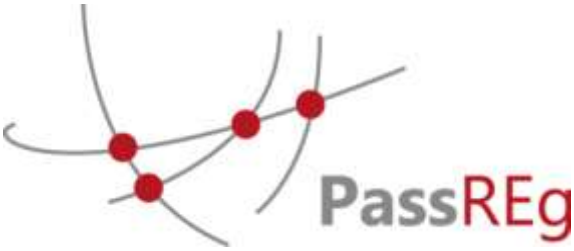
Co-funded by the Intelligent Energy Europe Programme of the European Union



IEE PassREg

PASSIVE HOUSE REGIONS WITH RENEWABLE ENERGY

Success Model

Latvia

Designed for use by aspiring regions involved in PassREg project

Version 1.0 / 20.12.2012 / 21.01.2013

Developed by Latvian Environmental Investment Fund

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ACRONYMS

EU — European Union
ME — Ministry of Economics of the Republic of Latvia
CSB — Central Statistical Bureau
GDP — gross domestic product
NZEB — nearly zero-energy building
PH — Passive House
MoEPRD — Ministry of Environmental Protection and Regional Development of the Republic of Latvia
SEAP — Covenant of Mayors project "Sustainable Energy Action Plan"
CCFI — Climate Change Financial Instrument
ERDF — European Regional Development Fund
ESF — European Social Fund
CF — Cohesion Fund
EEA FM — European Economic Area Financial Mechanism
NFM — Norwegian Financial Mechanism
ESCO — energy service companies
REA — Riga Energy Agency
ZREA — Zemgale Regional Energy Agency
GHGE — greenhouse gas emission
AAU — greenhouse gas emission units owned by the State (assigned amount units)
EBRD — European Bank for Reconstruction and Development
EIB — European Investment Bank
NIB — Nordic Investment Bank
KfW — German development bank KfW Bankengruppe, Kreditanstalt für Wiederaufbau
EEIC — Energy Efficiency Information Centre of Riga Energy Agency
LEIF — Latvian Environmental Investment Fund
CEPH — Certified European Passive House Designer
LIPB — Latvian Sustainable Building Council
ETAG 004 — Guideline for European Technical Approval of External Thermal Insulation Composite Systems with Rendering
NGO — non-governmental organisation
BREEAM — British Research Establishment Environmental Assessment Method
LEED — Leadership in Energy and Environmental Design
MVHR — mechanical ventilation with heat recovery
toe — tonne of oil equivalent
RES – Renewable energy source

1. ENERGY AND BUILDING POLICY

1.1. National Guidelines

Sustainable Development Strategy of Latvia until 2030 (approved by the Saeima on 10 June 2010) is the main national planning instrument having the force of law. In nearer and further future, all strategic planning and development documents shall be drafted according to the guidelines and priorities set by this strategy. The goal set by the strategy in the field of renewable and safe energy (Article 7) is *to maintain leadership in the EU in using renewable energy sources and fully develop the potential of "green economy"*[1].
See: Sustainable Development Strategy of Latvia until 2030, first version

Energy Strategy 2030
Currently the most topical document in energy field in Latvia is the project Energy Strategy 2030, drafted by the Ministry of Economy of the Republic of Latvia, which highlights the energy policy for coming 20 years based on four key directions — security of energy supply, energy competitiveness, efficient use of renewable energy resources, and increase of energy efficiency. Based on the Energy Strategy 2030, a planning document for national development guidelines has been elaborated Latvian Energy Long-Term Strategy 2030 — Competitive Energy for Society, which provides for the Latvian energy policy scenario.
Targets related to renewable energy sources (RES) and energy efficiency until 2030:

- to ensure 50% of RES in gross final energy consumption;
- to reduce energy and energy sources import from third-country suppliers by 50%;
- to reduce the average heat energy consumption for building heating up to 100 kWh/m2.

National Reform Programme of Latvia for the Implementation of the "Europe 2020" Strategy (version approved by the Cabinet of Ministers on 26 April 2011 (minutes No. 27, § 34)). Based on the sustainable development goals for improving energy efficiency of buildings defined in the European strategy "Europe 2020" and "European Energy 2020 Strategy", which prescribe that member states shall reduce the greenhouse gas emission by 20 %, increase the energy efficiency by 20%, and ensure 20 % of renewable energy sources in total gross final energy consumption by 2020. Articles 3.6 and 3.7 of the Programme for the Implementation of the "Europe 2020" Strategy set forth the main policy directions, measures, and competent authorities for increasing the energy efficiency and proportion of renewable energy sources.
See: http://www.em.gov.lv/images/modules/items/LV_NRP_lat.pdf

National Development Plan 2014–2020 (approved by the Saeima of the Republic of Latvia on 20 December 2012); Paragraph 194 of the strategic objective "Energy Efficiency and Energy Production" of the priority "Growth of the National Economy" defines the goal *to ensure sustainable use of energy sources necessary for national economy by promoting availability of resource markets, reduction of energy and emission intensity in sectors, as well as increase of proportion of local renewable energy sources in the total amount consumed by focusing on competitive energy prices*[2].
Tasks to be performed for improving energy efficiency of buildings are defined in Articles 202 and 203 of the National Development Plan (NDP):
[202] Energy efficiency programmes for the State and local governments' public buildings;

[1] http://www.latvija2030.lv/page/238
[2] http://likumi.lv/doc.php?id=253919

[203] Support programmes for energy efficiency of residential buildings and shift to renewable energy sources.
One of the chosen indicators for achieving the target is minimum 40% of renewable energy in total gross final energy consumption by 2020.
See: http://www.pkc.gov.lv/images/NAP2020%20dokumenti/NDP2020_English_Final.pdf

Energy Development Guidelines for 2007–2016 (approved by the Cabinet Ordinance No. 571 of 1 August 2006, amended by Ordinance No. 246 of 8 May 2008), the main targets to be achieved in the field of increasing energy efficiency of buildings are those set in Articles 149, 162, and 163, providing that the average specific heat energy consumption (for producing heating and hot water) in buildings have to be at least 195 kWh/m2 per year by 2016, but the average specific heat energy consumption by 2020 shall be 150 kWh/m2 per year. Guidelines also state that support investments shall be attracted from the European Regional Development Fund and Cohesion Fund for reaching the targets (more detailed in Modes of Financing).
162. Support to investments for increasing the energy efficiency in residential sector and wider use of renewable energy sources in all types of heat supply shall be available irrespective of the form of property and consumer group (household, merchant, public sector). Support to investments for increasing the energy efficiency in residential sector shall be provided according to the plan for measures for improving energy efficiency elaborated in the result of building energy audit.
See: http://likumi.lv/doc.php?id=141070

Second National Energy Efficiency Action Plan of Latvia, 2011–2013 (approved by the Cabinet Ordinance No. 460 of 16 September 2011); its main aim is increase of energy efficiency in energy end-use sectors (households, transport, industry, services, and agriculture) and energy transformation. The estimated national energy saving target in energy end-use sectors is 3483 GWh (including 2701 GWh in household sector) in 2016. The most important measures are planned in the household sector: implementation of the activity "Measures improving heat insulation of the multi-apartment residential buildings", where the total available ERDF funding for improving heat insulation of multi-apartment residential buildings amounts to 63.08 million EUR (44.33 million LVL).
See: http://likumi.lv/doc.php?id=236279

Success Model
Law on Energy Performance of Buildings (from 9 January 2013) was adopted by the Saeima of the Republic of Latvia, based on the requirements set forth 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, as well as to inform the general public about energy consumption of buildings. The law defines term *"nearly zero-energy building — a building with a very high energy performance using high efficiency systems for the energy supply thereof"*.
According to Section 15 of the Law, the general supervision and coordination of the energy performance of buildings shall be performed by the Ministry of Economics, which shall:
"..4) perform measures which promote the renovation of buildings or the construction of low or nearly zero-energy buildings;
5) perform measures so that users are provided with recommendations in respect of inspection of heating systems and air conditioning systems and improvement of the performance thereof.."

Legal acts issued basing on the Law on Energy Performance of Buildings:

Cabinet Regulation No. 383 Regulations regarding Energy Certification of Buildings (Riga, 9 July 2013 (minutes No. 39, § 39)), which stipulates the classification system for energy certification of buildings and requirements for nearly zero-energy buildings:
Energy efficiency classes for residential 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 B — energy efficiency index for heating does not exceed 50 kWh/m2 per year;
Class B — 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.

A building shall be classified as nearly zero-energy building if it conforms to all the following requirements:

- energy consumption for heating accounts to not more than 30 kWh/1 m^2 per year and ensures conformity of the micro-climate in building to the requirements of national legislation in the field of construction, hygiene, and occupational safety at the same time;
- total consumption of primary energy for heating, hot water supply, mechanical ventilation, cooling, and lighting accounts to not more than 95 kWh/1 m^2 per year;
- high efficiency systems are in use in the building that:
  - provide for recovery of minimum 75% ventilation heat during heating season;
  - provide for at least partial use of renewable energy;
- no low-performance fossil fuel heating equipment have been installed in the building.

Cabinet Regulation No. 382 Regulations regarding Independent Experts in the Field of Energy Efficiency of Buildings (Riga, 9 July 2013 (minutes No. 39, § 32)), which 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 (Riga, 25 June 2013 (minutes No. 36, § 27)) sets forth 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.

Laws and regulations adopted in 2013 in the field of NZEB and energy efficiency neither determine and nor provide for standards for Passive Houses; however, they form legal basis for further measures. In Latvia, the maximum defined energy consumption for providing heat in NZEB is 30 kWh/m^2 per year, which is twice as big as the Passive House Standard — 15 kWh/m^2 per year.

State support and interest are necessary in the monitoring of existing situation related to energy consumption in buildings *in form of accounting of both consumed energy for providing heat for building* (measured in kWh/m^2 per year) and carbon dioxide emission (measured in kg CO2/m^2 per year).

In Latvia, more should be done for applying the national Passive House Standard with data characteristic of the Latvian climate, since our maritime climate is favourable with milder

temperature in winter close to calculation of German standard climate. But energy consumption of a similar building in Daugavpils will be larger by approximately 10–25 kWh/m^2 per year.

1.2. Political Will at Regional Level

The territory of Latvia has been divided in five planning regions (Kurzeme, Zemgale, Riga, Vidzeme, and Latgale), which are under supervision of the Ministry of Environmental Protection and Regional Development of the Republic of Latvia (MoEPRD). MoEPRD is the leading authority in drafting and implementing State regional policy, as well as in coordination of implementation of State support measures for regional development.

Figure 1. Planning Regions in Latvia Source: MoEPRD

According to the Latvian National Development Plan 2014–2020 (NDP 2014–2020), each region shall create its development plan that would reflect the characteristic (specifics) of region's economy and development prospects in line with the set priorities, to ensure purposeful development of the territories.

In relation to energy efficiency, development plans of regions mainly reflects the common goal of Latvia and EU member states, which is determined by the Kyoto Protocol — to reduce the greenhouse gas (CO_2) emission by 20%, increase proportion of renewable energy sources in total energy consumption by 20%, and to increase the energy efficiency by 20%. There is a lack of more detailed explanation of goals put forward by regions and local governments and methods for achieving them, putting emphasis on implementation of NZEB or Passive House Standard.

Taking into account that Latvia has one of the higher indicators for use of renewable energy sources in Europe and world (34.2% of total consumption of primary energy sources in 2012), which is mostly made up of the electricity produced by hydroelectric power stations and high proportion of biomass (wood chips) use in centralised heating networks, national methodology and regional data bases should be developed for accurate calculation of primary energy in the energy end-use. It would allow for a comparison proportion of renewable sources in regions in Latvia and modelling of measures to be taken, and would have a maximum positive impact on the economic development of regions.

Success Model

Currently no region or local government has stated NZEB or Passive House Standard as its middle-term or long-term priority. Local governments, as the level of authority closest to general public, should implement measures, set an example, and introduce support instruments for implementing NZEB standards.

It should be taken into account that one of the common goals of EU member states provides that starting from 2018 all newly erected public buildings shall comply with NZEB standards. By incorporating implementation of NZEB/ Passive House projects in action plans of local governments, the economic justification of Passive Houses would be supported by regional case studies.

Larger activity by the local governments is necessary, as well as joining to the project "Sustainable Energy Action Plans — united Europe in energy management" (SEAP Plus) of the Covenant of Mayors' Sustainable Energy Action Plan (SEAP) (more detailed in Key Actors), which is one of the EU key instruments for promoting energy efficiency and development of renewable energy on the regional level.

Findings by other regions.

I In Latvia, similarly to Wales region: Innovative financial mechanisms will inevitably need to be introduced to drive political support for Passive Houses , or any very low energy standard, compared to current building practices. Until that time, it will be very difficult for politicians to 'demand' Passive House (or similar) energy standard."

Regions shall learn from Brussels municipality, where it was regional (Brussels) political leadership, rather than Federal (Belgium) drivers that brought about advanced regional changes. In theory, Local Authorities (if there was support for Passive Houses at this level) could set their own requirements on land sales and via their Local Development Plans that could drive energy standards further than Building Regulations."

1.3. Climate and Sustainable Energy Policy on Regional Level

Sustainable Energy Action Plan of Zemgale 2020 has been drafted for Zemgale Planning Region, as it participated in the implementation of the project "EU Going Local 2020" of the EU programme "INTERREG IVC". In Latvia, similar document has been only prepared in Riga Planning Region, which is another project cooperation partner from Latvia. Currently specialists of local governments and majority of experts find the implementation of measures for increase of energy efficiency to be the main priority; these measures are related with insulation of public and residential buildings, construction or modernisation of lighting systems, reduction of losses in heat transmission.

Success Model

Participation of also other regions and local governments in the implementation of Sustainable Energy Action Plans is necessary, and indicators to be achieved by insulation measures should be defined that would approach the Passive House and NZEB standards, as well as the impact of these indicators on the reduction of end-use consumption should be assessed.

1.4. Regional Policy Instruments for Increasing Energy Efficiency of Buildings

Taking into account the fact that the local government level is the decision making and action level where energy efficiency issues are solved most often, institutions competent in

energy supply and energy efficiency management should be established in local governments.
Such institutions are:

- local and regional energy agencies;
- groups of energy managers and specialists of local governments.

One of the main directions of action of regional agencies and energy managers is attraction of financing from various investment funds to solving of issues related to energy supply and energy efficiency. Here are the financial instruments currently available in Latvia for increasing energy efficiency (more detailed in Modes of Financing):

- EU structural funds:
  - **European Regional Development Fund** (ERDF) has been established with an aim to mitigate the regional disparities within the EU. This fund provides support to less developed regions mainly focusing on improvement of public infrastructure and entrepreneurship promotion.
  - **European Social Fund** (ESF) has been established with an aim to promote employment in EU member states, eliminate all kinds of discrimination and inequality in labour market, as well as select human resources and promote creation of information society.
  - **Cohesion Fund** (CF) is one of the financial instruments of EU regional policy with an aim to even economic and social disparities existing among the states. It has been created to finance large-scale infrastructure development measures (projects) in the field of environmental protection and transport. Fund provides financial investment to projects to reach the goals set by the EU in the fields of environment and transport, implement EU policy, and fulfil the requirements of directives[3].
- Aim of investments by the European Economic Area Financial Mechanism (EEA FM) and Norwegian Financial Mechanism (NFM) is to eliminate the social and economic inequality within the EEA and strengthen the bilateral relations among donor states (Norway, Iceland, and Lichtenstein) and beneficiary state[4].
- State budget programme of the Republic of Latvia:
  - **Climate Change Financial Instrument** (CCFI) is aimed at elimination of the global climate change, adaptation to the consequences caused by climate change, and facilitating reduction of greenhouse gas emission[5].
- Energy service companies (ESCO):
- In 2008, the first energy service company in Latvia and Eastern Europe was established — **SIA "RENESCO"**, which deals with implementation of energy efficiency projects in multi-apartment residential buildings.

[3] http://www.esfondi.lv/page.php?id=336
[4] http://www.eeagrants.lv/?id=21
[5] http://www.esfinanses.lv/index.php?lang=lv&dir=lapa%2Ffondi-un-finansu programmas&region=a&sbm=search&search_text=

Success Model

Network of energy agencies in Latvia is not sufficient, as currently only Zemgale Regional Energy Agency (ZREA) and Riga Energy Agency (REA) are operating. Kurzeme Regional Energy Agency and Vidzeme Regional Energy Agency have either terminated their operation, or their operation is inefficient.

It would be beneficial to renew and establish such agencies also in Kurzeme, Vidzeme, and Latgale Regions, as well as largest cities in Latvia.

The main task of regional energy agencies is drafting and updating of long-term energy supply and energy efficiency planning documents, promotion of increase of energy efficiency and use of renewable energy sources, as well as provision of information services to general public.

Position of local government energy manager or specialist must be established in small local governments. Tasks of these officials must be identical with the functions of local/regional local government energy agencies — promotion of development of sustainable energy supply in the administrative territory of the particular local government. It is necessary to establish the position of regional energy manager in all local governments and to ensure regular trainings and seminars to these employees regarding topicalities in the field of NZEB and implementation of these standards in real life.

Functions of municipal building authorities are educational and advising, it depends mostly on training of specialists. Municipal energy specialists and building authorities have to cooperate closely, since the specialists of building authorities receive all construction plans first.

In future, an action model would be possible where rebuilding and reconstruction projects, together with Energy Certificate, are examined and consulted also by an energy specialist. Such a consulting model would not need large investments, but would yield significant result in improving energy efficiency of buildings. In addition, visual information on energy classes of buildings and available information channels, as well as other additional information should be placed at building authorities.

