of district heating) as main priorities. The Plan identifies sectors with largest energy efficiency potential: multi-apartment residential buildings, local government and public institution buildings, industry, services sector and transport, as well as centralized heating systems. [2]

In Latvia, nearly all new measures focus on the building sector. Roughly half of all savings from alternative measures (1,690 GWh) will come from building renovation measures covering residential, central government and municipal buildings, as well as those of small and medium enterprises. Additional 1,050 GWh savings will result from upgrades in heat insulation of multi-apartment

residential buildings. Additional new measures include an agreement with municipalities and businesses on improvement of energy, electrification and modernization of the rolling stock, as well as reduction of greenhouse gas emissions in municipal buildings and in the lighting infrastructure of municipalities. [3]

Under the Energy Efficiency Directive, EU countries should set up an energy efficiency obligation scheme. This scheme requires energy companies to achieve yearly energy savings of 1.5% of annual sales to final consumers. In Latvia 81% of the target will be met using these energy efficiency obligation, and the remainder with alternative measures that have not been fully developed yet (tax breaks, monitoring measures for energy producers).

2.2 Energy Efficiency Targets

As an EU member State, Latvia is bound by EU legislation and has set out some key goals that must be achieved by 2020 within the framework of the EU climate and energy package:

- energy saving target of 3.5 TWh (300 ktoe) in 2016, 78% of which must be achieved in the household sector, 12% in the services sector, 6% in the transport sector and 5% in industry;
- by 2020, primary energy savings should reach 7.8 TWh, including 6.1 TWh in end-use sectors;
- 40% share of renewables in final energy consumption by 2020 (in 2009 this ratio was 34.3%, in 2010 – 32.5% but in 2011 – 33.1%);
- 60% share of renewables in electricity consumption by 2020;
- 10% share of renewables in total energy consumption in the transport sector by 2020 – in 2009 the share was 1.1%, in 2010 – 3.3% but in 2011 – 4.8%;
- in 2020 GHG emissions should be reduced by 20-35% of 1990 level;
- Latvia's national target under the Effort Sharing Decision is equivalent to a 17% increase in the greenhouse gas emissions from non-ETS sectors in 2005, by 2020; [4]
- emissions covered by ETS by 2020 should be 21% below the 2005 level.

Within the implementation of the Directive 2012/27/EU Latvia has to achieve the indicative national energy efficiency target, which includes two binding targets to be pursued: the annual final energy savings of 1.5 % supplied to final consumers in the country and annual renovation of 3% of the national stock of buildings. The national energy efficiency target corresponds to the following amounts of energy savings expressed in figures:

- The overall indicative national energy efficiency target – the primary energy savings in 2020 – 0.670 Mtoe (28 PJ) (according to the requirements of the Article 3 of EED); [5]
- The annual final energy savings target of 1.5%[1] – in the amount of 1.5% of the energy supplied to final consumers – overall by 2020 – 0.213 Mtoe (8.9 PJ);
- The annual renovation target of 3% of central government stock of buildings (maximum estimates – total of 678 460 m2), along with the renovation of local government buildings ensure 0.016 Mtoe (0.67 PJ or 186 GWh) energy savings in the entire period from 2014-2020.

[1] Savings are determined as the difference between the base scenario and the scenario with measures. These savings do not refer to the absolute reduction of national energy consumption. However, it refers to the limit of the increase achieved by those measures. The methodological requirements for notifying about the target have been laid down in the Annex V to the Directive 2012/27/EU.

Latest cumulative final energy savings target over 2014–2020 for Latvia according to the NEEAP is 0.851 Mtoe; total final energy savings planned in 2020 - 0.315 Mtoe. For Latvia, although the savings reported as planned for 2020 are significantly above the minimum expected because of steep ramping up of savings, the planned cumulative savings between 2014 and 2020 are below the minimum expected. This is probably because of the baseline they use for calculating the target, from which energy from fuel wood is subtracted. Smaller differences could be due to use of different baselines, which is allowed under the EED. [3]

2.3 Explicit policies

2.3.1 Administrative

There are also several legal acts regulating energy efficiency development in Latvia.

The **Law on the Energy Performance of Buildings** came into force on 9 January 2013. The Law comprises legal norms arising from the Directive 2010/31/EU of the European Parliament and of the Council of 19 May 2010 on the energy performance of buildings. The low introduced new provisions regarding increased requirements for energy efficiency energy certification of state-owned buildings and certain parts of buildings, rights and obligations of building owners, and task to promote construction of near zero-energy buildings.

Several regulations subject to the Law on the Energy Performance of Buildings were adopted:

- Cabinet Regulation No. 348 of 25 June 2013 “Regulations Regarding the Methodology for Calculating the Energy Performance of Buildings”;
- Cabinet Regulation No. 383 of 9 July 2013 “Regulations Regarding the Energy Certification of Buildings”;
- Cabinet Regulation No. 382 of 9 July 2013 “Regulations Regarding the Independent Experts in the Field of Energy Performance”.

The latest regulation relating to energy efficiency is **Energy End-use Efficiency Law**. As this law does not include all the provisions required by the EED the new Energy Efficiency Law is under development. The new law will should include the main part of the requirements of EED. In addition amendments in other regulations are in process, for example, amendments of Law on Energy, Electricity market Law and Law on Public Procurement.

Law on Energy Performance of Buildings (from 9 January 2013) was adopted by the Parliament, based on the requirements set by Directive 2010/31/EU regarding energy certification of buildings and “nearly zero-energy buildings”. Its aim is to facilitate rational use of energy sources by improving energy efficiency of buildings. The law defines the term “nearly zero-energy building — a building with a very high energy performance using high efficiency systems for the energy supply thereof”. Cabinet Regulation No. 383 Regulations regarding Energy Certification of Buildings (9 July 2013) stipulates the classification system for energy certification of buildings and requirements for nearly zero-energy buildings:

- Class A — conforms to the requirements for nearly zero-energy buildings;
- Class B — energy efficiency index for heating does not exceed 40 kWh/m2 per year;
- Class C — energy efficiency index for heating does not exceed 50 kWh/m2 per year;
- Class D — energy efficiency index for heating does not exceed 60 kWh/m2 per year;
- Class E — conforms to the average consumption of buildings of the particular type;
- Class F — conforms to the permissible level of energy consumption set in national legislation regarding management of residential buildings.

In addition, Cabinet Regulation No. 382 regarding Independent Experts in the Field of Energy Efficiency of Buildings (9 July 2013) determines requirements for independent expert competence and procedure for competence approving, procedure for registration and supervision of independent expert, as well as content of independent expert register data and procedure for use thereof. Cabinet Regulation No. 348 Calculation Method of Building Energy Efficiency (25 June 2013) sets a method for calculating energy efficiency of building, which is used for drafting balance at the building level, and determines the engineering systems to be included in the appraisal of building energy efficiency, as well as limits and types of appraisal.

2.3.2 Economic instruments

Latvia uses several economic instruments mostly taxes and subsidies from EU structural funds.

2.3.2.1 Taxes

One of taxes used in Latvia is real estate tax. According to the law municipalities can apply 50% tax discount for the buildings which have implemented energy efficiency projects which have been funded via EU or national funds or has ensured 20% energy savings. [6] OECD and EU Semester recommendation asked to increase property taxes in Latvia. Such increase in combination with the tax break would even more stimulate energy efficiency.

Additionally there are also energy and transport taxes which has an impact on household energy use. Excise duty on energy resources in Latvia apply to mineral oils and natural gas used for both transport and heat and power. All excise duty rates in Latvia are above the minimum set out in the EU Energy Taxation Directive; however, almost all of excise duty tax rates are also below the EU-28 average, putting Latvia towards the lower end of OECD Member States in terms of energy taxation. However, if we compare tax burden by purchasing power, the situation is vice versa – Latvia has the higher excise tax burden than OECD average by purchasing power. Furthermore, the government preparing National budget for 2016 is planning to increase the excise duty rates for fossil fuels using the current market situation with low energy prices. Therefore, it will be additional pressure to the cost of consumers and will make even higher energy taxation burden in Latvia than in most of the OECD comparing by purchasing burden. LPG used for industrial and commercial purposes is taxed at a higher rate in Latvia than the European Union average already.

Several reliefs also apply, e.g. biofuels and gas oil used for certain agricultural purposes are exempt from excise duties and so are any fuel used for aircrafts and ships, except those used for private recreation and entertainment; generation of energy or in CHP plants; and chemical treatment processes.

There are also several taxes on electricity. Electricity tax was introduced in 2003 in order to promote electricity production from renewable resources. It is levied on electricity supplied to the final consumers or consumed by suppliers. Tax exemption have both social and environmental aim, as tax should not be paid for electricity generated using renewable energy and high efficiency CHP plants, but also households and transport sector are exempt from the tax.

Furthermore, tax for subsidized electricity producers was introduced in January 2014. The tax is paid by the companies receiving financial support for power generation from renewable energy sources (feed-in tariff) or from CHP plants (including those running on fossil fuels) and is differentiated according to the energy source (15% rate for fossil fuels and 5% for renewables and high efficiency CHP). If energy supplier is providing heat for district heating tax rate is also fixed at 5%, to minimalize an impact on district heating prices. Aim of this tax is to compensate households and Latvian companies increase in electricity prices due to the introduction of feed in tariff called the mandatory procurement component which has been added to electricity bills since 2013. This happens via the state budget program Electricity Customer Support.

There are also support mechanisms to promote environmentally friendly transportation in Latvia. New draft Sustainable alternative fuels strategy and Electro-mobility development plan 2014 – 2016 foresees several support mechanisms, e.g. for electric cars – free parking, use of public transport lanes. If successful, this policy in the future will increase the electricity consumption of households.

2.3.2.2 EU structural funds

Until 2030 Latvia needs 3.6 – 4.5 billion EUR for investment in housing efficiency. To ensure this investment there are several funding sources available:

- homeowners own financial resources
- grants from the EU Structural funds
- loans from commercial bank
- the National Energy Efficiency Fund (ALTUM)
- municipal Energy Efficiency / Rotary Fund
- private International Energy Efficiency Funds
- ESCO service

However, in Latvia most of the funding so far has come from the EU Structural funds and revenue generated by sales of Kyoto quota to support energy efficiency. Activities supported were energy audits of multi-apartment buildings, technical inspections, preparation of project documentation (80% co-funding rate) and renovation of multi-apartment buildings (20% co-funding rate). In addition to this, some municipalities e.g., Daugavpils, Liepāja, Rēzekne, Rīga, Ventspils have provided financing for carrying out energy audits in multi-apartment buildings. [7]

Two activities aimed at energy efficiency were implemented in the EU Structural funds programming period 2007–2013 within grant program "Housing energy efficiency":

1. Subprogram “Improvement of Heat Insulation of Multi-apartment Residential Buildings":
    a. Total financing EUR 89 million (ERDF 78 million + state budget 11 million);
    b. Final beneficiaries – owners of flats (project application by authorized person);
    c. More than 1400 project applications (demand for ERDF – EUR 128 million);
    d. More than 635 projects accomplished by October, 2015. [8]
2. Subprogram "Improvement of heat insulation of social residential buildings"[2]:
    a. Total financing EUR 9.2 million (6.9 mill. EUR provided by ERDF and 2.3 mill. EUR by national government);
    b. Final beneficiaries – municipalities;
    c. 78 project applications;
    d. 55 projects accomplished by October, 2015; ~5.183 million EUR public (ERDF plus national) co-financing.