It is recommended to use also findings by other regions:

Tyrol — Lead by example by setting requirements to refurbish public buildings, plus additional energy criteria for federal contracts.
Hannover — Set requirements in the contract of sale for municipal land for 'low energy' or 'passive' standard.
Brussels — Interest in energy reduction and renewable sources driven by air quality and fuel cost increase.
Wales — New policy measures could be introduced to help contribute to the NZEB targets include:

- *higher requirements on public buildings as a role model for the industry;*
- *strengthen ventilation requirements via regulation: set up a competent person scheme for installation of ventilation and MVHR (mechanical ventilation heat recovery);*
- *conditions on sale of land regulate energy standard for building.*

2. Renewable Energy Sources

2.1. Renewable Energy Sources in Latvia and beacon regions

Energy from renewable sources means energy from renewable non-fossil sources, namely wind, solar, aerothermal, geothermal, hydrothermal and ocean energy, hydropower, biomass, landfill gas, sewage sludge gas and other biogases.

Latvia has significant potential for the expansion of renewable energy sources (RES), especially biomass. RES in 2012 accounted for 36.3% of total primary energy balance and the two most commonly used forms of renewable energy are fuelwood (27.5%) and hydro resources (7.0%). Wind energy, biogas, biofuels and straw are used to a less extent. Solar energy is used only in very small quantities of pilot projects.

Total electricity generation from RES in the 2010 amounted to 3635 GWh, in the 2011 – 3078 GWh and in the 2012 – 4109 GWh.

According to Directive 2009/28/EC of the European Parliament and of the Council of 23 April 2009 on the promotion of the use of energy from renewable sources and amending and subsequently repealing Directives 2001/77/EC and 2003/30/EC on renewable energy Latvia has got one of the highest individual targets for the share of renewable energy by 2020, namely 40% from total gross final energy consumption. The share of renewable energy sources has traditionally been significant in Latvia's energy supply and in 2010 it comprised 32.5%, in 2011 it comprised 33.5% and in 2012 it comprised 35.8% of the total gross final energy consumption. The share of renewable energy in the transport sector must reach at least 10% by 2020 of gross final energy consumption for transport (in 2010 it comprised 3.3%, in 2011 – 3.2%, in 2012 – 3.1%).

Additional information about Latvia RES policy can find in information report "Republic of Latvia National Renewable Energy Action Plan for implementing Directive 2009/28/EC of the European Parliament and of the Council of 23 April 2009 on the promotion of the use of energy from renewable sources and amending and subsequently repealing Directives 2001/77/EC and 2003/30/EC by 2020", which can find in European Commission homepage: http://ec.europa.eu/energy/renewables/transparency_platform/action_plan_en.htm.

Total share of electricity generated from RES in Latvian gross electricity consumption (%)[6]

	2000	2005	2008	2009	2010	2011	2012
Total share	47.7	48.4	41.2	49.2	48.5	41.9	52.3
Hydro power plants	47.6	47.1	39.9	47.9	46.9	39.3	47.2
Large hydro power plants	47.2	46.3	39.0	46.9	45.9	38.5	46.2
Small hydro power plants	0.4	0.9	0.9	0.9	1.0	0.9	1.0
Biomass power plants	-	0.1	0.1	0.1	0.1	0.2	0.8
Biogas power plants	-	0.5	0.5	0.6	0.8	1.5	2.8
Wind power plants	0.1	0.7	0.8	0.7	0.7	1.0	1.5

Table 1. Total share of electricity, Source: Ministry of Economics of the Republic of Latvia

Wind map and quality It can be found by looking at the map that shows the wind speed averages in 10 m height. In order to obtain more accurate data need to contact the Latvian Environment, Geology and Meteorology Centre www.meteo.lv [7]

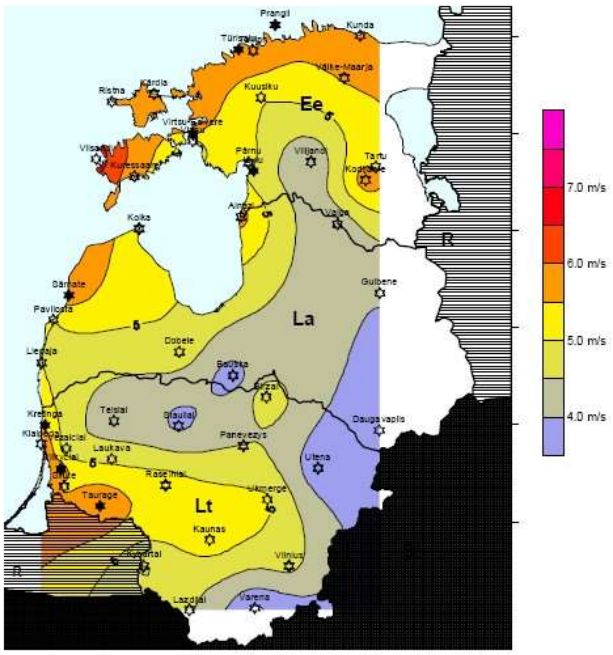


Figure 1.Wind map of Latvia, Source: www.meteo.lv

[6] http://www.em.gov.lv/em/2nd/?lng=en&cat=30170
[7] http://www.kerveju.lv/veja_karte.php

Wind energy: In Latvia wind energy as a way of obtaining electricity is continuing to devolve, just as in Europe, where it has consolidated its position in the energy sector. High wind energy potential is in coastal areas, especially in Kurzeme and in the NorthVidzeme in these regions, wind energy can be used in large wind parks with a range of facilities or in the shore or off the coast of the Baltic Sea. In Latvia central part of the wind energy use is limited because of forests, topography and other factors. The total installed capacity of wind power plants in Latvia at the end of 2010 was 31 MW. **Hydropower:** In Latvia in 2010 were 144 small scale hydro power plants. Small river theoretical hydropower resources are up to 300 GWh of electricity per year. According to JSC „Latvenergo" data the smaller hydroelectric power total installed capacity in Latvian is about 26 MW, Kegums - 264 MW, Plavinas - 884 MW, Riga HPP - 402 MW, along the Daugava HPP cascade - 1,550 MW. **Solar Energy:** Currently in Latvian more efficient is to accumulate solar thermal in collectors, still very topical is electricity production from renewable energy sources, including the received solar radiation. Solar thermal energy use, such as hot water addition is beneficial for both households and various public buildings. Solar technologies for electricity production in Latvian climate conditions are require very high capital costs. Now in Latvia are wide-ranging discussion about the possibility of households put the total produced electricity in the common grid, with favourable procurement feed-in tariffs would be possible to stimulate solar energy technologies in Latvia. However, the use of solar energy is an excellent addition to energy supplies, because the use of solar energy is free of charge, and duration of installed equipment service is very long. Manufacturers have now provided for PV modules operating time of up to 25 years, but the forecast of more than 30 years.

Solar map [8]

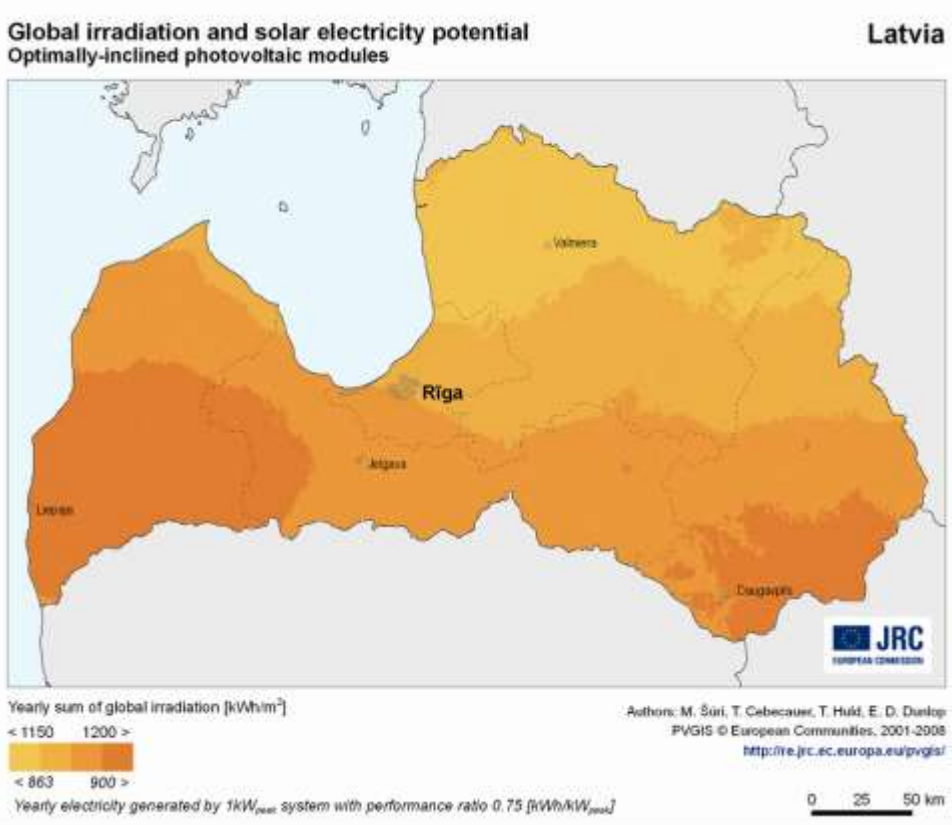


Figure 2. Solar map of Latvia, Source: www.solenergo.lv

[8] http://solenergo.lv/raksti-un-noderiga-informacija/saules-energijas-izmantosanas-iespejas-latvija

According to Photovoltaic Geographic Information System information average global radiation gain in territory of Latvia is 1000 kWh/m2 - 1200 kWh/m2 per year. It can be concluded that the use of solar energy in Latvian to electricity will pay back only with high-efficiency technologies and potentially lower capital investment. Approximately 40% - 60% of the annual production of electricity is produced during the summer months, that is, about one-quarter of the year. On the other hand, solar collectors for hot water production in households have already proved its efficiency in Latvia. If the PV module isn't mounted in the optimum angle then for the Latvian climatic conditions the energy loss is about 28%.[9]

Geometral energy: Ground source heat pumps use in Latvia in recent years has grown rapidly. **Biomass -** Biomass has traditionally been the most widely used renewable energy sources (RES), in Latvia mainly used wood for heat, historically - firewood for heating buildings. There is strong need for a favorable political environment, to promote the development of bio-energy sector, to develop new technologies and scientific advances in this area. In Latvia cogeneration is widely used as a fuel for natural gas, in recent years become increasingly popular CHP biogas and wood chips. According to the Central Statistical Bureau of the year 2010, 80% of the total consumption of RES in the Latvia is biomass, including biofuels 2% and 1% biogas. In the end of 2010 All kind of biomass and biogas plants installed electrical capacity in Latvia was 22 MW. [10]

Differentiation: with regard to definition of criteria and relevant indicators on sustainable biomass extraction from forests, there should be distinction made between different types of forests as they differ in soil, biodiversity, dominant flora and fauna etc. Besides at present Latvia has little experience with limiting harmful impacts on biodiversity related to biomass plantations as those type of plantation have been limited in their scale, nevertheless the sector is expected to increase in coming years. In summer of 2012 there were regulations approved laying down rules on establishing and maintaining biomass plantations. Possible challenges with new regulation are still to be seen, although biodiversity experts anticipate that there might be possible conflicts with biodiversity protection. **Certification:** forests managed by JSC "Latvian State Forests" have been certified both by PEFC scheme and FSC scheme therefore biomass originating from those forests fulfils most of criteria with regard to biodiversity and resource efficiency.

Beacon project regions: The region of Latgale covers an area of 14,547 km^2 or 22.5% of the total territory of the country. It comprises 27% of the country's agricultural land, which constitutes 44% of the overall territory of the region. 38% of the region is covered by forest, mainly pine and spruce forest, although broad-leafed trees, often from natural regeneration on former farmland and usually of poor quality, are also widespread. Bogs and swamps cover 5% of the region, and about one third of the country's water bodies are located here. Due to the region's relief and poor soils farming conditions are comparatively bad. The border area has its own specific problems such as declining population, structural unemployment, insufficient road quality, poor transport, communication and social services, abandoned manufacturing objects and unutilized agricultural land.

Region of Vidzeme, where one of beacon projects is located, is one of the most forested regions in Latvian - they take up half the territory of the region. In recent years, the proportion of forest land tends to increase. Forest quantity and quality determined by the regions of Vidzeme which forest products are used not only to satisfy local consumption; they are also an essential element for a mosaic landscape and significant recreational potential.

Promising developments in Latgale in the field of bioenergy: In recent years the region of Latgale has experienced some progress in the field of renewable energy deployment and energy efficiency. In Latgale region is one of beacon projects - Low energy refurbishment of

[9] http://www.aea.lv/en/saules-energija
[10] http://www.aea.lv/en/bioenergija/biomasa

two buildings: school and dormitories in Rezekne region. Ludza was among the first municipalities in Latvia to successfully convert its district heating system from heavy fuel oil to biomass in the 1990s. Other municipalities in the region followed. In recent years, an increasing number of biomass co-generation plants has been commissioned (e.g. Jēkabpils, Dagda, Preiļi) or is planned to be commissioned (Mežvidi 2). Many of these projects are based on rather innovative conversion processes and technologies, including ORC (Jēkabpils) or wood gasification (Dagda, Viļāni, Mežvidi 2). Most of these plants have been supported by investment grants provided by the so called Climate Change Financial Instrument, the Structural and Cohesion Funds, and/or preferential feed in tariffs for electricity produced from biomass. Further bioenergy sub-sectors with growing importance include the production and processing of rape seed for biodiesel, as well as production and utilization of biogas, particularly from agricultural residues (e.g. Viļāni). There are several wood pellet factories operating in the region, e.g. in Jēkabpils, Kārsava, Rēzekne and Krāslava, which are producing wood pellets mainly for export purposes.[11]

Cogeneration produces 51% of the total electricity generated in Latvian

CHP plant electric power and fuel consumed in Latvia regions in 2013

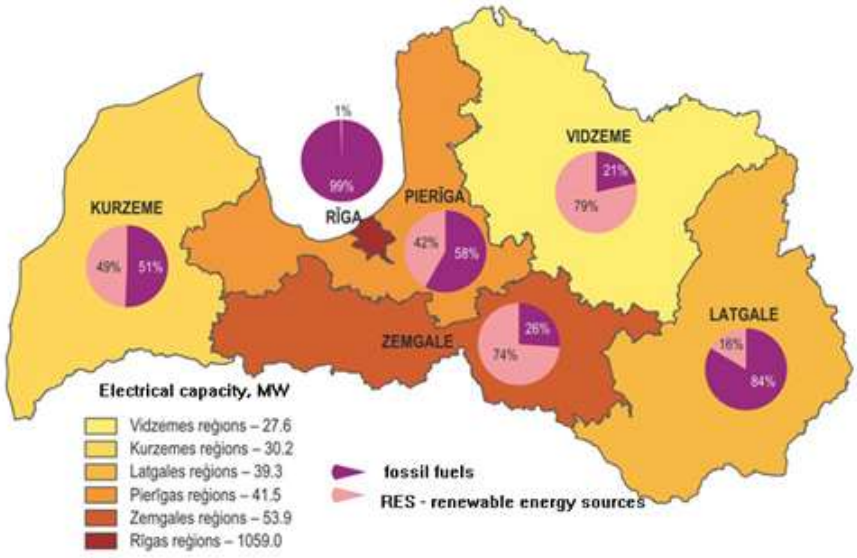


Figure 3. CHP plant electric power and fuel consumed in Latvia regions in 2013,

Source: Central Statistics Bureau of Latvia

[11] **Recommendations for co-creating Latgale as a bioenergy region**, Bioenrgy Promotion2, Baltic See Region, Programme 2007-2013.

CHP plant breakdown by type of fuel consumed by the year 2012 and 2013

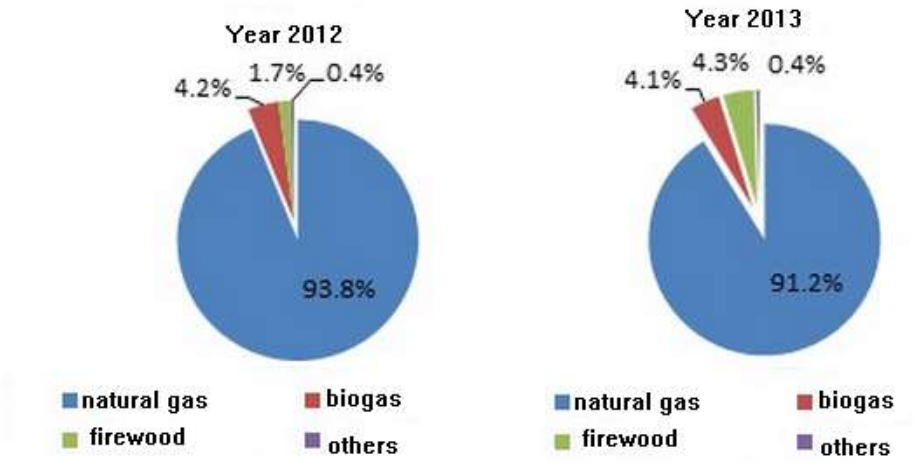


Figure 4. CHP plant breakdown by type of fuel consumed by the year 2012 and 2013

Source: Central Statistics Bureau of Latvia

During last seven years from the 2007 by 2013 significant increase in the CHP plants have been of the renewable energy sources (RES). If in 2007 the electric power cogenerating plants operating on biogas and fuel wood was 6 MW, then in 2013 this figure reached to 105 MW.[12]

2.2. Renewable Energy Sources in buildings

48% of Latvian households use renewable energy source – fuelwood (91% of fuelwood consumption is firewood) as a primary energy source. In industrial, commercial and public sector RES consumption share is 28% of the total energy use and more than half of it (64%) are woods wastes and wood chips. [13]

Why focus on buildings?

- Buildings must be central to the EU's energy efficiency policy –nearly 40% of final energy consumption (and 36% of greenhouse gas emissions) is in houses, offices, shops and other buildings;
- Buildings provide very large untapped cost-effective potential for energy savings, estimated to be 65 million ton oil equivalent;

[12] http://www.csb.gov.lv/notikumi/kogeneracijas-sarazo-51-no-kopeja-sarazota-elektroenergijas-daudzuma-latvija-39628.html

[13] Central Statistical Bureau of Latvia, Section of Environment and Energy Statistics, 2012.

- This corresponds to a cumulated investment need of approximately 587 billion € for the period 2011-2020, i.e. around 60 billion € per year to realise this savings potential.

Climate change financial instrument (CCFI)

Aim of CCFI is to **prevent global climate change, adaptation to the effects of climate change** and contribute the reduction of greenhouse gas emissions (for example, implementing activities to improve the energy performance of buildings in both public and private sectors, the development and implementation of technologies that use renewable energy resources, as well as the implementation of the integrated solutions to reduce greenhouse gas emissions). The financing of the Tenders is formed by the Proceeds from the Assigned Amount Units (AAU) Purchase Agreements which are made within the international emissions trading under the **Kyoto Protocol**. Latvian Environmental Investment Fund provides supervision of implementation and post-implementation monitoring of projects co-financed by CCFI – National Implementing Agency (CCFI co-financing – **200 million EUR**).

Legal basis

- Principles for using the revenues from the sale of AAUs, including a clear provision stating that **all income from the sale of AAUs shall be earmarked for "greening" projects**
- Special budgetary arrangements:
  - Money from the sale of AAUs is transferred **to income budgetary account in State Treasury**
  - Disbursements are organized under the budget programme **"Climate change financial instrument"**
  - In annual budget the financing for the Climate Change financial instrument is ensured in **amount of received and unused proceeds** from AAU sales in previous years **(carry-over provision)**

Use of revenues ("greening")

The Latvian government will ensure that every AAU sold will be used for "greening" purposes which means:

- increase of renewable energy use
- improvement of energy efficiency in buildings
- application of innovative low carbon technologies
- capacity building for climate change policy design and implementation

Figure 5. Entered contracts in household sector

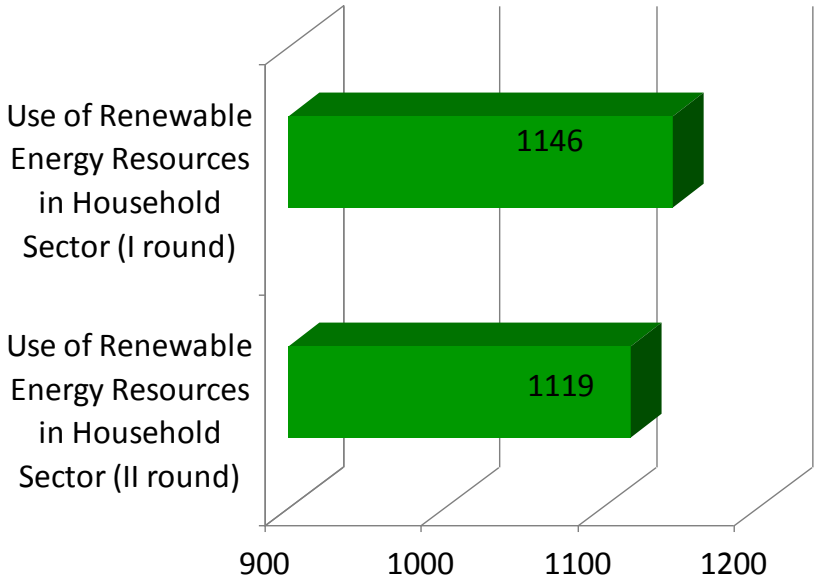
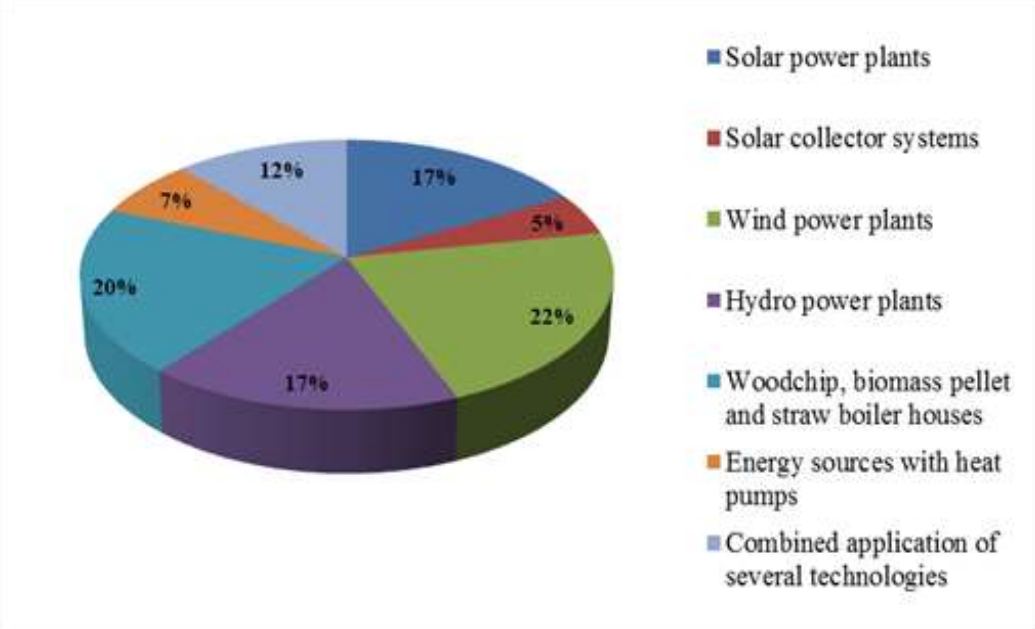


Table 2. Results achieved

No	Public tender	CCFI financing EUR	CO_2 emissions t/per year	Number of buildings
1	**Increase of Energy Efficiency in Municipal Buildings**	33 810 935	2 205.02	222
2	**Increase of Energy Performance in Higher Education Establishment Buildings**	10 074 749	2 466.31	34
3	**Complex Solutions for Greenhouse Gas Emission Reduction in State and Municipal Vocational Education Establishment Buildings**	16 975 425	5 310.14	48
4	**Complex Solutions for Greenhouse Gas Emission Reduction in Manufacturing Buildings**	11 315 258	9 689.1	72
5	**Complex Solutions for Greenhouse Gas Emission Reduction in Municipal Buildings (II round)**	24 695 241	8 429.96	139
6	**Low Energy Consumption Buildings**	9 420 805	2 205.02	28
	TOTAL:	**106 292 412**	**30 305.55**	**543**

Figure 6. Renewable energy source technologies chosen by Project beneficiaries



Risks of implementation: Increase of project costs: result of Public procurement procedure; inaccurate estimated costs; weak quality of technical documentation; Problems with supervision of construction process and construction work quality; Procurement procedure irregularity; Lack of experience, competence; Poor planning; Bad management. [14]

Success Model

Above mentioned data shows, that Latvia is one of the "greenest" EU countries, because it's rich with wood and most part of energy are produced from biomass. Each municipality has its District heating companies and most part of them uses biomass, so the heat is produced from RES.

- To promote use of RES in private sector, there is strong need to organise more tenders as Climate Change Financial Instrument. In 2011 and 2012 altogether 1761 projects were implemented in private sector for private houses in Latvia region. Co-financing was 50% but not more than 10 000 EUR for one beneficiary. Co-financing was available for wind power generators, PV, solar collectors, heat pump such as land, air-water, air-air and pellet boiler – not only with pellets, but with woodchips and biomass as well.
- **Support the development and implementation of regional and local energy action plans**: this can provide multiple benefits at regional, national and EU level by achieving national and EU targets and raising public awareness and knowledge on renewable energy and energy efficiency.
- Increase the organisational, financial and human resources of planning regions and municipal authorities.

Solutions to avoid risks:

- More communication and information in all levels; - Involving experts and other professionals. **Precondition** – understanding and responsibility achieving project's results!

[14] Latvian Environmental investment fund- Research and analysis on CCFI tender implementation and results, 2013.

3. ECONOMICS AND FINANCES

3.1. Economic Goals and Indicators

One of the comparative indicators used in the EU is energy consumption in kg or tonne of oil equivalent (kg/T of oil equivalent) per EUR 1000 GDP. This indicator is closely related to economic development, since it includes energy consumption in all sectors (residential, industrial, services, and transport), as well as GDP growth. Article 4 of document "On Guidelines for Energy Development in 2007–2016" of the Republic of Latvia states: "Energy intensity (ratio of total consumed amount of primary energy resources to unit of gross domestic product) in 2010, 2015, and 2020 shall decrease to 0.35, 0.28, and 0.22 TOE/EUR 1000, respectively."

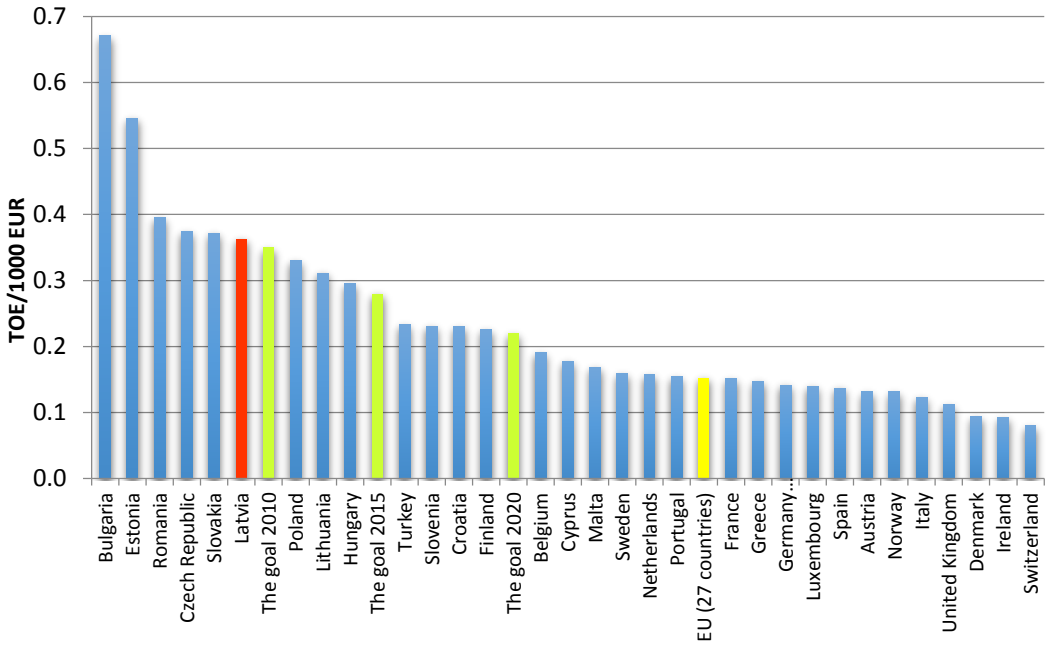


Figure 7. Intensity of energy use in Europe and Latvia in 2010: results by state, targets of Latvia by 2010, 2015, 2020 (Eurostat, 2010)

It should be taken into account that Latvian statistics for 2010 reflects the decrease of GDP in 2008–2010. In 2011, the increase of GDP was 5.5%, but in 2012 — 5%. The Ministry of Economics (Informative Report "On the Fulfilment of Tasks Set forth in Energy Development Guidelines for 2007–2016") estimates the growth of GDP by 4–5% per year by 2020.
Improvement of the energy intensity indicator depends on several factors:

- increase in gross domestic product;
- decrease in energy consumption in State in general.

Significant energy consumer is households (32% in 2011, CSB), who do not yield any increase of GDP, but is the largest consumer of energy sources.

"Report on Energy Efficiency Monitoring in 2011" prepared by the Ministry of Economics in 2012 states the following: "In 2000–2007, GDP experienced sharper growth than energy consumption, this was influenced by improvement of energy efficiency both in energy production and transmission, and energy end-use sectors. Positive examples from other

states (Denmark) show that it is possible to ensure growth of GDP in states with high energy efficiency in case of stable energy consumption."

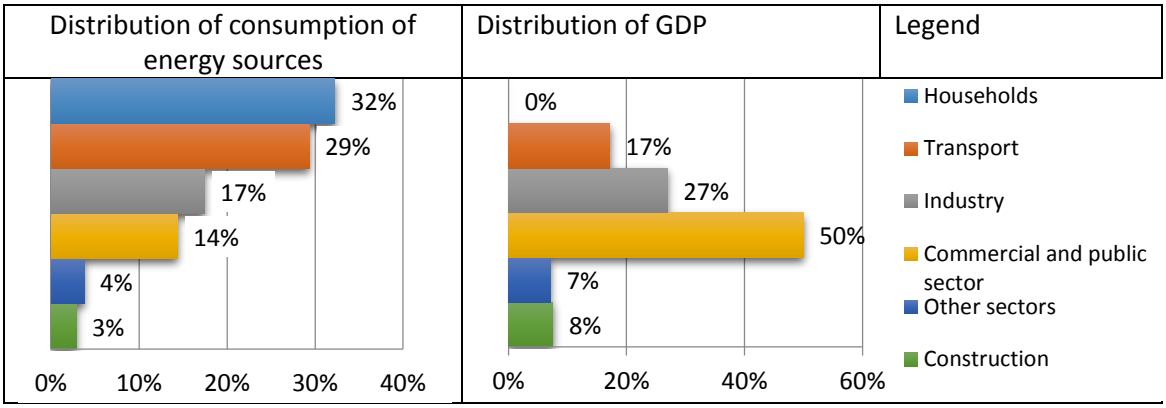


Figure 8. Distribution of consumption of energy sources and GDP in Latvia, 2011 (2011, CSB)
Also statistics for the last year's show the negative trend of energy intensity development in Latvia.

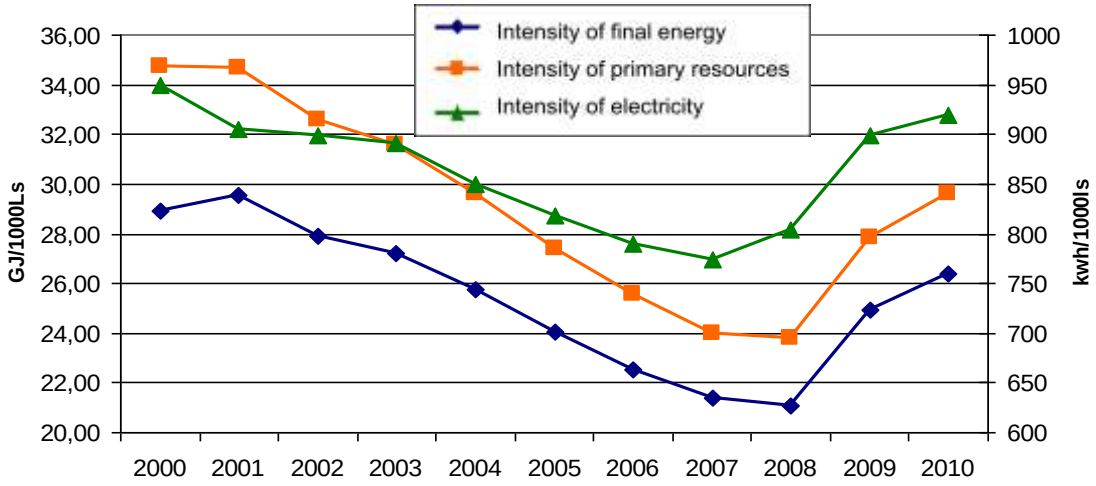


Figure 9. Fluctuations in energy intensity indicators in Latvia, 2000—2010 (prices as in 2000). ("Report on Energy Efficiency Monitoring in 2011", Ministry of Economics)

The large amount of energy consumed in buildings contains significant potential for reaching the common targets in energy efficiency. Due to bad characteristics of building envelope and heating systems, households in Latvia consume twice as much energy as average EU households with similar level of welfare[15].

[15] http://www.latea.lv/userfiles/images/pdfi/Konference_Energoefektivitate/prezent_Ekon_ministrija.pdf

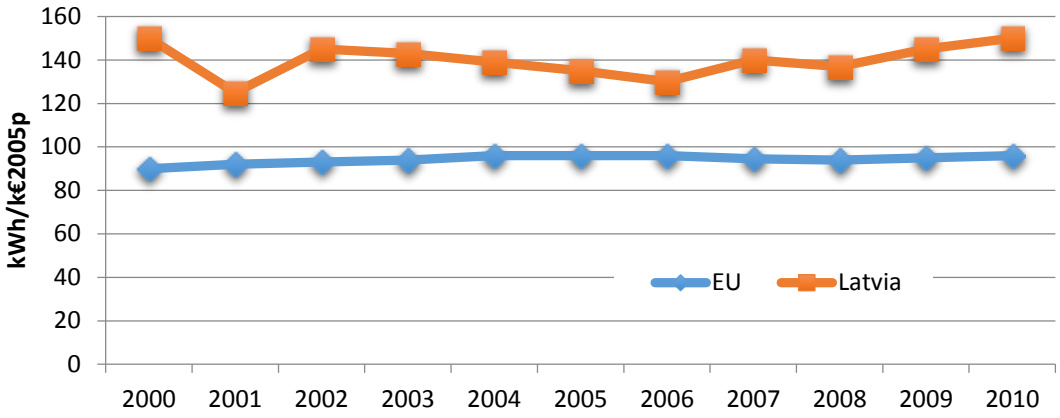


Figure 10. Expenses for the consumed heat energy. Source: http://www.latea.lv/userfiles/images/pdf-i/Konference_Energoefektivitate/prezent_Ekon_ministrija.pdf

See more detailed information on indicators of construction sector in Latvia and energy efficiency of buildings in Appendix I.