Results from renovations of multi-apartment residential buildings demonstrate that investments have been efficient, because the analysis of data on completed projects shows that the average heat energy savings after renovation comprise 43%. Average heat consumption in the building after project was 80 kWh/m^2 per year and renovation costs on average are 100 EUR/m^2. The average return period of investments in these projects is approximately 22 years, but saving are 2.8 MWh heat per year.

[2] Financial support (75% co-founding share) was granted for preparation of project documentation, carrying out supervision of construction, for implementation of measures reducing energy consumption of a building e.g., insulation, changing of windows and doors.

It is envisaged that in year 2016 total energy savings due to implementation of the subprogram "Improvement of heat insulation of social residential buildings" will be 36 GWh (0.13 PJ). Government's report on the implementation of the measure states that specific energy saving per 1000 EUR, invested by ERDF, are ~0.4 MWh/year. [9]

Another EU SF program is "Measures Regarding the Increase of Efficiency in Centralised Heating Supply Systems" (public funding - 84.449 million EUR). The program aims to significantly increase the efficiency of thermal energy production, to reduce thermal energy losses in transmission and distribution systems, and to promote the substitution of fossil fuels with renewable fuels. By March 2015, 145 projects were approved for the total financing of the CF in the amount of EUR 82.7 million, out of which 56 projects have been completed for the CF financing of EUR 41.2 million. The project implementation is expected to result in installation of heat capacity of 323 MW and reconstruction of 168 km of heating pipes.

2.3.2.3 Climate Change Financial Instrument

The Ministry of Environment and Regional Development was administrating Climate Change Financial Instrument (CCFI), internationally known as Green Investment Scheme, which aimed to decrease GHG emissions by providing co-financing for projects increasing the use of renewable energy sources, introducing new technologies and improving energy performance of buildings. Since 2009, more than 2500 projects were completed. [10] Several of the measures also aimed at increasing energy efficiency:

- **Complex Solutions for Reducing Greenhouse Gas Emissions in state and municipal buildings** - 44 projects for the total CCFI financing of EUR 17.5 million;
- **Complex Solutions for Reducing Greenhouse Gas Emissions in state and municipal professional educational buildings** - 29 projects for the total CCFI financing of EUR 11.9 million;
- **Complex solutions for Reducing Greenhouse Gas Emissions in the industrial buildings** - 49 projects for the total CCFI financing of EUR 8.1 million;
- **Low energy consuming buildings** - 31 projects have been implemented to increase energy performance in buildings of state and local government institutions, enterprises, and individuals, and for construction of new energy efficient buildings for the total CCFI financing EUR 7.2 million;
- **Energy efficiency increase in municipal buildings** - 49 projects, available funding EUR 37.3 million;
- **Reducing Greenhouse Gas Emissions in Lighting Infrastructure of Municipal Public Territories** - financial support to municipalities in introducing a lighting infrastructure to reduce the current electricity consumption, thus reducing GHG emissions. From 2012 until 2014 56 projects were implemented for the total CCFI financing of EUR 6.6 million.

2.3.2.4 European Investment Bank

Latvia has also some co-operation with the European Investment Bank (EIB), which issues low-interest loans to Member States and developing countries for projects, including ones focused on increasing energy efficiency related ones. E.g. in 2008–2012, the EIB lent Latvia EUR 190 million for the energy sector. The country has also not made use of other financial instruments like Sustainable Energy Initiative or JESSICA, which has been used in Lithuanian since 2006. [11]

2.3.2.5 Project example

The *Ergli Vocational Secondary School Student Dormitory* in the Vidzeme region of Latvia, originally built in 1972, was retrofitted in 2012 with passive house components. The goal was to complete the first large scale EnerPHit renovation of this type in Latvia and Northern Europe. The project was built

with the support of Climate Change Financial Instrument for the retrofits of school buildings. This project is an excellent example of an affordable EnerPHit[3] retrofit supplied with renewable energy. The total construction costs for all implemented energy efficiency measures were only €240 per m² of living space.

The space heating demand of the building was reduced from 154 kWh/m² to 9.8 kWh/m². Renewable energy was integrated by using the local district heating system, produced by biomass (wood-chips). An excellent airtightness result was achieved by wrapping the old building shell with an airtight membrane.

The Ērgļi Vocational School took the first place in the national energy efficiency completion, category "The Most Energy-Efficient Public Building in Latvia 2013". The school serves as an inspiration for multi-family building retrofits in Latvia as it teaches new construction professionals, but also is open for the visits to demonstrate how the retrofit project has been done. [12]

2.3.2.6 Future EU funds

According to the Ministry of Economics previous system was bureaucratic, with unpredictable economic returns (doubtful return on investments and floating interest rates for loans), and didn't ensure unrestricted access to financing for projects with good energy efficiency in regions, for houses with small number of apartments and house managers that have already taken other loans. Projects implemented in the 2007-2013 period tended to be considered 'non-bankable', as the payback period is estimated on average at 22-23 years.

Moreover, regulatory barriers proved to be a drag on progress, especially in the regions: there were no possibilities to obtain grants – rather than loans – for the carrying out of even economically sound projects. A further obstacle to achieving improved energy efficiency in the residential sector has also been experienced as a result of excessive administration and procurement procedures, and, despite promotional campaigns, still enduring low levels of public awareness and communication between multi-apartment building owners. [13]

These obstacles where take into account when designing new funding period from 2014 to 2020. There are two main programmes planned to support energy efficiency projects from EU Structural funds in this period:

1. Support for energy efficiency in buildings 2014-2020:
   - Energy efficiency in housing sector - 150 million EUR
   - Energy efficiency in industrial buildings - 32.6 million EUR
   - Energy efficiency in state owned public buildings - 97.9 million EUR
   - Energy efficiency in municipality owned public buildings - 42.6 million EUR (Ministry of Environmental Protection and Regional Development)

In this programme private households will receive more than 40% of the funding available.