Success Model

Macroeconomic understanding that state and its entrepreneurs are not competitive if they spend significant portion of their income for heating of non-quality buildings shall be the main driving force. Latvia should follow the example of Wales (United Kingdom) and declare war against "poverty caused by heating bills" by putting forward the target to reduce heating costs to 10% of average household income. On the entrepreneurial level, there are good prospects for construction works, local builders and material producers and consulting sector if they make competent offer with prices corresponding to the market.

3.2. Economic Levers

Tax Levies

The Communication from the Commission to the European Parliament and the Council regarding strategy for the sustainable competitiveness of the construction sector and its enterprises[16] states that fiscal incentives (like, reduced VAT rates, preferential tax rates, CO_2 and energy taxes, targeted subsidies, etc.) and financial support measures are well accepted by market operators and boost the renovation of existing buildings. To optimise the lever effect, efforts should be made to ensure mutual complementarily of the State scheme, on the one part, and EU and private funds and financial instruments, on the other part.

Regulation for application of property (including buildings) tax is defined by the Law On Real estate Property Tax (in force as of 01.01.1998); local government determines the property tax rate from 0.2 to 3 per cent from the cadastral value of real estate property and provides for the principles for determining property tax rate and tax levies in its binding regulations.

Given the current property tax policy, if a building is reconstructed or renovated, its cadastral value increases along with the property tax rate. Reconstruction and renovation of buildings require significant investments, including necessity to assume financial liabilities in most cases. National legislation do not provide for separate tax levies in relation to reconstructed or renovated buildings, however the property tax policy may serve as an instrument for improving energy efficiency of buildings and using renewable energy sources in buildings.

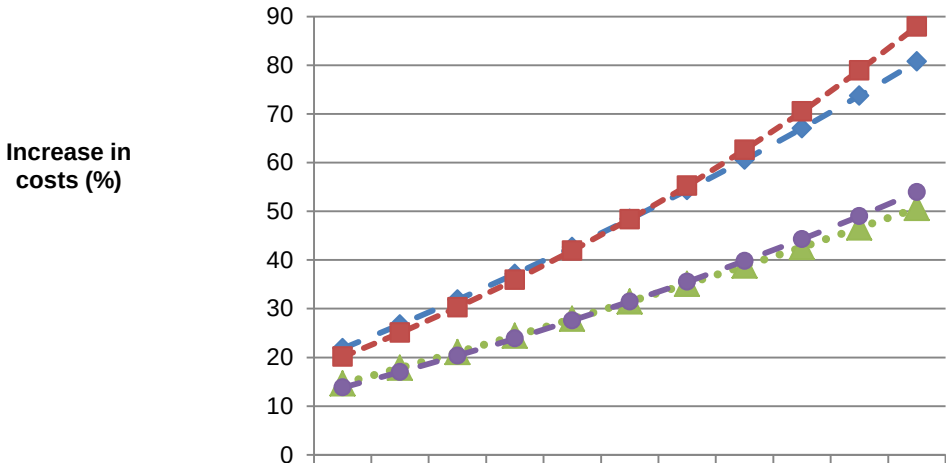
[16] Brussels, 31.07.2012. COM (2012) 433 final

Local governments by use of their binding regulations may provide for allowances to separate categories of payers of property tax in the amount of 90%, 70%, 50%, or 25% of the amount of property tax[17].

Riga City Council has started to develop municipal binding regulations, which provides for decreased property tax, meaning that reduced tax rate shall be applied to renovated buildings. It is planned to apply property tax reduction in the amount of 90% to insulated multi-apartment residential buildings. Thus, it will facilitate people's interest in performing energy efficiency measures and reduce the burden of heat expenses for residents.

Reduced Interest Rates

The current experience in relation to insulation of residential buildings in Latvia shows that bank loan has been necessary for covering expenses for building renovation in almost all cases. Depending on various factors, like, purchasing power of apartment owners, price of credit resources, etc., the annual loan interest rate currently is 5–7%. Thus, interest on the loan constitutes a significant part of payment liabilities of building owner. Figure 11 shows the rise in investment prices depending on the share of co-financing (D), credit (K), and loan annual interest rate (P). The figure shows that in 10 years period loan with credit interest rate 2.77% equals loan with 5% interest rate and share of co-financing in the amount of 50%, while loan with credit interest rate 4.025% equals loan with 7% interest rate and share of co-financing in the amount of 50%. Given the aforementioned financing conditions, lower interest rate is more beneficial in a period exceeding 10 years, but higher interest rate with a share of co-financing is more beneficial in shorter term. To choose the best solution, the actual possibilities, meaning, what are the conditions for attracting credit resources, must to be assessed[18].



	5	6	7	8	9	10	11	12	13	14	15
K(100%+P4.025%)	21.8	26.7	31.8	37.1	42.6	48.4	54.4	60.6	67.0	73.8	80.7
D(50%)+K(50%+P7%)	20.1	25.0	30.3	35.9	41.9	48.4	55.2	62.6	70.5	78.9	88.0
K(100%+P2.77%)	14.6	17.8	21.1	24.4	27.9	31.4	35.1	38.8	42.6	46.6	50.7
D(50%)+K(50%+P5%)	13.8	17.0	20.4	23.9	27.6	31.4	35.5	39.8	44.3	49.0	53.9

Figure 11. Rise in investment prices in per cent depending on the share of co-financing (D), credit (K), and loan annual interest rate (P)[19].

[17] Informative report on financing solutions for building renovation, 04.06.2012, Ministry of Economics

[18] Informative report on financing solutions for building renovation, 04.06.2012, Ministry of Economics

[19] Informative report on financing solutions for building renovation, 04.06.2012, Ministry of Economics

Local governments (also the State) may provide assistance in performing energy audits and renovation of buildings according to the procedure and financing provided by legislation, as prescribed in the cases and procedures by the Law On Assistance solving housing issues (in force as of 01.01.2002), by following the principles of most efficient investment return, sustainability, maximum energy efficiency, and use of environment-friendly technologies. The Law does not provide for mandatory requirements and deadlines for energy certification and renovation of the privatised residential property, thus currently allowing for self-initiative and complete voluntarism in this field.

Success Model

Efficient property tax policy will promote reconstruction and renovation of buildings, thus facilitating tax income from commercial activities. In addition it should be taken into account that local governments have the right to establish in their binding regulations such property tax relief or applicable rate thereof that would foster the interest of building owners to perform measures for the improvement of energy efficiency of building. To facilitate measures for energy efficient buildings, in addition to tax policy, , it is necessary to develop regulations for directing tax income (like, excise duty for energy sources, property tax, natural resources tax) to improvement of energy efficiency of buildings and use of renewable energy sources in buildings to ensure availability of budgetary resources to activities for increasing energy efficiency of buildings. However, the Ministry of Finance does not support such proposal and holds a view that expenses allocated for improving energy efficiency of buildings shall be financed from the State budget according to general procedure, not by linking them directly with excise tax revenue from fossil energy sources.

Local governments must prioritise complex renovation of buildings, which allows reducing consumption of heat energy thus reaching the requirements of Passive House or NZEB standards. In case of fragmented renovation, the local government may face a situation when people invest their share of payment in renovation of a building, but it does not yield any perceptible reduction of consumption and the following heat bill. Under conditions of high heat energy tariff, it can discredit the idea of insulating buildings and cause non-satisfaction of people with local government's proposals[20].

The following should be mentioned among other available assistance from local governments in insulating residential buildings: grant to cover completely payments for population with low-income, as well as possibility that local government covers part of interest for bank loan, etc.

Wales (United Kingdom) names the following potential opportunities and threats posed by the ESCO model:
ESCOs funding for new buildings: Fixed energy contract pricing that is lower than 'traditional' build, but an uplift on actual energy costs, covers excess finance expenditure for low energy measures/NZEBs. ESCOs must be very confident by running costs of a building to operate such contracts. At present, there is significant discrepancy between energy forecast in building design stage to actual performance, which would raise concerns about safe ESCO model.

Examples from other states shows positive application of financial mechanisms:
In Hannover Green Banks provide low rate loans and better credit terms for low energy buildings.

[20] Informative report on financing solutions for building renovation, 04.06.2012, Ministry of Economics

In Brussels 0% loans are offered for low income families by a credit cooperative, mediated by Brussels Environment agency. Repay over 4 years.

3.3. Types of Financing

Possibilities for implementing energy efficiency projects in buildings

- Local government financing
  - support to energy audits and building renovation projects, building support programmes and instruments included therein (budget for social assistance);
  - investment in equity capital or surety to local government's heat supply company.
- Co-financing by EU funds
  - activity 3.4.4.1 "Improvement of Heat Insulation of Multi-Apartment Residential Buildings";
  - activity 3.4.4.2 "Improvement of Heat Insulation of Social Residential Buildings" and other activities (heat supply, production).
- Climate Change Financial Instrument (university buildings, manufacturing sector, public buildings) until 2014
- Energy service companies (ESCO) or financing by third party
- Financing by bank
- Self-financing

Local Government Financing

State and local governments can provide assistance to the owner of residential building or apartment by allocating support for implementing building energy efficiency measures, according to requirements of Section 27[2] of the Law On Assistance solving housing issues.

Until now, financing from local governments' budgets for performing building energy efficiency measures was comparatively small, which can be explained with the limited possibilities of budget and fact that State and local governments' budget is planned for a short term — up to 3 years[21]. However, if taking a look on the projects co-financed by local governments and investments during the last four years, there is a positive trend.

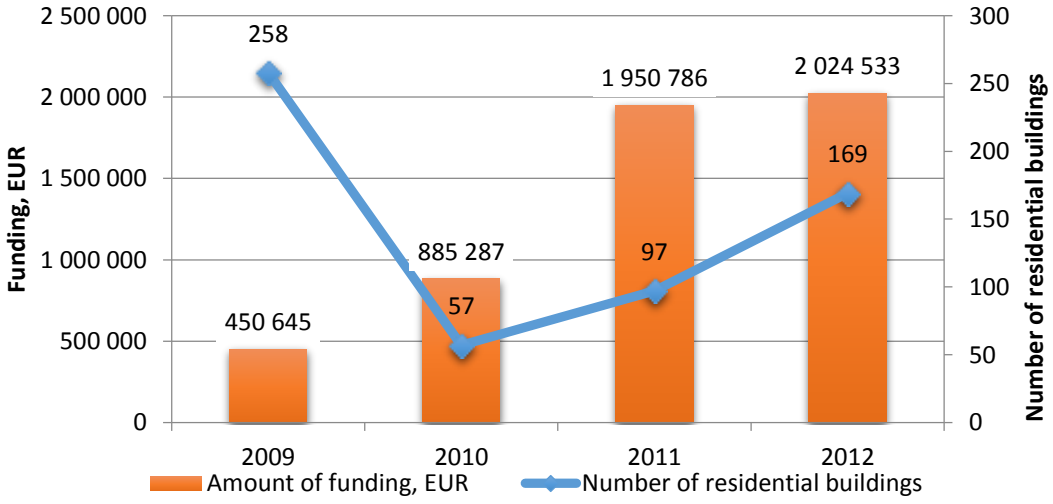


Figure 12. Support by local governments to implementing energy efficiency measures in residential buildings, 2009–2012. Source: Ministry of Economics.

[21]Informative report on financing solutions for building renovation, 04.06.2012, Ministry of Economics

European Union Funds

It is possible to use three funds for reaching targets of regional policy: European Regional Development Fund (ERDF), European Social Fund (ESF), and Cohesion Fund (CF). Also other financial mechanisms are available to provide technical support (Jaspers and Jasmine), improve access of small and medium-sized businesses to micro-financing (Jeremie), and support municipal development (Jessica and Elena).

Table3. Comparison of financing by funds, and national co-financing

Fund	European financing (EUR)	Latvian co-financing (EUR)	Total financing (European + Latvian) (EUR)	%
ERDF	2,440,017,364	662,793,319	3,102,810,683	53.86%
ESF+CF	2,090,430,270	478,714,544	2,569,144,814	46.14%
Total	4,530,447,634	1,141,507,863	5,671,955,497	100%

Data from http://www.esfondi.lv/page.php?id=478

Informative database on projects financed by the EU:

European Regional Development Fund (ERDF)

ERDF activity "Measures improving heating insulation of the multi-apartment residential buildings" is the first comparatively important support mechanism for improving energy efficiency of multi-apartment residential buildings. One of the key goals of this activity was to promote the energy efficiency issues that have been little understood by the society so far and to create examples so that people are more confident of benefits provided by renovation of buildings. Renovation of multi-apartment residential buildings with ERDF co-financing in the amount of 50% was launched on 14 April 2009; the initial total financing of the programme was estimated in the amount of 20.11 million EUR (14.13 million LVL). Financing for the support of multi-apartment residential building renovation was increased up to 89.29 million EUR (62.75 million LVL) over 4 years. On 31 July 2013 submission of projects reached the limit of the total programme financing[22].

[22] http://www.esfinanses.lv/lv/a/lapa/jaunumi/15653_atbalsts-daudzdzivoklu-maju-siltinasanai-tiks-turpinats-2014gada-vidu

Map of Latvia with multi-apartment residential buildings renovated within the ERDF activity "Improvement of Heat Insulation of Multi-Apartment Residential Buildings".

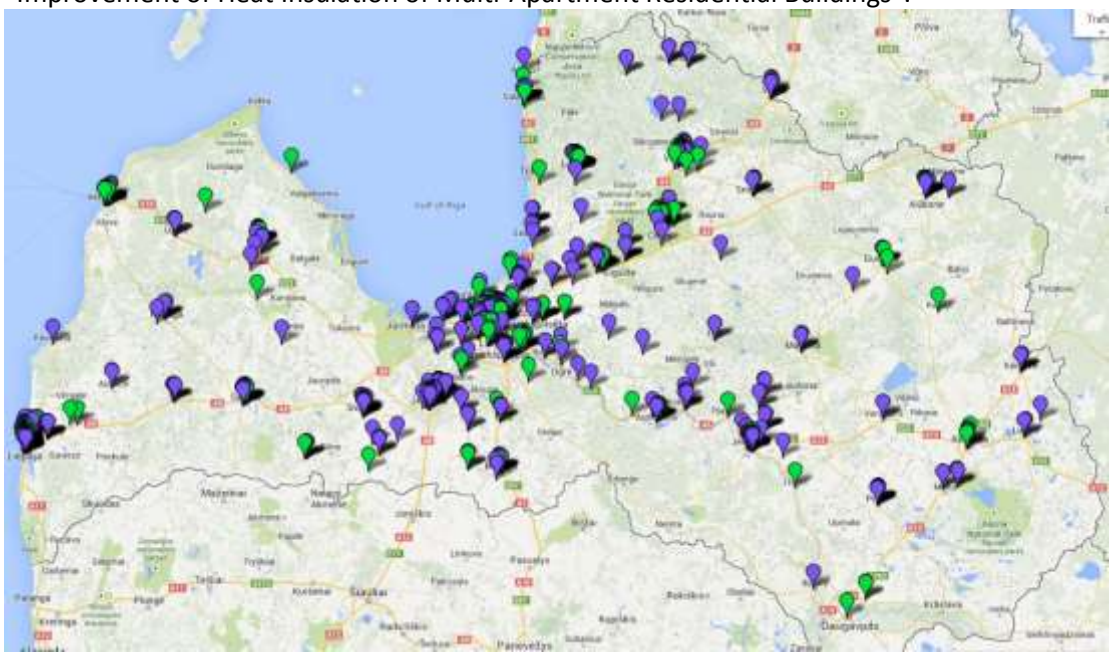


Figure 13. Projects implemented within the ERDF activity "Improvement of Heat Insulation of Multi-Apartment Residential Buildings"

Number of completed projects by regions per years (as of 13.09.2013)

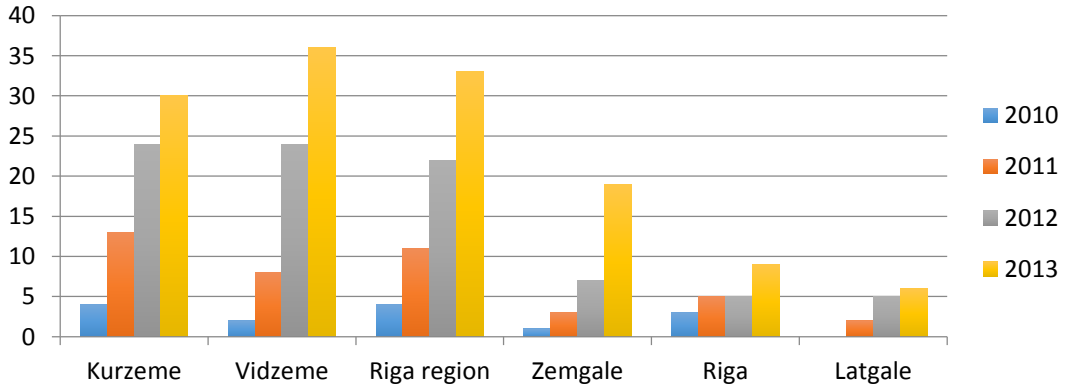


Figure 14. Projects completed within the ERDF activity "Improvement of Heat Insulation of Multi-Apartment Residential Buildings". Source: Ministry of Economics.

See more detailed information on the projects implemented in Latvian local governments by use of ERDF co-financing in European Regional Development Fund–local governments' projects in Latvia.

Green Investment Scheme

Climate Change Financial Instrument (CCFI) works in Latvia according to the principle of Kyoto Green Investment Scheme.

CCFI programme is financed by selling assigned amount units (AAU) within the international emission trade according to provisions of the Kyoto Protocol. Sale of AAU is possible, since Latvia will not need all AAU owned by it to fulfil liabilities set in the Kyoto Protocol for 2008–2012 (reduction of 8% in comparison to the level of 1990), and the potential surplus will be minimum 40 million units. Use of surplus AAU for other purposes, for example, for assigning

to European Emissions Trading Scheme companies, is not possible — AAU cannot be converted into emission quotas or used instead of emission quotas. However, AAU can be sold and the gained income can then be invested in the development of Latvia. Cabinet of Ministers decided on the sale of AAU on 12 April 2006 — Cabinet Ordinance No. 249 "On concept of participation of Latvia in international emission trade[23].

Fields where CCFI financing is available until 30 June 2014:

- improvement of building energy efficiency in public and private sector;
- reduction of greenhouse gas emissions in the transport sector;
- solutions for saving electric energy in public and private sector;
- development and introduction of renewable energy sources technologies, including:
  - use of biomass;
  - use of geothermal energy;
  - use of solar energy, etc.;
- integrated solutions for reducing GHG emission in technological processes, energy production and consumption.

Taking into account the planned use of CCFI programme financing (income from selling AAU are designated for particular aims), it is not expected that CCFI will be widely used for improving energy efficiency of residential sector[24].
See the CCFI project map with projects implemented in the territory of Latvia in CCFI project map.

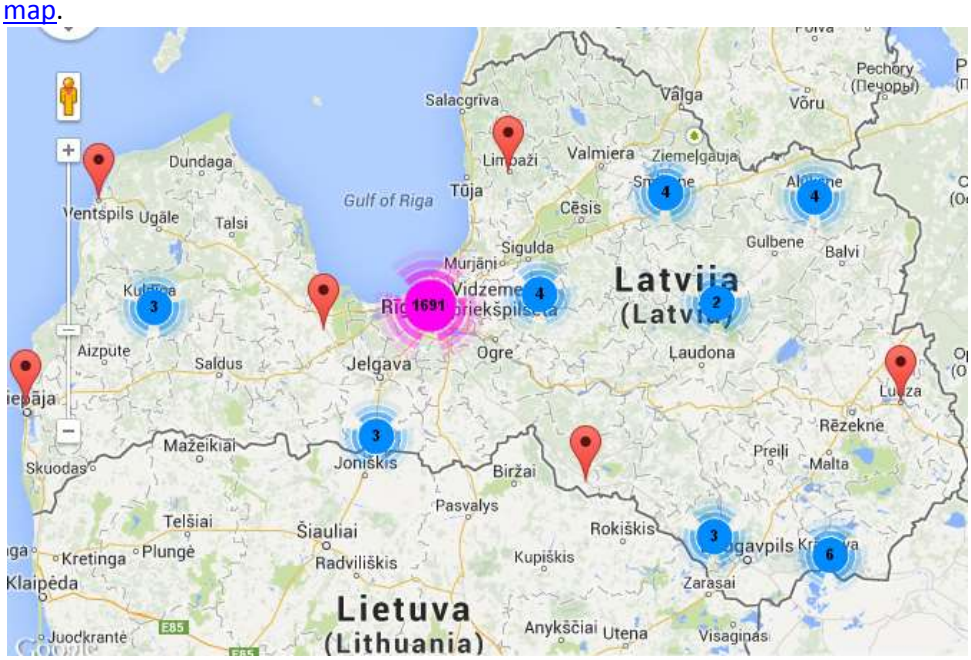


Figure 15. CCFI project map

[23] http://kpfi.lv/index.php?page=par-kpfi-projektu
[24] Informative report on financing solutions for building renovation, 04.06.2012, Ministry of Economics

Table 4. Project tenders implemented by CCFI and available financing

Name of CCFI project tender	Available CCFI project financing, EUR
Use of Renewable Energy Resources for Reduction of Greenhouse Gas Emission	39,437,562
Use of Renewable Energy Resources in Household Sector	stage I: 16,220,000
	stage II: 10,271,406
Low Energy Consumption Buildings	10,332,500
Complex Solutions for Greenhouse Gas Emission Reduction in Municipal Buildings, stage II	24,909,124
Complex Solutions for Greenhouse Gas Emission Reduction in Manufacturing Buildings	11,561,178
Complex Solutions for Greenhouse Gas Emission Reduction in State and Municipal Vocational Education Establishment Buildings	16,988,820
Technology Conversion from Fossil to Renewable Energy Sources	11,500,142
Increase of Energy Performance in Higher Education Establishment Buildings	10,000,000
Increase of Energy Efficiency in Municipal Buildings, stage I	37,269,858
Complex Solutions for Greenhouse Gas Emission Reduction in Manufacturing, Educational Establishment, Culture and Medical Institution Buildings	stage I: 5,963,685
	stage II: 44,378,312
	stage III: 19,361,873

Source: http://www.varam.gov.lv/lat/darbibas_veidi/KPFI/projekti/

As of 1 October 2013, 2080 projects have been completed and 100 projects are being implemented. It should be mentioned that the majority (81%) of all the completed projects is within the tender "Use of Renewable Energy Resources in Household Sector (stages I and II)".

The objective of the tender is the reduction of greenhouse gas emissions in the household sector by means of supporting purchase and installation of micro-generation technological equipment for production of thermal energy or generation of electricity in residential houses for the purpose of production of thermal energy or generation of electricity from renewable energy resources and providing heat or electricity exclusively for household needs.

Project measures:

- wood chips or straw biomass boilers, biomass granule or wood boilers, and biomass fireplaces with total installed capacity up to 50 kW (including) — 25.50% of the total number of approved projects;
- solar collector systems with total installed capacity up to 25 kW (including) — 31.59% of the total number of approved projects;
- heat pumps with total installed capacity up to 50 kW (including) — 31.80% of the total number of approved projects;

- wind turbines with total installed capacity up to 10 kW (including) and solar batteries with total installed capacity up to 10 kW (including) — 11.12% of the total number of approved projects[25].

In general within the tender, equipment for production of thermal energy or generation of electricity from renewable energy resources was installed in 1761 households.

European Economic Area Financial Mechanism (EEA FM) and Norwegian Financial Mechanism (NFM)

Net financing allocated to Latvia in 2009–2014 by EEA FM and NFM amounts to 67.48 million EUR (47.42 million LVL), which is ~30% more than in the previous financial mechanism planning period in 2004–2009. The responsible authority for implementation of programmes related to energy efficiency of buildings and renewable energy sources is Ministry of Environmental Protection and Regional Development (MoEPRD).

The aim of the **EEA FM programme "National Climate Policy"** is to support Latvia in the development of comprehensive national climate policy covering the sectors not addressed by the European Union Emissions Trading Scheme (non-ETS sectors) as regards emissions, and all other sectors as regards adaptation to climate change[26].

At the beginning of 2014, the EEA FM open tender "Development of sustainable buildings, renewable energy sources technologies, and innovative emission-reducing technologies" was announced. Eligible participants:

- Buildings designed for education (kindergarten, school, university) and scientific research (newly erected building or reconstruction of a building);
- Manufacturing buildings (reconstruction of a building);
- Museums (newly erected building or reconstruction of a building);
- Sport buildings (newly erected building or reconstruction of a building).

One of the main requirements is that consumption of heat energy for heating of the premises after implementation of the planned project measures in the building may not exceed 25 kWh/m^2 per year, thus approaching the NZEB definition in Latvia or Passive House in Latvia (with Passive House Standard climate calculation up to 15 kWh/m^2 per year according to PHPP standard climate data for Germany).

ESCO (energy saving company)

SIA "Renesco" currently is the only energy service company in Latvia. In total, until 2013, 7 projects in the field of building renovation have been completed, 5 projects are being implemented, and energy management contracts on renovation of multi-apartment residential buildings have been concluded for 11 buildings (renovation planned in 2013–2014). Currently organisation operates mostly in Vidzeme and Riga regions, therefore dissemination of ESCO in other regions and establishment of new ESCO and PECO (local government energy service company) would be regarded as a positive trend for the purposes of ensuring competition and quality.

More:
http://www.renesco.lv/index.php?option=com_content&view=article&id=4&Itemid=4&lang=lv

Bank Credits

Two credit models are applied to financing of energy efficient renovation of buildings:

1) investment credit — for buildings divided in apartment properties;
2) mortgage loan — for buildings owned by natural or legal person.

[25] http://www.varam.gov.lv/lat/darbibas_veidi/KPFI/projekti/?doc=13463
[26] http://www.varam.gov.lv/lat/fondi/grants/EEZ_2009_2014/nacionala_klimata_politika/?doc=14950

When issuing investment credit for renovation of multi-apartment residential building, the following information is taken into account: future cash flow in the multi-apartment residential building and the previous timeliness regarding management payments performed by the apartment owners. Although the maximum term for building renovation credits offered by banks is 15 years, the co-financing of EU funds allows for reduction of credit maturity by two times (up to 7 or 8 years) on average. Without co-financing of EU funds, the credit terms may reach even 20 and 30 years. Thanks to the support of ERDF for renovation of multi-apartment residential buildings, use of mortgage loans for building renovation has been re-commenced starting from 2009, as the majority of people cannot ensure personal co-financing in the amount of 50%. Since 2010, credits for building renovation are offered by: Swedbanka, Nordea, SEB and DnB bank, Banka Citadele[27].

International Banks

Several international banks providing support to development projects all over the world and Europe have made energy-saving and energy-efficiency related measures as their priority. Financial means of these banks are also available to Latvia. However, apart from banks operating in Latvia, international banks provide support to large-scale projects or for implementation of investment programmes, thus there should be a State-wide programme for covering the respective means.

European Bank for Reconstruction and Development (EBRD) provides support to energy efficiency measures within the Sustainable Energy Initiative by financing activities aimed at improving energy efficiency of local government infrastructure, including residential buildings, heat and water supply systems, and manufacturing infrastructure. The financing is ensured by providing loans with low interest rate to local banks for issuing credits for projects related to promotion of energy efficiency.

Until now, Latvia has not used the EBRD assistance available within the Sustainable Energy Initiative.

European Investment Bank (EIB), along with providing financing within the initiative JESSICA, provide low interest rate credits to EU member states and developing countries for solving issues related to environment quality, including energy efficiency, and implementing EU policy guidelines. In 2009, EIB provided support for solving energy-related issues in the amount of 3.4 billion EUR, including by issuing a 100 million EUR loan to AS “Latvenergo” for modernisation of TEC-2. EIB has also issued loans for improvement of building energy efficiency in other countries, like, Belgium or Luxembourg.

Nordic Investment Bank (NIB) ensure loans for energy efficiency related measures within the environmental improvement priority, which is aimed at elimination of environment pollution and facilitating reduction thereof. NIB supports activities aimed at cutting of CO2 emission, use of renewable energy sources, and introduction of environment-friendly technological solutions. Energy-efficient renovation of buildings has been included as group C or 3rd priority projects, where the procedure for receiving financing is easier (environmental impact assessment is not necessary). The bank mainly finances projects above 50 million EUR by supporting 50% of project costs. Similar to EBRD and EIB, also NIB is oriented towards allocating financing to measures by using local banks.

Taking into account that this bank is formed by eight countries, including Latvia, its operation is primarily aimed at supporting activities in its member states.

In 2009, Lithuanian government concluded a long-term agreement with NIB for assigning a 100 million EUR credit for implementing a 20-year building renovation programme. In total, 39 municipal buildings (230 thousand m^2) will be renovated during this period. In 2010, NIB

[27] Informative report on financing solutions for building renovation, 04.06.2012, Ministry of Economics

concluded an agreement with the Mortgage Society of Finland for a loan to provide support to private apartment owners in increasing energy efficiency of their buildings.

KfW Bankengruppe (KfW)[28] is a German government owned development bank providing significant support in environment and climate related issues, including building renovation with an aim to improve their energy efficiency, by issuing middle and short-term loans to cooperation partners. KfW cooperation partner in Latvia is AS "Hipotēku banka". KfW, in cooperation with the European Commission and Council of Europe Development Bank, is one of the financing sources of EU Energy Efficiency Programme, which promotes reduction of CO2 emission. In 2009, KfW invested 8.9 billion EUR for improving energy efficiency in residential buildings and cutting CO2 emission in Germany. In cooperation with other banks, KfW has developed several initiatives to support the less-developed countries. For example, together with EIB, KfW has created the South East Europe Energy Efficiency Fund, which provides support to countries in the region for increasing energy efficiency and promoting use of renewable energy resources. In addition, the bank has developed a special renewable energy and energy efficiency programme, where loans are provided to developing countries[29].

Building Inhabitants' Personal Financing

People's self-financing for renovation consists of accrued regular payments made for reconstruction works. To create such accrual, apartment owners have to agree on the necessity of this payment in a general meeting and determine its purpose and amount. The payment amount is 10–20 centimes/m^2 per month, depending on what owners have decided and the planned works. This method is suited for financing some particular renovation-related small activity, for example, paying for energy audit, roof replacement, or reconstruction of heating system, but not for complex renovation of building. It is due to the small amount of finances accrued every month. Depending on the chosen financing model, self-financing allows additional decreasing of credit amount, ensures better monitoring of monetary flow and responsibility for the desired outcome, which is available immediately after completing the works. At the same time it should be mentioned that making accruals increases the amount of monthly payments, therefore this method is not very popular[30].

Success Model

In-depth analysis of current co-financing funding programmes (ERDF, CCFI) and application of these models to further financing projects.

Findings by other regions:

Hannover — Utility companies contribute to the 'Climate Protection Fund', which is used to provide subsidies for higher energy performance.
Financial incentives provided from Proklima fund (derived from uplift in bills from utility companies) for those voluntarily aiming for higher (Passive House) energy standards.
Brussels — Finance levied from energy companies used to fund the BatEx programme — projects had to be simple, affordable, repeatable with long term monitoring to demonstrate performance. Valid for new build, refurbishment, any building type. Not initially PH standard, in earlier funding rounds, but more recently expected to be PH to be awarded funds.
PLAGE scheme, funds cheaper energy reduction measures in government buildings, plus optimising and educating occupants. New and existing buildings, large focus on social

[28] KfW — Kreditanstalt für Wiederaufbau (Credit Institution for Reconstruction)
[29] Informative report on financing solutions for building renovation, 04.06.2012, Ministry of Economics
[30] Informative report on financing solutions for building renovation, 04.06.2012, Ministry of Economics

housing and schools. (Create manuals/guidance for building managers and energy consultants.)
Prioritised for low income families, separate subsidies for social housing. Covers: photovoltaic, Solar Hot Water, insulation measures, green roofs, windows, MVHR, blinds/ shading, gas boilers, controls, heat pumps, efficient appliances.
Tyrol — Climate and Energy fund (financed by national tax system). By 2016 will fund projects to achieve 'klima-aktiv' Standard: additional ecology, materials and comfort standards, like BREEAM, plus airtightness and overheating requirement. From 2015, grants will be used for new buildings to the PH standard. Also used to refurbish post war buildings by 2020.
Buildings of tomorrow initiative: Grants towards demonstration projects towards low energy and RES. Aim to be as close to typical construction costs as possible.

4. KEY ACTORS

4.1. Regional and Local Administration Divisions

Riga Planning Region

The task of the 5th objective of the Riga Planning Region Development Strategy 2000–2020 is "Energy saving, efficient use of energy sources, promotion of development of renewable and new energy sources"[31]. To reach this objective, local governments are responsible for the Development Programme and creating of a sustainable development strategy (SDS) for their territories, where goals of the particular local government are defined together with methods for reaching them.

Out of 30 local governments of Riga region, 12 local governments have developed SDS, 12 local governments are working on it, but six local governments have not started to develop SDS.

More: http://www.rpr.gov.lv/pub/index.php?id=54

Riga Energy Agency (REA)

The main directions of operation of Riga municipal agency "Riga Energy Agency" (REA):

- development and updating of long-term concepts and programmes for energy supply and energy efficiency, organisation and monitoring of implementation of these documents;
- attracting financing for solving energy supply and energy efficiency problems from various investment funds on the national and international level;
- energy certification of buildings and organisation of energy audits in buildings;
- informing, consulting, and training society about reduction of energy consumption;
- registration and regular monitoring of small boilers with capacity of >20 kW and air conditioning systems with capacity of >12 kW in line with requirements of EU directive.

REA Energy Efficiency Information Centre (EEIC) provides to its visitors - private and legal persons — availability of free information and consultations according to EU, Republic of Latvia, and Riga municipality's policy regarding energy efficiency[32].

Table 5. Average actual specific heat energy consumption, Riga, 2012

	Multi-apartment residential buildings with complex renovation	**Non-renovated multi-apartment residential buildings**
	kWh/m^2 per year	kWh/m^2 per year
with centralised hot water supply	**101**	**201**
without centralised hot water supply	**77**	**170**

Source: www.rea.riga.lv

Until the end of 2012, 40 multi-apartment residential buildings and eight social multi-apartment residential buildings had been renovated in Riga. See map: http://www.rea.riga.lv/files/Renovacijas_karte.pdf

But in 2013, in total 22 contracts on starting renovation of buildings were concluded.