2. Support for multi-apartment residential buildings in 2014-2020:
   - Support provided through Energy efficiency fund:
     - Full amount loans for construction and supervision costs (low interest rates – indicatively 2%)
     - Decrease of loan principal up to 35% when a specific level of energy efficiency is achieved

[3] The Passive House Certificate for retrofits.

- Advisory support for:
    - Preparation of project documentation
    - Project implementation

Several of these programs are specifically aimed at the housing sector, especially program "Energy efficiency in housing sector". Using this measure it is planned to insulate 14 000 buildings before 31.12.2023. According to the estimates the costs for building renovation should be around 140 €/m^2.

Additionally it is planned to support energy efficiency and the use of local RES in centralized heat supply: reconstruction of heat sources, including the purchase and installation of technological equipment, as well as reconstruction and construction of heat transmission and distribution systems with an aim to reduce heat losses. The estimated CF financing is EUR 53.19 million.

However, there are also other tools to support energy efficiency. One of them is rotation funds - long-term investment funds providing funding with low interest rates. Advantage of these funds is that payback for the loan only starts after the renovation project is completed. Thus it can easier afforded from the energy savings. Such rotation funds already exist in Estonia and Lithuania since 2009. In Estonia the fund offers loans for 10 years with the fixed interest rate of 3%.

2.3.2.7 Energy Efficiency Fund

In Latvia Ministry of Economics is planning to set up Latvian Energy Efficiency Fund, which will managed by the state joint-stock company ALTUM. It will combine EU funds in order to introduce as many energy efficiency measures as possible. The main difference for beneficiaries who are used to at least a 50% grant is that now they will receive a loan of 100% of the amount required for construction and supervision costs as mentioned above. This loan will have a low interest rate (EURIBOR + 2%) but if the project will achieve high energy efficiency4, it will be possible to receive a grant of up to 35% of the loan. The idea of the loan is to ensure high investment efficiency and insulate as many buildings as possible.

2.3.3 Information instruments

Several information campaigns and studies have been conducted in Latvia in the fields of energy efficiency. Research has mainly been financed by EU Structural Funds, the National Research Program, Administration of Latvian Environmental Protection Fund, and Horizon 2020.

Project "Energy efficiency, sustainability of building construction and thermal comfort in Latvian climate conditions" (http://www.eem.lv/) was funded by the ERDF and aims to test the energy efficiency and sustainability of different building constructions made from local materials in Latvian climate conditions, at the same time ensuring thermal comfort.

Within the **National Research Programme for 2014–2017**, approved by the Cabinet of Ministers, the programme "Energy efficient and low-carbon solutions for a secure, sustainable and climate variability reducing energy supply" has been launched in 2014. The main objective thereof is to develop scientific and methodology justification of the instruments for the implementation of Latvian climate and energy policy long-term framework until 2030 and methods for evaluating the expected impact.

The Ministry of Economics has developed an energy saving catalogue [14] in cooperation with researchers and business association which is based on the Danish example (*Standardværdikatalog for energibesparelser*, version 3.1). It provides suggestions for energy efficiency measures and gives estimates of potential energy savings.

[4] A grant of 25% will be available if energy consumption for heating after implementation of the renovation is not more than 90 kWh/m^2; 30% if not higher than 80 kWh/m^2 per year, and 35%, if not higher than 70 kWh/m^2 a year.

The Ministry of Economics has also organized several **meetings with stakeholders**, mostly with representatives of energy companies to discuss the possibilities to implement energy efficiency scheme. Representatives of Ministry of Economics have participated in the regional workshops regarding the new requirements for the municipalities regarding the development of energy efficiency plans on local or regional level and participated in international, national and local scientific conferences, workshops and discussions.

2.3.3.1 Labelling

There are no voluntary labelling schemes implemented in Latvia however Latvia has adopted EU energy labelling directive (2010/30/EU) for appliances and other energy efficiency products [14]. However, there has been little promotion of energy labelling in Latvia. E.g. within the framework of the Danish–Latvian co-operation program an information campaign was implemented – including information material – on the labelling of household electrical appliances. [15]

The Law on Energy Performance of Buildings regarding energy certification of buildings and "nearly zero-energy buildings" (see 2.3.1) also has contains regulation about the labelling scheme to inform the general public about energy consumption of buildings.

2.3.3.2 The campaign "Let's live warmer!" ("Dzīvo siltāk!")

The campaign "Let's Live Warmer" ("Dzīvo siltāk!") is an integrated, multimedia communication campaign that promotes the energy-efficiency of Latvian buildings. This campaign was introduce in February 2010 to stimulate use of the funding provided by European Regional Development Fund (see section 2.1.2. on economic instruments). Campaign was response of the government to the low demand for the available funding for energy efficiency in buildings.

The campaign was based on the cooperation memorandum aiming to ensure the availability of information on housing insulation issues. Additional aims are the following:

- To encourage cooperation between industry associations in order to ensure the flow of information about current industry promotion;
- To ensure the information about apartment house management;
- To ensure the information about EU funding for housing insulation;
- To give the information about benefits of insulation;
- To educate people about conditions providing qualitative insulation;
- To give the information about construction quality standards and technologies;
- To inform people about latest trends in housing insulation issues.

The Ministry of Economics during five years of the campaign **organized seminars, conferences and different discussions, participated in trade fairs and exhibitions.** Two-way communication was established through social networking, engaging in direct communication with citizens. Total number of events from 2010 until 2014 – 198; more than 6390 participants in person and more than 2740 participants through online channels. Success of the campaign can be measured with the steady increase in number of submitted project applications for funding increasing from 117 in 2009 (when the campaign did not yet exist), to 170 in 2010 (when the campaign was started), to 470 in 2011 (highly attributable to the campaign, as taking the decision about renovation and preparation of project application can take up to 6 months), to 435 in 2012 (continuing results of the campaign) and 248 in 2013 (in 2013 project applications were submitted only till 31 of July). There has been also the much higher density of discussions about the necessity and benefits of energy efficiency in the media and general public. According to the assessment done by Latvian Green Movement campaign

has stimulated positive effect as investment (national and ERDF) in the housing energy efficiency which was increased fourfold – from 20 to 89 million EUR.