[31] http://www.rpr.gov.lv/uploads/filedir/RPR%20strat/RPR_Att_strategija_2000_2020.pdf

[32] http://www.rea.riga.lv/

http://www.rea.riga.lv/files/Noslegtie_ligumi_par_renovejamam_ekam_Riga.pdf

Zemgale Planning Region

Zemgale Planning Region has developed the Sustainable Energy Action Plan of Zemgale Region[33] providing plans how the region will cut CO2 emission by minimum 20% by 2020.

Zemgale Regional Energy Agency (ZREA) unites five councils of Zemgale towns and municipalities; Table 4 shows the measures taken for increasing energy efficiency of buildings. Ozolnieki Municipality Council has been the most active one, while Auce Municipality Council has not developed any project so far.

Table 6. Buildings renovated by ZREA

Town	Support mechanism	Type of building	Status	Number of buildings
Jelgava Town Council	ERDF	multi-apartment residential building	under assessment	2
	ERDF	multi-apartment residential building	realisation	15
	ERDF	multi-apartment residential building	completed	2
	German Federal Ministry for the Environment	multi-apartment residential building	completed	2
Bauska Municipality Council	ERDF	multi-apartment residential building	under assessment	1
	ERDF	multi-apartment residential building	realisation	4
	ERDF	multi-apartment residential building	completed	2
Jēkabpils Town Council	ERDF	multi-apartment residential building	under assessment	7
	ERDF	multi-apartment residential building	realisation	5
	ERDF	multi-apartment residential building	completed	5
	CCFI	pre-school education establishment	completed	1
	ERDF	social care building	completed	1
Ozolnieki Municipality Council	ERDF	multi-apartment residential building	under assessment	6
	ERDF	multi-apartment residential building	realisation	10
	ERDF	multi-apartment residential building	completed	10
	CCFI	pre-school education establishment	completed	2

[33] http://www.zrea.lv/lv/energoefektivitate/ilgtspejigas_energetikas_ricibas_plans_zemgales_regionam/

Participants of Sustainable Energy Action Plan (SEAP)

The main tasks of Sustainable Energy Action Plan is to facilitate the cooperation among local governments and energy sector companies and knowledge and experience exchange between the Covenant of Mayors' local governments[34].

Sustainable Energy Action Plan describes the main planned activities not only in energy saving field, but also in other fields — creation of qualified and permanent employment locally, healthier environment and higher quality of life, improved economic competitiveness and larger energy independence[35].

Currently (September 2013), ¼ of towns in Latvia (19 towns) have signed the Covenant of Mayors, and seven of them have developed and submitted Sustainable Energy Action Plans (two of them have been approved by the European Commission, the other ones are being assessed).

Signatories	Council meeting	Target for CO_2 emission reduction
Ikšķile, LV	28 aug 2013	**20 %**
Kegums, LV	22 mai 2013	**20 %**
Salaspils, LV	24 apr 2013	**20 %**
Tukums, LV	25 aug 2011	**20 %**
Riga, LV	6 jul 2010	**44 %**
Jelgava, LV	25 nov 2010	**20 %**
Jekabpils, LV	11 nov 2010	**20 %**

Table 7.. Submitted SEAPs (Source: http://www.pilsetumerupakts.eu)

Success Model

Clients and building designers lack motivation and knowledge for realisation of the quite complicated Passive House projects. More active involvement by planning regions and building authorities in the implementation of Passive House Standard would improve the awareness of construction market participants about low energy consumption buildings.

Based on the implemented Passive House projects in Latvia, the planning regions must develop guidelines for technical solutions that are accompanied by an investment/saving analysis.

4.2. Other Stakeholders

Latvian Environmental Investment Fund (LEIF) is a State-owned non-profit limited liability company established by the Ministry of Environmental Protection and Regional Development of the Republic of Latvia, whose task is to "attract local and international financial means and grant loans with favourable conditions to municipal and private structures for implementation of environmental protection projects that improve the condition of environment, and support development of environmental protection projects"[36].

The overall goal of the fund is reduction of environmental pollution by facilitating implementation of environmental protection projects and increasing capacity of local governments and capital companies in preparing and implementing quality and efficient environmental projects starting from the project idea until its realisation.

One of the directions of fund's activity is monitoring of implementation of projects funded by the Climate Change Financial Instrument (CCFI) by facilitating efficient and transparent covering of financing by the Climate Change Financial Instrument and performing quality and

[34] http://www.seap-plus.eu/lv/c/seap-method/
[35] http://www.pilsetumerupakts.eu/about/covenant-of-mayors_lv.html
[36] http://www.varam.gov.lv/lat/par_ministriju/padotas_institucijas/?info=16

professional monitoring of implementation of the projects funded by the Climate Change Financial Instrument[37].
More about projects implemented by LEIF: http://www.lvif.gov.lv/?object_id=622

LEIF development cooperation projects:

- Energy Efficient Construction Strategy of Latvia
- Passive House and renewable energy sources regions (PASSREG)
- Sustainable Energy Action Plans — united Europe in energy management
- Bioenergy Promotion 2 — implementation of action plans
- Industrial Energy Efficiency Cluster — LIAA Cluster Programme

More: http://www.lvif.gov.lv/?object_id=288&l=1

Association Passive House Latvija

The aim of the association Passive House Latvija is to unite and coordinate the efforts of Latvian architects, engineers, developers, product and construction material manufacturers, higher education establishments, State and municipal institutions in creating sustainable and low-energy urban and suburban environment and its further development in Latvia; and to influence the activity of State institutions in Latvia regarding issues related to possibilities to cut energy consumption in environmental projects, construction, service of buildings and structures, power industry, and other related fields, by using its right of legislative initiative[38].

Some of the projects:

- Association has concluded a contract, within the PASSREG project, on further organisation of Certified Passive House Tradesperson (CEPH) courses.
- Within the project of the life-long learning programme Leonardo da Vinci, the Austrian partner will share its knowledge in the methods of training for CEPH. By adapting the Austrian experience to the national standards of Latvia and Estonia, a training course will be developed and implemented in these Baltic States.
- The aim of the project "Industrial Energy Efficiency Cluster" is to raise local and export capacity of Latvian manufacturing companies and energy efficiency service providers. More: http://www.klasteris.lv/
- In cooperation with partners, a project "Promotion of the use of sustainable and low energy buildings and constructions in Latvia and Estonia (Active through Passive!)" has been developed; its objective is to reduce the use of energy, thus contributing to a larger energy independence of Latvia and Estonia via using sustainable and low energy building principles. More: http://www.activethroughpassive.eu/lv/
- Within the project "Competence of independent experts in planning energy efficiency policy", professionals in the energy efficiency field assessed the content of national legislation and policy planning documents drawn up by State administration institutions and gave an independent expert opinion regarding more than 10 documents directly related to energy efficiency field.

Association organises various information seminars and regular training on sustainable, low-energy and Passive Houses.
More: http://passivehouse.lv/lv/

[37] http://www.lvif.gov.lv/?object_id=377
[38] http://passivehouse.lv/lv/par-mums/

Association "Latvian Sustainable Building Council" (LIPB) is a member of the World Green Building Council, which unites building professionals and leaders to facilitate public awareness about sustainable building and possibilities of its application.
LIPB objectives:

- education of society and popularisation of sustainable building;
- enhancing of professional knowledge and skills;
- providing consultations and presenting proposals to policy makers in Latvia;
- preparing of information for implementation and assessment of sustainable projects.

LIPB organises also a 10-module course Green Building Professional for building specialists, clients, and other interested persons.
More: http://www.ibp.lv/lv/musu-projekti/

Latvian Energy Efficiency Agency (LATEA) allows its members more active use of their specific knowledge and professional experience by participating in solving different issues of energy efficiency and other related issues. LATEA gives the possibility to participate in particular projects or presenting and implementing new, energy efficient technologies[39].
Implemented projects: http://www.latea.lv/?lang=lat&p=3

Success Model

NGO sector in Latvia is active, and largely financed by EU funds for training and dissemination activities. In future, we will see a great potential in collaboration with universities, and vocational education system, as it defines the general knowledge for workforce in industries.

The closest objective is establishment of regional competence centres with exposition of Passive House examples and construction materials by support of local education establishments and constructors. Since the vocational education system approaches implementation of dual training (with practice), it provides for wide possibilities. Association Passive House Latvija will launch creation of such exposition in 2014, within the framework of Leonardo da Vinci education programmes.

NGO is active in organising training courses and, given available financing, could follow the Brussels' example of free consultation centre, in cooperation with local governments.

[39] http://www.latea.lv/?lang=lat&p=8

5. CAPACITY FOR PLANNING, DESIGN AND CONSTRUCTION

5.1. Training of Local Administration Specialists

MoEPRD Open Door Days in Regions
At the end of September 2013, the Ministry of Environmental Protection and Regional Development of the Republic of Latvia, in cooperation with planning regions and State Regional Development Agency, launched a cycle of visiting seminars and consultations. During the five-week visiting cycle, specialists of local governments in regions were informed on investments and covering of fund financing, to-date issues in planning programmes, and other issues related to the development of local government system.
More: http://www.varam.gov.lv/lat/aktual/aktuali/?doc=17311

Strategies Towards Energy Performance and Urban Planning (STEP-UP, 11.2012–04.2015), within this project the Riga Energy Agency will correct the Action Plans drafted by employees of local governments to significantly exceed the Europe 2020 targets.
Thus, by taking over the best practices, engaging and receiving support from stakeholders (State, entrepreneurs, politicians), planning of sustainable urban environment will be improved, viable technical solutions will be identified according to the individual conditions of each particular town, and innovative projects will be developed. It will result in more efficient integration of knowledge, objectives, and resources among employees of local governments, additional investments, projects, and improved general economic performance.
Currently it is planned to train Tukums, Balvi, and Ogre municipalities.
More: http://www.rea.riga.lv/rea-projekti/starptautiskie-projekti?id=594

Improvement of professional competence of energy staff in Zemgale (07.2013–12.2014) is a project of the EU life-long learning programme "Leonardo da Vinci", which is implemented in cooperation with Zemgale Regional Energy Agency. The objective of the project is to improve the quality of knowledge and practical skills of energy specialists in Zemgale by cooperating with similar organisations or companies in Europe to ensure transfer of knowledge, practical skills, and innovations across EU member states[40].
More: http://www.zrea.lv/lv/jaunumi/zrea_uzsak_istenot_leonardo_da_vinci_projektu/

Success Model
Education and training of employees of planning and development departments at local governments about the Passive House principles and their practical application.

Courses for improving qualification of local governments' architects and building authority staff.

[40] http://www.zrea.lv/lv/jaunumi/zrea_uzsak_istenot_leonardo_da_vinci_projektu/

5.2. Training of Designers and Construction Specialists

Build up Skills — Latvija (EEBR-LV)

Within the project Build up Skills, action plan "Raising of Construction Sector Employee Qualifications and Skills for Achieving Energy and Climate Targets of 2020" has been developed; the plan summarises proposals for raising construction sector employee qualifications and knowledge.

To reach the energy and climate targets of 2020, the Roadmap states that plan provides for the following: *"The Roadmap envisages that short training courses on the construction of zero energy buildings which provide for very low energy consumption in buildings would be necessary for the majority of employees working in the construction sector. The improvement of experienced workers' qualifications can be made over a rather short period of time, for example, by organizing intensive training courses on the building site which can be implemented together with vocational education institutions, study centres, suppliers of building materials and technologies. Likewise, it is necessary to prepare instructors (teachers) for the course."*

The report and Action plan are available at:
http://www.rpr.gov.lv/uploads/filedir/BUS_Roadmap_Latvia_LV_fin_Endorsment.pdf

Courses for Energy Auditors

Professionals working at construction companies, architecture firms and other construction specialists have the possibility to develop professionally by studying the programme "Energy Efficiency Audit of Buildings and Structures". After completing the course it is possible to pass Energy Audit Certification Exams: "Building Energy Auditor", "Heating System Energy Auditor.

The courses are offered by the Further Education Centre of Riga Technical University (RTU), Centre for Life-long Learning of Latvia University of Agriculture, SIA "Ekodoma", LBS Konsultants, and other training organisations.

Further Education Centre of Riga Technical University

The Centre provides high-quality, modern and practical courses for raising education, qualification, and professional competence of construction professionals and related specialists. The programme of courses include training on the methodology of calculating energy efficiency, materials for increasing the energy efficiency of buildings, work technologies and projects, etc.

More: http://ptc.rtu.lv/

Courses for Certified Passive House Designer (CEPH)

The CEPH courses organised by SIA Krauklis&Grende and association Passive House Latvija aim at widening the range of specialists who understand the specifics of designing a passive house and can use the PHPP (Passive House Planning Package) in their professional or everyday work. The study course covers all the necessary information so that qualification of Certified Passive House Designer can be acquired successfully.

More: http://passivehouse.lv/lv/

Latvian Association of Civil Engineers (LACE), LBS Konsultants

LACE unites Latvian civil engineers and organise regular seminars to increase knowledge on energy efficiency of its members and other interested persons.

Some of the seminars:

- energy efficient buildings;
- energy efficient building ware and application technologies of building ware;

- pre-project measures for improving heat insulation of multi-apartment residential buildings;
- a 24-seminar cycle "Energy efficient and environment-preserving construction — from planning to realisation".

More: http://www.buvinzenierusavieniba.lv/index.php

Success Model

To ensure implementation of the Passive House Standard in education system and daily work of construction experts, Passive House Tradesperson and Passive House Designers courses in Latvian will be organised.

Within the Leonardo da Vinci project, translation of the training programme Certified Europe Passive House Designer (CEPH) into Latvian was launched at the end of 2013; the translation will be adapted to the legal regulations and geographical aspects of Latvia and will raise the pedagogic skills of professional education and training institution staff and managers. The CEPH training programme will be started at professional education establishments starting from 2014.
In this way, requirements of the Passive House Standard will become a self-evident part of training, instead of being hard to advertise and expensive. Having attended the course and passing the exam one will acquire a certificate, which is an official education document proving one's competences and being recognised in Latvia and abroad.

At the end of 2013, the association Passive House Latvija launched training of Passive House Tradespersons in Latvian, in cooperation with Latvian Environmental Investment Fund and Vidzeme University of Applied Sciences. The content of course is oriented towards raising competence of construction company designers and managers of construction and engineering works when implementing Passive House projects.
Course structure:
http://www.passivhaus-handwerk.de/upload/120718_Course_Structure.pdf

5.3. Other Training and Education Measures

Education Establishments

Latvia University of Agriculture (LLU), Riga Technical University (RTU) Institute of Energy Systems and Environment (VASSI), Vidzeme University of Applied Sciences (ViA), Riga International School of Economics and Business Administration (RISEBA), and Rēzekne University offer construction and architecture students separate courses on designing NZEB, sustainable and energy-efficient solutions, and new building materials. Also vocational secondary education establishments offer training of students in eco-building — Vidzeme University College programme and Ērgļi Vocational Secondary School.

Riga Technical University (RTU)

Institute of Energy Systems and Environment (VASSI) offers Environment Science Study programmes of bachelor, master, and doctor level, performs scientific research and participate in local and international projects to facilitate development of sustainable technical solutions and environmental development.
Some of the projects:

- Project "Compact solar and pellet module";
- Project "System Thinking Integration in Environmental Policy";
- IZM-RTU scientific research project "Modelling of Solar Combisystems for Heating Systems of One-family House";

- IZM-RTU scientific research project "Optimisation of Distributed Energy Generation".

VASSI, in cooperation with the RTU Further Education Centre, offers to any interested person to study Environmental Engineering Programme free of charge since 2006. The course covers such topics as pollution, clean manufacturing, energy, renewable energy sources, climate technologies, eco-design, and other.
More: http://www.videszinatne.lv/

Information campaign "Let's Live Warmer!" organised by the Ministry of Economics of the Republic of Latvia

The information campaign "Let's Live Warmer!" was launched to facilitate local cooperation in and learning about building renovation among the non-governmental organisations, commercial banks, State administration institutions, and apartment owners, to develop the communication and cooperation network among the social partners, entrepreneurs, and apartment owners, to raise the awareness about energy saving measures, and to inform about the support from the EU funds for renovation of multi-apartment residential buildings, and optimum measures in building renovation and high-quality construction.
Over three years, more than 175 information activities have taken place throughout Latvia — various public discussions, conferences, exhibitions, seminars — where more than 8500 people participated. Part of the seminars were also broadcast on-line on the Internet, and video materials can be found at *www.youtobe.com/siltinam* and *www.vimeo.com/dzivosiltak*. The activities have been organised on various topics — necessity to improve the technical condition of one's house, decision-making process at general meetings of apartment owners, performing of high-quality renovation of buildings, sharing experiences about already renovated buildings, and other[41].

Success Model

Non-governmental organisations shall develop new and improve the current construction and energy management education programmes, in cooperation with universities, vocational secondary schools and competence centres.

Regular training seminars are also necessary for educating Passive House end-users — operators and inhabitants.

[41] http://www.nozare.lv/atbalsts/item/FC46828B-CE26-48FC-B3D3-999539850DA5/

6. MARKET FOR PASSIVE BUILDINGS

According to the information provided by the Passive House Institute web page (updated in July 2013), there are no certified passive buildings in Latvia, there are also no certified buildings with passive elements, although several objects have been successfully implemented, see in Successful practices.
The main obstacles why Passive Houses enter the Latvian construction market so slowly are connected with the economic situation (Latvia is the third poorest country in the EU) and private property rights — apartment owners in multi-apartment residential buildings could not agree on the necessity of measures to be taken and did not believe in the investment return — good work quality and result.