Within the campaign the contest "The Best Energy Efficiency Building" has been regularly organized since 2011, assessing buildings renovated in the previous year. Since 2010 Ministry of Economics in partnership with Ministry of Environmental Protection and Regional Development and magazine "Būvinženieris" organizes competition *The Most Energy Efficient Building in Latvia* (www.energoefektivakaeka.lv). The contest promotes good practice in the field of energy efficiency, as well as raising public awareness of the heat resistance of buildings and the role and opportunities for greenhouse gas emissions to create high quality living space and expressive architecture.

The price is given in several categories: renovated multi-apartment building, multi-apartment building (new), public building, industrial building and single family building (not awarded in 2015). Firs single family building to receive this award was "Lielkalni" which was first building in Latvia built according to the Passive House standard. In 2015 the award was given to the "Valmieras stikla šķiedra", 2 new buildings almost reaching passive house standard and 5 renovate multi-apartment buildings where energy use was cut by more than a half. [16]

2.4 Side effects of politics

A major effect on the energy efficiency of housing will be from the new **Building law,** General Construction Regulation and Housing Construction Regulation (all in force since 01.10.2014.) as they states energy efficiency as one of the main characteristics of the building. Also minimum **standards** for the new buildings have been significantly increased to ensure better energy performance of the buildings.

Another important policy block is innovation. National priorities and courses of action to promote innovation have been set in the Guidelines on National Industrial Policy for 2014-2020. According to the Guidelines, promotion of innovation is set as one of the key pillars to enhance competitiveness, productivity and export volumes. Four equally important elements emphasized within the Guidelines to improve national innovation system are: 1) knowledge capacity, 2) innovation supply, 3) innovation demand, and 4) transfer system [17].

In these Guidelines one of the action areas is "Decrease the costs of energy" where energy efficiency is highlighted as one of the two priorities. To promote this government should develop national energy efficiency support program aiming also to decrease energy consumption. This action is also linked with the development of low carbon economy and is going to be funded with EU SF.

Simultaneously national innovation policy objectives and actions are set out in Guidelines for Science, Technology Development, and Innovation 2014-2020. One of the sectors with significant horizontal impact and contribution in transformation of national economy highlighted in the Guidelines is Innovative energy efficiency solutions and technologies. Guidelines state that "Increasing the level of energy efficiency with the help of innovative solutions in the national economy as a whole, is a sustainable and cost-effective way to reduce risk, simultaneously creating additional jobs and promoting economic growth". Priority is improvement of energy efficiency, which include the creation of new materials, production process optimization, technological innovation, the use of alternative energy sources and other solutions. Guidelines set 5 smart specialization areas and one of them is "Smart Energy" which also corresponds to this priority. [18]

3 Private sector and municipal support

Comprehensive renovation and insulation of buildings is crucial not only in the context of potential housing crisis, but also because renovation and insulation especially of multi-apartment buildings may provide a significant contribution in reduction of GHG emissions and improvements social wellbeing. [19]

3.1 Bank loans

In addition to loans from the EU Structural Funds and Climate Change Financial Instrument used to support energy efficiency third-party financing is also a common form of energy efficiency project financing in Latvia. In Latvia bank credits in the form of loans rank among the most common form of external financing. It can be furnished for even relatively small projects.

One of the first such financing schemes in Latvia was launched in 2004 and jointly implemented by the German Ministry of Environmental and the development bank KfW, along with Latvia's Ministry of Environmental Protection and Regional Development, the Latvian Environmental Investment Fund and Hipoteku un Zemes Banka. With this project, local authorities, associations of apartment owners and individuals were offered an opportunity to receive loans for the complex insulation of apartment buildings on favourable terms.

127 applications for the EUR 5 million were received, but after examining compliance with project criteria, experts selected only about 50 projects for participation in the program. However, problems with collective decision making in the multi-apartment buildings and fear of large loads hindered the success of the program and many applicants refused further participation. As a result, only seven multi-apartment buildings in Riga, Broceni, Salacgriva and Liepaja carried out the complex renovation, including the replacement of windows, insulation of exterior walls and the covering of the basement and top floor.

3.2 Green Buildings

There have been also several initiatives aiming at the low-energy and ecological building. One of such private sector initiatives is NGO "Green buildings" (Zaļās mājas; http://www.zalasmajas.lv/), which at the beginning was set up to promote wood as a construction material, but now is also actively promoting low-energy buildings. "Green buildings" adopted the British passive-house standard BREEAM for Latvia and was one of the initiators to set up Latvian Sustainable Building Council (http://www.ibp.lv/en) – member of the World green building council. Latvian Sustainable Building Council works with information and education activities, policy development activities and practical support to sustainable construction project development. However, Council does not target households directly.

3.3 Energy Service Companies (ESCO)

Energy efficiency services (EES) in Latvia are not well developed and in general the national framework conditions are not sufficient for sustaining a real market transformation. However, article 14 in the new Energy End-use Efficiency Law describes rules for energy efficiency services and financing procedures.

So far, there are several ESCO examples in Latvia. The main company providing Energy Efficiency Services in Latvia is RenESCO (www.renesco.lv) which has implemented several renovation projects in multi-apartment building in Cēsīs, Valmiera, Sigulda and Riga. These projects ensured 50% energy savings. First time in Latvia ESCO used for the implementation of streetlighting renovation project using efficient lighting technology was in Tukums municipality. The project has achieved annual energy savings of 630 000 kWh and GHG emission reduction of 365 t CO_2. The main project funding

was coming from the Nordic Investment Fund and Latvian Environmental Investment Fund. These projects have served as good examples in third party financing for other municipalities. However, so far they have not ensured wide multiplication effect. [20]

Latvia is also involved in the Transparense project, which aims to increase the transparency and trustworthiness of Energy Performance Contracting (EPC) markets throughout Europe. One of the results this project is the European Code of Conduct for EPC launched by Transparense in 2014. [21]

To promote ESCO in the Baltic States and other Eastern Europe countries a new NGO called "Building and Energy Conservation Bureau" [23] was established in Latvia in 2012. It is focussing on the multi-apartment Soviet Era buildings providing information on deep retrofit and energy efficiency improvements using a long term Energy Performance Contracting (EPC). The EPC scheme addresses technical measures (external walls insulation, window and doors replacement, heating, ventilation and hot water systems renovation) as well as practical, fundamental elements (i.e. staircases, doors, roofs, fire equipment, balconies, etc). While these additional measures do not directly contribute to reducing energy consumption, financing them within the energy efficiency renovation increases the payback period of the ESCO investments.

Then main barriers to the development of energy service companies in Latvia are insufficient quality of public information on the ESCO, lack of client confidence, concept of excessively high technical and business risks, lack of adequate legislation on public procurement, generally accepted, the lack of standard savings measurement and verification process, lack of appropriate funding sources, small size of projects, unclear ESCO partner status for apartments in the housing sector and energy efficiency is not in the daily routine/agenda. [22]

3.4 Support from local municipalities

In its **NEEAP** Latvia states that it will start a voluntary energy efficiency agreement for municipalities in 2016. The municipalities entering the agreements shall commit to at least 10% of energy efficiency improvements within five years after signing the agreement. The government has developed methodological support for energy planning in municipalities [24] as well as financial support in the establishment of revolving funds in cities in the form of soft loans. The activities are subject to variations according to the size of municipalities as the agreement is planned to cover municipalities of different sizes.

There are several instruments municipalities can use to stimulate energy efficiency in its territory. Municipality has a right to decrease real estate tax rates for the buildings who has implemented energy efficiency projects. However, Riga City council and most of the other municipalities in Latvia apply up to 95% real estate tax breaks to all the buildings so this tax break would not be good enough stimulus.

19 municipalities from Latvia (Rīga, Jelgava, Jēkabpils, Liepāja, Jūrmala, Balvi, Ikšķile, Kārsava, Ķegums, Līvāni, Ludza, Lielvārde, Ogre, Salaspils, Saldus, Tukums, Valka, Viļāni, Limbaži) have joined Convent of Majors for local sustainable energy [23]. However, only few of these municipalities have developed their energy action plans and there are only two energy agencies set up in Latvia – one in Riga (Riga Energy agency, http://www.rea.riga.lv/) and the Zemgale regional energy agency (http://www.zrea.lv/).

Municipalities are actively using EU Structural Funds to support energy efficiency, but in the future (as stipulated in the new energy efficiency regulation) they can also develop municipal rotation funds to stimulate energy efficiency investments and redirect funding from local energy supply companies.

In 2014, the Latvian Association of District Heating Companies commissioned Ernst & Young to do the study on implementation of energy efficiency obligation schemes. They have calculated that implementation of article 5 of EU Energy efficiency directive will increase heating tariffs to final customers by 5 to 25%. They also suggests that there is a need to promote the involvement of residents: for example, in the case of households, legislation should define a concrete minimum energy consumption threshold above which households would be required to implement energy efficiency measures. Serious consideration should be given to the fact whether the achieved energy savings can cover the heating cost increase to residents. [24]

Currently, financial support for the development of technical documentation for the implementation of energy efficiency measures is provided only in a few municipalities, but this support is crucial for EE project implementers to meet all requirements and deadlines. EE measures introduced during the previous EU funding period show that there is still not enough time devoted to the development of technical documentation, which then contributes to delays in project implementation and significant cost increases.

In 2010, Riga approved its sustainable energy action plan 2010-2020, which in its planning period aims to decrees final energy consumption by 20%. One of the important steps to do this is energy efficiency measures in the housing sector. Riga aims to renovate and insulate around 6 000 building with the total floor space of 12 million m^2. To do this city needs 1.8 billion EUR.

However, before 2014 only 63 buildings were renovated in Riga. To stimulate more active housing insulation projects city has prepared template technical documentation for the 12 most popular building type available in Latvia. This should ease the process of preparation of technical documentation necessary.

Currently Riga energy agency is participating in the project INFINITE Solutions. Within this project peer coaching activities will be carried out aiming at developing the expertise of local staff and replicating two proved financing schemes tested by the cities of Stuttgart (DE) and Delft (NL) in learning local authorities. Riga within this project is developing concept for the local rotation fund to stimulate investment in the energy efficiency of buildings. This fund when set up will be attracting funding necessary for the building insulation projects.

4 Initiatives targeting households behaviour

4.1 NGO campaigns

Community information actions are implemented with the assistance of both state institutions and public and non-governmental organisations. The role of the latter is even more important. NGOs organise actions, rallies, campaigns and other activities aimed at attraction public attention and changing household behaviour.

Information campaigns are implemented within the scope of various cooperation programs. These in the majority of cases are linked with promotion and introduction of new environmentally friendly technologies and behavioural change. Three last information actions in Latvia linked with new energy technologies and reduction of the impact on climate change were as follows. [25]

4.1.1 SCORE - Supporting the Cooperative Organization of Rational Energy Use

One of the first energy conservation campaign in Latvia was implemented within the scope of the Dutch-Latvian co-operation program SCORE - Supporting the Cooperative Organization of Rational Energy Use. The program was implemented at the end of 1990ies and early 2000. Within this program several projects and campaigns were implemented, including public opinion pools, clarifying public attitude and knowledge about various kinds of energy conservation activities, preparing a brochure “How to Save Energy and Money” and “Energy Conservation Newsletter”. Campaign Energy conservation week “Saving Box of Light” was implemented in schools. Within the framework of the Danish – Latvian co-operation program, there was implemented an information campaign on labelling of household electrical appliances as well as prepared information material.