Figure 16. shows the distribution of heat energy consumption in multi-apartment residential buildings in Latvia. Only some of the newly erected buildings have been designed and built to ensure that energy consumption for heating is less than 45 kWh/m2 per year, and even smaller number of them corresponds to the parameters of NZEB or Passive House.

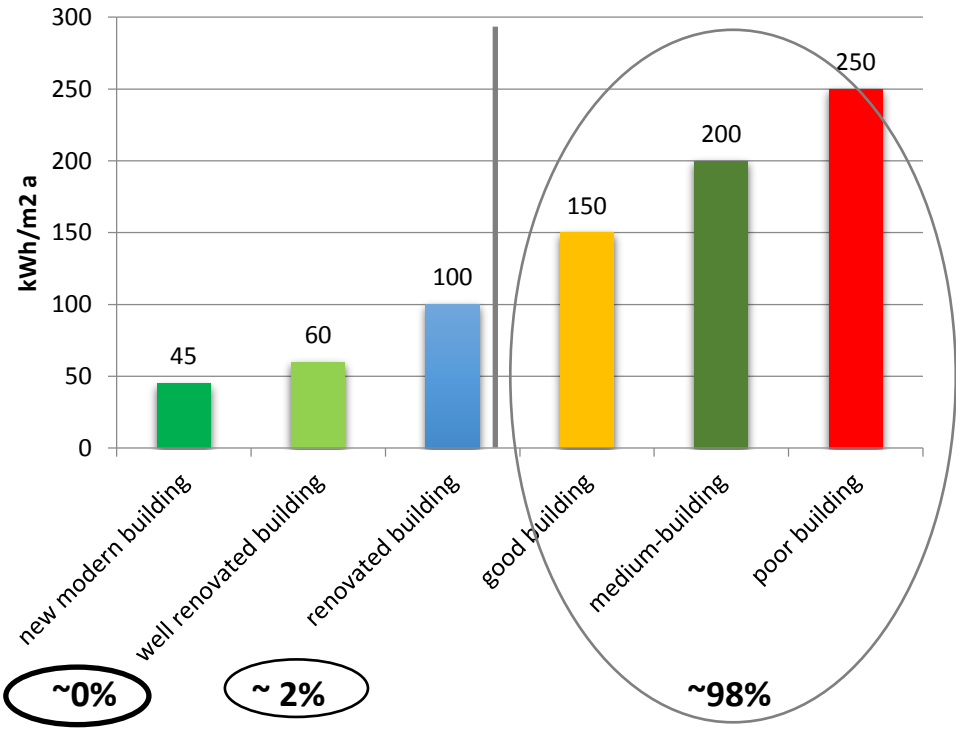


Figure 16. Consumption of heat energy in multi-apartment residential buildings. Source: http://www.latea.lv/userfiles/images/pdfi/Konference_Energoefektivitate/prezent_Ekon_ministrija.pdf

See the certified distributors of Passive House construction elements in Appendix II.

Success Model

Only 3% of all multi-apartment residential buildings in Latvia can be considered corresponding to the thermal technical requirements of current legislation. The energy consumption for heating in majority of Soviet-time multi-apartment residential buildings exceeds 150 kWh/m^2 per year; renovation of these buildings to reach the Passive House

criterion of 15 kWh/m^2 is practically impossible and would require extremely large investments. Thus, application of EnerPHit (Quality-Approved Energy Retrofit with Passive House Components) standard would be more suited for Latvia. Application of complex solutions with Passive House elements may yield even 75–90% reduction of specific heat energy consumption.

According to Directive 2010/31/EU, all public and social State-owned buildings will be low-energy buildings, meaning they will have to comply with NZEB or Passive House Standards, irrespective of market development model. Development of training and cooperation models should be supported so that this process is of the highest possible quality.

It is expected that private building market will be commercially attractive given appropriate offer, and it will need no special support mechanisms.

7. SUCCESSFUL PRACTICES

Currently (October 2013) there are 10 Certified Passive House designers and 4 Certified Passive House Consultants in Latvia. The next Passive House Designer training course is planned for 2014 (the previous courses took place in 2012 in English). The first Passive House Tradesperson training course will take place at the end of 2013 (more in Passive House Courses).

"Most Energy Efficient Building in Latvia"

Starting from 2010, the Ministry of Economics in cooperation with the Ministry of Environmental Protection and Regional Development organises competition "Most Energy Efficient Building in Latvia" within the information campaign "Let's Live Warmer!". The objective of the competition is to facilitate the good practices in building energy efficiency field by constructing energy efficient buildings, performing building renovation and reconstruction, thus reducing the amount of carbon emission and raising public awareness about the building heat resistance and significance and possibilities of reducing greenhouse gas emission to create a high-quality architectonic living space[42].

"Most Energy Efficient Building in Latvia" nominations:

- Most Energy Efficient Renovated Multi-apartment Residential Building in Latvia;
- Most Energy Efficient Renovated Multi-apartment Residential Building in Latvia;
- Most Energy Efficient Newly Erected Public Building;
- Most Energy Efficient Newly Erected Public Building;
- Most Energy Efficient Newly Erected Single Family Residential Building;
- Most Energy Efficient Manufacturing Building in Latvia.

Residential building "Lielkalni", Ģipka, Roja rural territory[43] — the first building in Latvia with Passive House elements

It was designed in 2007–2009, completed in 2010; architect — Ervins Krauklis, "Krauklis Grende". The construction of load-bearing walls consists of ceramsite concrete blocks and has been insulated with a 500 mm mineral cotton layer, the roof construction — a 600 mm mineral cotton layer in timber roof trusses.

Characteristics: U_{wall}=0.065 W/m^{2}K, U_{roof}=0.068 W/m^{2}K, U_{floor}=0.049 W/m^{2}K, $U_{windows}$=0.8 W/m^{2}K; U_{doors}=0.9 W/m^{2}K, energy consumption for heating — 15.6 kWh/m^2 per year. The object received the award "Most Energy Efficient Newly Erected Single Family Residential Building 2010".

[42] http://www.energoefektivakaeka.lv/index.php?option=com_content&view=article&id=110331&Itemid=80
[43] http://www.em.gov.lv/images/modules/items/LB_2009_pirma.pdf

Figure 17. "Lielkalni" — the first building in Latvia with Passive House elements. Source: Architect Ervins Krauklis

Figure 18. "Lielkalni" — the first building in Latvia with Passive House elements. Source: Architect Ervins Krauklis

Figure 19. "Lielkalni" — the first building in Latvia with Passive House elements. Source: Architect Ervins Krauklis

CCFI Competition "Low Energy Consumption Buildings"

In summer 2011, the CCFI open tender "Low Energy Consumption Buildings" was announced. By implementing the project, the energy consumption for heating could not exceed 35 kWh/m^2 per year. In total, 82 projects were submitted, 31 project with total available CCFI financing in the amount of EUR 10,332,499 (LVL 7,261,722) was approved, but only 14 projects were implemented thus covering 49% or EUR 5,016,662 (LVL 3,525,730) of the available CCFI co-financing (7 objects have been completed, and 7 are being implemented).

"Daugaviņas" in Tīnūži, Ikšķile Municipality[44] — Single Family Passive Residential Building

The object was implemented in 2012; architect — Ervins Krauklis, "Krauklis Grende". The building was constructed with the support of CCFI open tender "Low Energy Consumption Buildings". Total construction costs without VAT amounted to EUR 126,306 (LVL 88,769), including EUR 41,388 (LVL 29,088) co-financing by the CCFI. The total area — 158.5 m^2, heated area — 98.5 m^2, load-bearing constructions — timber frame with a 400 mm insulation layer. The pressure test before installing the fireplace and ventilation system outputs gave the result of 0.09 h-1 (PHPP value — 0.6-1), specific heat energy consumption — 17 kWh/m^2 per year.

Figure 20. "Daugaviņas", northern elevation. Source: Architect Ervins Krauklis

Figure 21. "Daugaviņas", southern elevation. Source: Architect Ervins Krauklis

[44] http://www.em.gov.lv/images/modules/items/LatvijasArchitektura-01_02_2012_daugavinas.pdf

Passive Office Building in Liepāja[45]

The building was constructed with the support of CCFI open tender "Low Energy Consumption Buildings", the object was completed in 2013. Total project costs amounted to EUR 269,840 (LVL 189,645), including EUR 103,798 (LVL 72,950) co-financing by the CCFI. Vacuum insulated panels with nominal heat transfer coefficient of 0.007 W/(m*K) were used for insulation of outer walls. The estimated heat energy consumption is 13.80 kWh/m^2 per year.

Figure 22. Passive Office Building in Liepāja[46]

Figure 23. Passive Office Building in Liepāja[47]

Some of the winners of "Most Energy Efficient Building in Latvia 2013":

- Ventspils City Council building — annual space heat demand 12 kWh/m2a;
- Ventspils City Council building — annual space heat demand 25 kWh/m2a;
- Office building in Liepāja — annual space heat demand 13.8 kWh/m2a;
- Dormitory of Ērgļi Professional Secondary School — annual space heat demand 16 kWh/m2a.

[45] http://building.lv/news/541-aktuali-jaunumi/122183-pasiva-biroja-eka-liepaja
[46] http://building.lv/news/541-aktuali-jaunumi/122183-pasiva-biroja-eka-liepaja
[47] http://building.lv/news/541-aktuali-jaunumi/122183-pasiva-biroja-eka-liepaja

Success Model

Majority of projects with Passive House elements have been implemented in Latvia by co-financing of the CCFI open tender "Low Energy Consumption Buildings", announced in 2011. The next similar financial support for NZEB is planned in 2014 within the EEA FM open tender "Development of sustainable buildings, renewable energy sources technologies, and innovative emission-reducing technologies"; however, this co-financing will not be available to private and multi-apartment residential buildings. Implementation of support mechanisms (similar to CCFI and EEA FM) for increasing energy efficiency of residential property to reach the Passive House or EnerPHit standards would facilitate the implementation of Passive Houses.

Taking into account that majority of multi-apartment residential buildings in Latvia are standardised buildings, it would be beneficial for preparation works to develop sample document for the most popular types of residential buildings. At the beginning of 2014, REA started development of sample projects for 12 standard serial multi-apartment residential buildings. The document package includes energy audits, technical inspections and renovation technical projects, which can be used by associations of multi-apartment residential house owners, building managers and operators, as well as ESCO, when preparing application for renovation of a particular building. Such drafting of renovation projects for standard buildings should be performed in line with Passive House Standard, since the REA's objective matches the one of Riga Development Strategy providing that heat energy consumption has to be reduced to 150 kWh/m^2 by late 2020.

8. PUBLICITY AND PUBLIC SUPPORT

8.1. Communication Strategy

Communication strategy includes targeted development of all regions in Latvia to reach the EU 20-20-20 objective, providing that starting from 2020 all newly erected buildings will be NZEB using renewable energy sources. To achieve this objective, the level of information and knowledge about NZEB/Passive Houses of all participants involved in the construction process has to be raised.

Main stakeholders:

- the existing Passive House experts (designers, constructors, Passive House element representatives, NZEB owners);
- representatives of planning regions and local governments;
- education establishments (universities, vocational secondary schools — staff and students);
- Passive House project designers (civil engineers, architects, engineering system designers);
- Passive House project implementers (construction work managers, building supervisors, tradespersons);
- society (end-users of Passive Houses).

Strategy implementation tools:

- Internet environment (information publications, activities on social networks);
- organising seminars to raise competence of participants of the construction process;
- development of study materials, organisation of training courses, certifying of Passive House specialists;
- visits to real NZEB, information on actual costs and the achieved result.

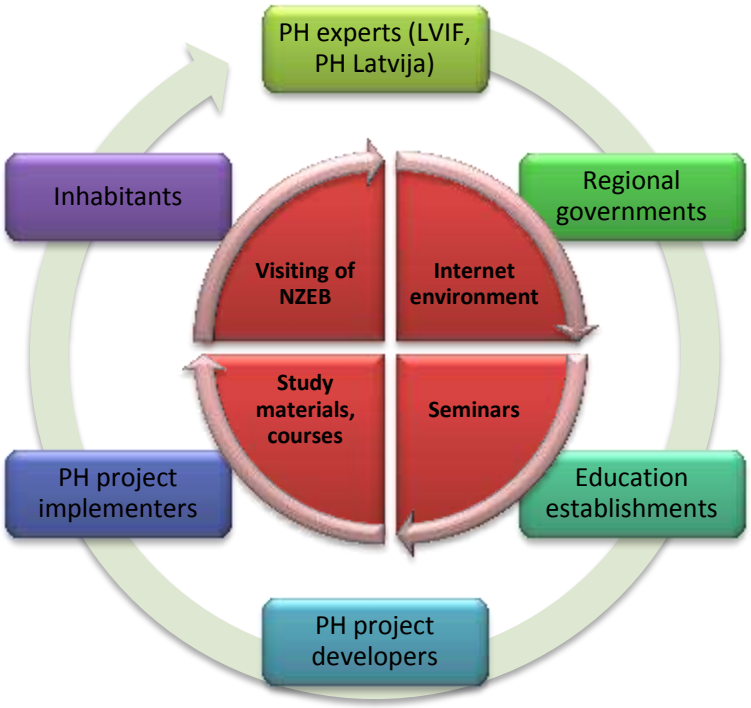


Figure 24. Communication strategy

8.2. Communication Plan

Communication plan for implementing Passive House and NZEB regions in Latvia is based on the activities planned and implemented within the PassReg project. After the project is completed in 2015, the measures will be continued to achieve the EU targets by 2020.

Table 8. Communication plan

Competent authority	Target audience	Measure	Activity	Result	Duration
LEIF, regional governments	Employees of regional governments	Introduction of Passive House/NZEB standards in regional development plans	Information seminars	Educating of employees of regional governments in Passive House field	2013 – 2017
LEIF, regional governments, Passive House owners	Any interested party	Passive House open door days	Visiting of objects	Increase of society interest (market participants) about Passive House	2013 – 2020
LEIF, regional governments	Any interested party	Regional Energy Days	Information seminars, visiting of objects	Educating of regional market participants, awareness of current developments in Latvia and abroad	2012 – 2020
LEIF	Any interested party	PassReg reports	Electronic reports on Internet (web page — which?)	Educating of market participants, awareness of current developments in Latvia and abroad	2012 – 2015
LEIF	Any interested party	Creation of PassReg platform	Web page	Educating of market entrants, awareness of current developments in Latvia and abroad	2014 – 2020
PH Latvija	Construction work managers, building supervisors, tradespersons	Courses “Passive House Tradesperson”	Training courses	Increase in number of Certified Passive House Tradespersons, construction of high-quality Passive Houses	2013 – 2015
PH Latvija	Civil engineers, architects, engineering system designers	Courses “Passive House Designer”	Training courses	Increase in number of Certified Passive House Designers, preparation of high-quality Passive House project	2013 – 2015
PH Latvija	Vocational secondary schools, universities	Implementation of Passive House Standard in higher education establishments	Development/improvement of study courses, stressing the Passive House/NZEB	Raising qualifications of staff and students in the Passive House field	2014 – 2020

8.3. Communication activities within the project

Within the Regional Energy Days, information seminars have taken place in Balvi and Rēzekne Municipalities about the latest innovations, solutions, and accomplishments in the field of Passive House and renewable energy sources. Summary of the seminar results reveals positive trend — great interest from local governments, as the State sector will be the first one which the Energy Performance of Buildings Directive 2010/31/EU about newly erected buildings according to NZEB standard will apply to. Also representatives of regional universities and vocational secondary schools were active in seminar discussions, which means that education establishments are ready to cooperate and train smart NZEB specialists.

Success Model

Passive Platform

In Latvia currently there is a lack of unified database about the implemented NZEB projects, used solutions, and certified technology suppliers. It is necessary to create a national NZEB and Passive House database in Latvian, which would collect and systemically update information on NZEB and Passive House related topicalities in Latvia and abroad. The Passive House Platform would be based on PassReg objectives and information database, which is suited to the characteristics of the Latvian building market. Passive Platform target audience — all construction employees, education establishments, regional development departments, and constructors. Such official Passive Platform would be a sign of quality for Passive House constructors (designers and tradespersons), and NZEB end-users (owners and tenants).

Content of Passive Platform

- International content:
  - PassReg project information EN-LV;
  - information links, In the spotlight in abroad;
  - authorized translations from different sources
- Regional content:
  - original articles;
  - Latvian data base of PH, NZEB and low energy buildings;
  - Latvian data base of CEPH, and Tradespersons;
  - Tradesperson training course promotion;
  - PHPP info and course promotion;
  - Blogs
- Communication:
  - promotion of trainings;
  - linking the information;
  - use of different channels.

Regional Energy Days

Organisation of Regional Energy Days should be continued in cities and municipal governments to inform society and local entrepreneurs on the topicalities in NZEB/Passive House sector by organising seminars, discussions, and training and offering possibilities to visit newly erected or renovated NZEB buildings.

Findings by other regions:

Brussels — awareness raising, including building tours, literature, etc. Issue of magazines and PH fairs for professionals and general public, symposiums for construction professionals.
Tyrol — Public awareness raising initiatives where there was concern that consumers did not understand new technologies (e.g. MVHR).

9. QUALITY CONTROL

How to ensure work quality on site?

The quality of construction works in Latvia is regulated by legislation, national building regulations, and legislation for quality of construction works. It is of primary importance to develop sufficiently detailed technical specification (task), since every following construction process directly depends on the quality of prior works.

Before designing NZEB and Passive House, architects, engineers, energy consumption specialists have to prepare specifications, giving detailed description of all the important conditions and works that are necessary for successful implementation of an energy efficient project, and which can be directly used by constructors when performing works.