These campaigns aimed to create interest in people about rational use of energy, provide information about energy and energy saving possibilities, motivate and involve residents in energy conservation activities. The campaign also includes implementation of a grant program to Latvian NGOs, preparing environmental stories and producing educational film “Megavatenis” (Mega Wadded Jacket) in co-operation with the Environmental Film Studio. The prepared stories were shown on National TV program “Environmental Facts”. A project for secondary school students “Reasonable Energy Use” in cooperation with the Children’s Environmental School was also carried out.

4.1.2 Efficient Lighting Initiative

Between 2000 and 2003 Efficient Lighting Initiative program was implemented in different rural municipalities and towns of Latvia. At that time this campaign focused on promotion of compact fluorescent bulbs (CFB). This includes setting up of information stands, brochures, developing document packages and instructions to municipalities. Days of Light were organised during such actions when CFB were sold at a reduced price. CFB actions were implemented with the aim to reduce the amount of GHG emissions and impact on global climate.

4.1.3 Latvian Volunteers for Energy Efficiency

At the beginning of 2001 NGO – Public Policy Institute (PPI) with the financial support of George Soros foundation started a survey on Energy Efficiency of Housing in the Latvian Climate Policy. Within the scope of the survey information campaign Latvian Volunteers for Energy Efficiency was organised. This was a joint project with NGOs from Rezekne, Madona and Smiltene, initiated by the Public Policy Institute as a means of raising awareness about residential energy efficiency measures. The program was developed in close conjunction with the International Energy Brigades, an NGO network that has been working on similar projects in Central and Eastern Europe since 1994. Volunteers from each of the Latvian cities were trained in window and door weather-stripping, using specially adapted carpentry tools and silicon strips. Average energy savings are 10–20%, depending on the building. The advantage of using silicon strips is that they last at least 10 years, can be removed and put back again after painting windows, and allow windows to be freely opened and closed for ventilation throughout the heating season. Weather-stripping can be done in any individual apartment to increase temperatures and comfort levels, reduce noise and dust from outside. Economic benefits, however, are only possible if all apartments are treated and there is a heat substation in the basement where the heat supply to the building can be regulated. During the pilot project, one small multi-family building in each of the three towns was weather-stripped. The first results show temperature increases in apartments of approximately 2^{o}C. The future aims of the program are to provide a free volunteer service to pensioners and socially disadvantaged groups. The service will also be available to other residents who are **t**o pay for the cost of the silicon strips.

On the whole, the results of the various pilot projects have been mixed. While most show the potential for significant energy savings, many of the first projects suffered from problems with lack of accurate data about energy use prior to the project; many projects have also done insufficient monitoring after the completion of the project, so that efficiency could not be measured. Most projects also suffered from insufficient information and awareness-raising efforts for residents, which resulted in both social problems (dissatisfaction from residents who weren't selected) and technical problems (improper use of newly installed technologies). These problems could easily be overcome by investing larger portions of the initial project financing in informational and educational campaigns, as well as monitoring. Financial problems resulted both because building conditions were worse than imagined and because of

As a part of the program, a resident survey was also conducted in the three cities (100 people in each city). The main findings from the survey are that 35% of residents are only partially satisfied with their heating system because they are not able to control temperatures in their apartments. 59% of respondents said they have large gaps in the windows and 48% feel that weather-stripping and insulation are very necessary in their apartments. 80% have at some point tried to weather-strip their own windows using either glue-on strips or other materials, and about the same percentage would be interested in professional long-lasting weather-stripping (of those, 44% only on low-price conditions). Insulating or replacing windows were the first priorities of residents as types of energy efficiency measures, followed by the installation of heat controls on the radiators, and then by insulation of outer walls. Ranking of reasons for interest in energy efficiency measures reveal that people see energy efficiency primarily as a means of saving money, increasing temperatures and improving the appearance of the building; environmental protection is the last priority.

35% of residents feel that the maintenance of multi-family buildings should still be the responsibility of the municipalities, but an almost equal number believe that it is their own responsibility. Approximately 10% of residents would be willing to take out a loan for insulation projects, but only at very low interest rates. 42% feel that they do not have enough income to take a loan, 26% feel that it is not their responsibility, and another 10% have other higher priorities.

lack of possibilities to secure co-financing from other partners. The first issue is a contingency that must be reckoned with; the latter is an issue which has been at least partially solved by the new availability of low-interest loans.

General lessons from the pilot projects are that comprehensive retrofit packages are most beneficial, but that it is very important that controls are installed first in order to insure that residents have both an incentive and a means to reduce heat consumption. [26]

4.1.4 Friends of the house

In 2010–2011, KfW initiated a training and experience exchange project "Design, planning and implementing energy savings measures in residential buildings by local residential building renovation managers" (also known as Mājas draugs or "Friends of the house" www.majasdraugs.lv). The project shared the results of the existing renovation project and the experiences from the Latvian–German partnership. 25 experts from Latvia were trained as building renovation managers and were involved in managing the renovation processes in the project buildings. The project was led by the German and Latvian environmental ministries in collaboration with the German Development Bank, and it was introduced by the Housing Initiative of Eastern Europe IWO eV (Initiative Wohnungswirtschaft Eastern European e.V.).

4.1.5 Active through Passive!

The overall objective of the project 'Active to Passive' is the promotion of the use of sustainable and low energy buildings and constructions in Latvia and Estonia. It aims to help reducing the use of energy, thus contributing to a larger energy independence of Latvia and Estonia via using sustainable and low energy building principles. This is achieved by sharing of know-how among the professionals of both countries, joint tools and standard technical solutions for energy efficient building. [27]

One of the major goals of the project is raising of professional capacity regarding the low energy consumption buildings. A special training module on low energy and passive house building for architects and engineers has been developed, including elaboration of a model building that is in line with the architectural design and climate conditions shared on both sides of the border. This training module has been already applied during pilot training courses/workshops for the specialists from both countries.

Project has also formed a working group developing evaluation guidelines and criteria for sustainable and low energy buildings, rating system for sustainable and low energy buildings and adjusted special procurement criteria for the design and construction of such buildings. These project specialists are also developing master solutions and draft drawings for three public buildings with low energy use (Tartu Technology Park in Estonia, kindergarten building in Strenči and Ērgļi vocational school in Latvia).

Besides the mentioned activities, the project also focuses on public awareness rising about energy efficient building. This is done through the project's interactive website, comprehensive printed and electronic (downloadable as e-book) info material about the low energy consumption buildings for designers, architects and other professionals. Various articles have been published on the topic in regional and national media, and six seminars for wider audience (residents, house managers/owners) have been carried out. In addition, open doors event has been organized in the low energy building example - kindergarten in Valga.

4.2 Research project with household/consumer participation

A survey commissioned by SEB group (Market Data, 2010) show that the inhabitants of the renovated houses positively evaluate the experience of insulation projects. 13% of inhabitants indicated that the main complexity is the communication problem inside the neighbourhood. It seems hard to deal and negotiate with neighbours in multi-apartment buildings; only 6% of respondents point out the unsatisfying quality of the renovation repair. The survey data demonstrates that in 60% of cases the staircase was repaired during the renovation project; in 53% of cases the front wall was insulated; in 29% - the old wooden windows were replaced by the plastic ones; the roof was restored in 26% of cases, and finally the heating system modernization was required in 36% of cases; water and sewer system reconstruction and basement insulation was performed in 19% of cases. The research data considers the house renovation as a complex matter, which consists of several important stages of energy efficiency incensement in buildings.

Ministry of Economics has commissioned several **studies on energy efficiency**. One regarding the best solutions to include in the next national energy efficiency plan, another regarding the best methods for calculating energy savings. In 2013, Ministry of Economics commissioned a study on implementation of Article 5 of EED. The results of the study suggests cost effective energy efficiency solutions for different types of buildings, e.g. for single family buildings most cost effective is insulation of attic and roof (if windows and doors are already changed); for multi-apartment buildings deep retrofits are suggested. [28]

Several studies also have been done by state Housing agency, e.g. study on energy efficiency potential of multi-apartment buildings funded by CCFI. Baltic Consulting, Ltd did a study on industrial energy efficiency potential. It analyses different development scenarios for manufacturing sector and proposes possible steps to improve its energy efficiency. [29, 30]

4.2.1 Housing and Energy Conservation Bureau (ESEB)

The Housing and Energy Conservation Bureau (ESEB)[5] is a non-governmental organization. ESEB is striving to ensure that by 2020 Latvia meets the energy efficiency targets set for both public and residential buildings, in particular promoting deep renovation and create a discussion between all parties working to improve the condition of Latvian buildings.

One of the projects looked at the obstacles for building renovation. For the purpose to facilitate preservation of the residential building stock built during the Soviet era in Latvia, the ESEB in collaboration with the Riga Technical University, and Norwegian social anthropologist Lars Søftestad, has launched a research on experience of residents in renovation and insulation of buildings (project “Renovation Impact on Climate Change and Energy Efficiency Habits of Residents”).

The research will evaluate decision-making process among residents of Latvia, as well as quality and economic reasoning of renovation and insulation. As a result, specific recommendations will be developed for policy makers to improve and alleviate the decision-making process for residents of standard multifamily buildings during the pre-renovation period. It is planned to use the obtained findings in the project “Sunshine”, the objective of which is to improve renovation of buildings in Latvia (see chapter SUNShINE project).

The project “Renovation Impact on Climate Change and Energy Efficiency Habits of Residents” has been launched in May 2015, and the research conducted within the scope thereof will involve comprehensive and in-depth analysis in the multifamily residential housing sector combing research methods used by social and environmental engineering sciences. The ESEB along with its partners

[5] For more information about this and other projects please visit: http://www.ekubirojs.lv/?cat=3&lang=en

will strive to understand how to motivate residents of Latvia to renovate their homes, to make them comfortable, safe, sustainable, so that their operation would leave as less impact on climate change as possible; also, which business models would be most feasible to protect interests of the residents, and which package of measures reducing impact on climate change (energy efficient) should be implemented in the multifamily buildings in order to achieve as significant reduction of GHG emissions as possible at optimum costs.

For the purpose to accomplish objectives of the research residents are currently interviewed throughout Latvia in order to survey impressions and opinions about renovation of buildings, as well as work is conducted to collect data about contracts used in renovation and insulation processes between the residents and service providers, or implementers of renovation and insulation, and investments made, and outcomes gained under these contracts.

The project “Renovation Impact on Climate Change and Energy Efficiency Habits of Residents” is implemented using co-funding of the financial instrument of the European Economic Area. The total costs of implementation of the project amount to 82,000 EUR, of which 10% are contributed by partners of the project. Aim of the study is to develop specific recommendations to policy makers in order to improve and facilitate the decision-making process model in the multifamily residential buildings population in the pre-renovation period; to carry out an analysis about the use of contracts for the renovation process between citizens and service providers, or renovation implementers, and the investments made and the results achieved in this agreement.

4.2.2 SUNShINE project

The project “Sunshine” co-funded under the European Union programme “Horizon 2020”, is aimed to improve renovation of buildings in Latvia [31]. SUNShINE supports public and private ESCO's (see 3.3) and leads to an innovative investment scheme, guaranteed and deeply renovated buildings.

A major objective is to demonstrate the financial viability of deep renovation via suitable financial engineering of public funds and private capitals. Most ESCOs have limited balance sheet capacity and are not able to support much long term debt. So re-financing may be achieved by selling future cash flow (receivables) through a forfaiting transaction. After this transaction, the ESCO continues to guarantee long term energy savings (15-20 years). The project delivers a special purpose fund for EPC.

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