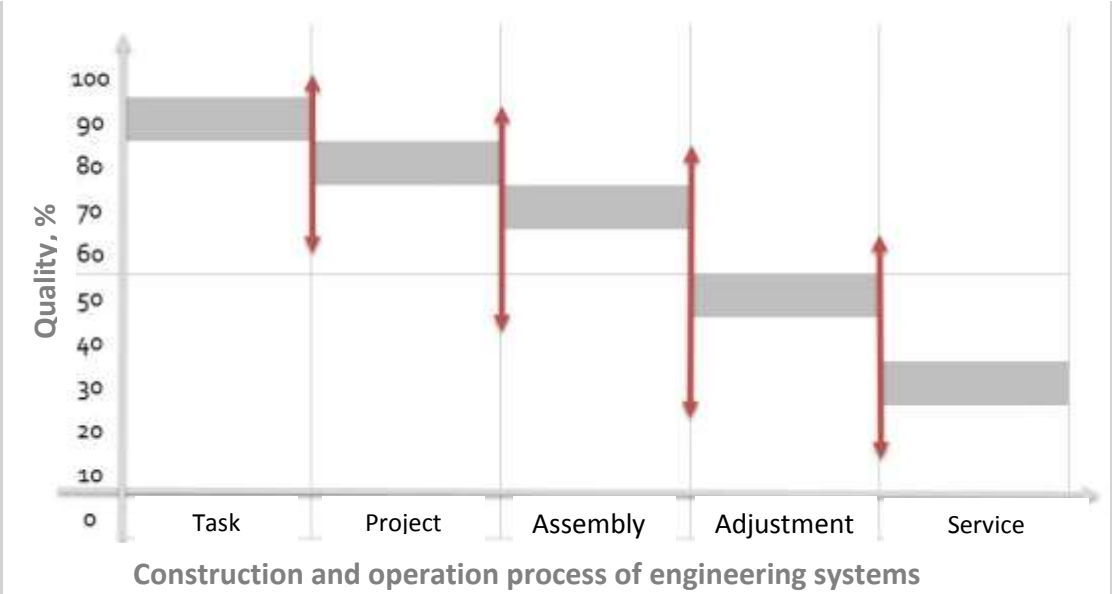


Figure 25. From idea to results

Cabinet Regulation No. 112 General Construction Regulations sets forth that a building contractor and each company is responsible for the quality of the construction work and shall develop a quality control system for construction work in conformity with the profile, type and scope of the work to be performed.

Construction material manufacturer SIA Sacret performs tests of materials and building ware manufactured by company itself and other manufacturers according to EOTA (www.eota.eu) certification document ETAG 004, which guarantees compatibility of insulation system products and high-quality end result. To help architects, designers, building supervisors, clients and constructors, manuals for installation and designing insulation systems have been drafted. However, ETAG standard is not applicable to insulation constructions thicker than 200 mm with separate fastener system, usually it is a challenge to building contractor and constructors both on the design and implementation stages.

Work list for assuring quality of NZEB and Passive House:

- training for work managers and workers;
- selection and purchase of construction materials;
- site management and quality control of building ware;

- high-quality construction work — without thermal bridges;
- controls of uniformity of insulation layer to eliminate thermal bridges;
- building envelope air tightness testing;
- ventilation system air tightness and other parameters testing;

The Latvian Sustainable Building Council has drafted BREEAM sustainable building criteria for evaluation and certification of commercial buildings (office, retail and industrial buildings) in Latvia. In comparison to BREEAM original, the Latvian version provides for compliance with Latvian legislation, and also changes several parameters specific to Latvia. These BREEAM criteria gives the idea about all aspects that must be taken into account in planning, designing, constructing, and using a sustainable building.

Control of specialists' competence and quality in architecture, design, construction, and site supervision is evaluated during the certification exam. CEPH and Certified Passive House Tradesperson courses will ensure examination and evaluation of knowledge about NZEB and Passive House solutions.

Monitoring

For a Passive House to perform as it has been planned in the project, it is mandatory to teach the operators and inhabitants of the building how to "treat" the Passive House after the commissioning. Otherwise, a situation may arise when the actual energy consumption of the building exceeds the estimates for several times. Most often errors are caused by incorrectly adjusted ventilation and/or heating system, arbitrary opening of windows and other habitual practices.

Inhabitants should be familiarised with the basic principles of Passive House designing (for example, functions and importance of shading). It is also mandatory to perform regular service and examination of heating and engineering systems (register, schedule, etc.).

Success Model

Freely available information on building classification, their characteristics, and certified and competent Passive House specialists and energy auditors (in the new wording of law — independent experts) should be placed at building authorities.

Mandatory requirement — presenting of temporary certificate for project acceptance and for simple renovation and insulation projects, actual performance of building certificate register (responsible authority — Ministry of Economics of the Republic of Latvia), similar to Land Registry, for example.

Realisation and commissioning— the building supervisor responsible for the quality of construction works must be well-informed about the specifics of Passive House construction, errors made most often, and quality solutions for eliminating the current problems/errors. Also quality performance control of construction works by the client representative — author supervisor — is advised. Verification of control data of formal acceptance has to be developed and performed — for example, during the construction process at least two air permeability tests (one — after constructing the building envelope, when the vapour barrier and windows have been installed, but before interior finish; the other — before putting the object into service) should be performed, adjusting of systems in line with the requirements of the project, etc.

The availability of Passive House and EnerPHit certification in Latvia should be facilitated by creating local certifying institutions, and also LEED and BREEAM certification systems should be popularised.

Building certification, which is available in terms of cost, must be developed, because one of the reasons why none of the Passive Houses in Latvia is certified is the high price for certification procedure.

Findings by other regions:

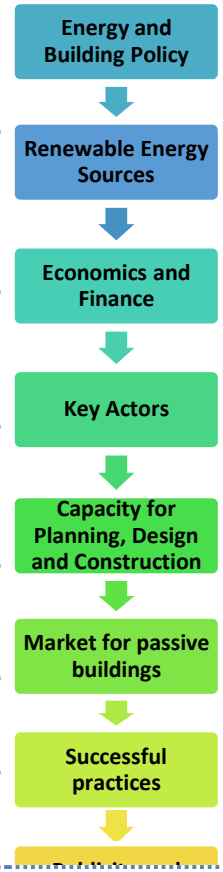
Wales:
Introduction of competent person scheme for the specification and installation of domestic MVHR systems.
Set requirements for as-built testing data to be submitted to Building Control to help prove performance, e.g. air pressure tests, MVHR commissioning tests, photographic evidence of build process, including detailing for thermal bridging, etc.
While independent 3rd party verification of Passivhaus buildings is beneficial, it would be costly to carry out this process in addition to standard regulatory approval procedures. May need to adapt existing calculation and certification approach of PH to gain acceptance in UK/ Wales.

10. ROADMAP

10.1. SWOT Analysis

Key strengths of the Success Model	Weaknesses of the Success Model
1) Positive experience in implementing building energy efficiency programmes in 2007–2013 planning period — successfully implemented Passive House projects, which serve as best practice examples 2) Raising interest and awareness of the society about improving of building energy efficiency and Passive Houses 3) Interest of process participants (constructors, manufacturers of construction materials, dealers) in implementing energy efficiency measures 4) Large potential to save energy resources in all sectors (residential, public, manufacturing buildings)	1) High costs for attracting financial resources (interest rates) from commercial banks 2) Public utility debts of building owners and credit liabilities for purchasing residential buildings, which limit the possibility to undertake new liabilities or receive loan from bank 3) Insufficient number of professionals (building operators, energy auditors, designers, construction workers) 4) Lack of qualified labour force 5) Low quality of construction works and lack of construction quality control
Favourable opportunities	**Threats and risks**
1) Possibilities for the development of energy service market 2) Possibilities for the development of public and private partnership 3) More efficient use of local and renewable energy sources would reduce dependence on imported energy sources 4) Rise of price for energy sources can shorten the term for investment return 5) Ensured sustainability of residential property 6) New and wide opportunities for entrepreneurship — in construction and operation of buildings	1) Deterioration of demographic situation threatens the investment efficiency 2) Low quality of construction works and failing to achieve the estimated level of energy saving

10.2. Roadmap



- National support to monitoring of existing energy consumption
- Application of Passive House Standard at national level with regional climate data
- Creating of local governments' examples and introduction of support mechanisms for implementation of NZEB (nearly zero-energy building) standards
- Implementation of real financial mechanisms

- Drafting of action plans for local governments, for example, within SEAP
- Establishment of energy agencies and position of Regional Energy Manager and their active operation in all regions and largest cities in Latvia
- Close cooperation of local governments' energy specialists and building authorities

- Improvement of macroeconomic understanding by reducing heat expenses to 10% of the average household income
- Establishment of energy suppliers' profit savings fund for subsidies and loans for implementing energy efficient measures
- Long-term planning of bank financial instruments
- Efficient tax policy for building reconstruction and renovation

- Grants to people with low income
- Verification and application of ESCO model to newly erected buildings
- Low or "0" interest rate for constructing and reconstructing to low energy goal Taking over of foreign examples: "House of Tomorrow" — grants for NZEB and renewable energy sources projects costs of which are not very different from costs of constructing a regular building

- Active engagement of planning regions and building authorities in implementation of Passive House Standard
- Drafting of guidelines for technical solutions and investment/saving analysis
- Collaboration with universities, and vocational education system

- Establishment of regional competence centres with exposition of Passive House examples and construction materials by support of local education establishments and constructors
- Participation of NGOs in organising training courses, establishment of a free consulting centre

- Training of employees of planning and development departments at local governments about the Passive House principles and concept
- Courses for improving qualification of local governments' architects and building authority staff
- Regular training seminars for end users — managers and inhabitants

- Organisation of Passive House Tradesperson and Passive House Designers courses in Latvian
- Development of training programme about competence centres and energy management in the result of cooperation among NGOs and universities and vocational secondary schools

- Application of the EnerPHit standard to current buildings (built during the Soviet period) by using complex solutions with Passive House elements thus reaching 75–90% reduction of specific heat energy consumption

- To public buildings — NZEB after 2018
- The private building sector shall develop under favourable market conditions without attraction of additional funding

- Implementation of support mechanisms (similar to CCFI and EEA FM) for increasing energy efficiency of residential property to reach the Passive House or EnerPHit standards thus facilitating implementation of Passive House

- Drafting of renovation solutions for standard serial buildings and projects with Passive House elements

- Creation of a national NZEB and Passive House database in Latvian, which would collect information on NZEB and Passive House related topicalities in Latvia and abroad

- Open door days at Passive Houses in regions
- General public education measures — campaigns in mass media

- Information on building classification and certified or competent specialists must be available at building authorities
- Mandatory Temporary Certificates for project approving and simple renovation of insulation projects, real performance of building certificate register
- Development of control data and verification thereof during formal acceptance of the object (air permeability tests, adjustment of systems)
- Quality control of building and author supervision and performance
- Availability of Passive House and EnerPHit certification in Latvia
- Popularisation of LEED and BREEAM certification systems
- Practical services provided by competent heating and ventilation system experts in regions
- Wider range of documents for putting building into operation
- Author and construction supervision

APPENDIX I

Parameters of Construction Market (Economics and Finances)

Source: Informative report on financing solutions for building renovation, 04.06.2012, Ministry of Economics

In total, 1.35 million buildings have been registered in the National Real Estate Cadastre Information System (NĪVK IS), with total area of 198 million m^2, including various auxiliary buildings. Out of the total number of buildings, approximately 400 thousand buildings use energy for regulating the micro-climate in building (they are heated), including 352.4 thousand residential buildings with the total area of 86.9 million m^2[48]. One-apartment buildings are the largest proportion — 85% (300.7 thousand) of buildings, but according to area, the proportion of one-apartment buildings amounts only to 39%, but the highest proportion 58% (50.4 million m^2) is taken by multi-apartment (three and more apartments) residential buildings, although their number constitutes only 11% (38.6 million) of buildings. According to provisional population census in 2011, in Latvia there are 988 thousand residential buildings, including 680 thousand (68.8%) multi-apartment residential buildings, 285 thousand (28.9%) are individual residential buildings, 16 thousand are twin or terraced houses. In total, 5 thousand buildings were not determined type of building and 1.5 thousand buildings were listed as non-residential buildings in the population census.

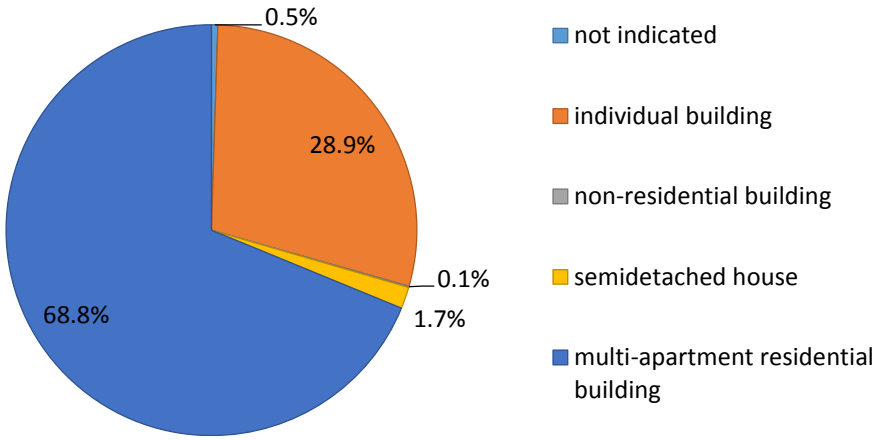


Figure 2. Proportion of residential buildings by type of building

If looking at the proportion of residential buildings by their type, majority of buildings — 303 thousand (86.1%) — are owned by natural persons, 25.6 thousand (7.2%) — by owners of various status (mixed ownership), 7.7 thousand — by legal persons, 5.4 thousand (1.5%) by local governments, 0.37 thousand (0.1%) — by the State, 10.2 thousand (2.9%) — the ownership status has not been established, according to NĪVK IS[49].

[48] Data about area of residential buildings registered with NĪVK IS differs from the data of the Central Statistical Bureau (CSB) on the residential property, since NĪVK IS accounts the total area of registered residential buildings, but residential property register only accounts the total useful space, without halls, stairways, basements, and other common area of residential or non-residential buildings. According to CSB data, the residential property was 61.1 million m^2 at the end of 2009.

[49] Data by the ownership status as of January 2011

Table 1. Distribution of residential buildings by ownership, number

Owner / Type of residential building	Natural person	Legal person	Local government	State	Mixed ownership	Ownership not determined	Total
One-apartment	282,380	5257	2447	163	832	9617	300,696
Two-apartments	9440	427	407	12	1919	160	12,365
Three- or more apartments	11,348	1846	2170	73	22,780	382	38,599
Various social groups	79	150	325	125	14	13	706
Total	**303,247**	**7680**	**5349**	**373**	**25,545**	**10,172**	**352,366**

In relation to heat engineering situation, the current building sector can be divided in the following periods:

Until 1940	Pre-war building; in rural territories — timber, in urban territories — brick wall. Majority of buildings do not have more than two floors.
1941–1960	Post-war building; the period is known for its good quality buildings, mainly of bricks; the residential sector is characterised by the Stalin-time standard project brick buildings.
1961–1979	Expansion of standard building, construction of standard multi-apartment residential buildings No. 316 and 318 (the so-called "Khrushchyovka"), standard buildings No. 467, 103 and 104, and at the end of the period also standard buildings No. 602. Clay bricks, aerated concrete, ceramsite concrete were widely used material for walls.
1980–1991	New requirements were included in the USSR Building Code "Heat Engineering of Building Envelopes"[50]. Construction of standard buildings No. 119 was started, and series of special projects were implemented, the sector is dominated by reinforced concrete and ceramsite concrete large-panel buildings.
1992–2002	Construction of standard buildings is practically terminated. According to the Ministry of Architecture and Construction of the Republic of Latvia Order No. 68 of 12 September 1991, requirements for building envelope were significantly increased.
From 2003	The standard LGN 002-2001 Thermotechnics of Building Envelope comes into force, which sets forth the requirements for heat engineering of building envelopes[51]. During this period, buildings with large glass areas emerge, thus these buildings rarely complies with the LBN requirements; however, this tendency is not present in residential buildings.

[50] СНиП II-3-79 Строительная теплотехника" (Construction Heat Engineering), СНиП II-3-79 2. Теплоустойчивость ограждающих конструкций (Part II — Heat Engineering of Building Envelope).
[51] Cabinet Regulation No. 495 "Regulations Regarding Latvian Construction Standard LBN 002-01 Thermotechnics of Building Envelopes" of 27 November 2001

Table 2. Normative values of heat transfer coefficient U for building envelope of residential buildings and heat energy consumption in buildings built in line with the normative

Construction elements			**1980**	**1992**	**2003**
Roofs and ceilings in contact with external air		*W/ (m²·K)*	0.90	0.25–0.40	0.2 k*
Floor slabs			-	0.5	0.25 k
Exterior walls with weight less than 100 kg/m²			1.1	0.33–0.50	0.25 k
Exterior walls with weight 100 kg/m² and more					0.3 k
Windows, doors			2.4	1.9–2.4	1.8 k
Thermal bridges			-	-	0.2 k
*Temperature factor **k** = 19/($T_{interior}$ – $T_{exterior}$), depending on the climate zone					
Energy consumption for heating	**kWh/m² per year**		**150–200**	**100–130**	**70–90**

Characteristics of building envelope of buildings constructed both before and after the war are usually based on building engineering physics calculations, which are aimed at eliminating humidity forming on the inside surface of outside walls to prevent freezing of outside walls. The value of heat transfer coefficient U for correctly constructed buildings is usually not less than 1.3 [W/(m² K)]. Research suggest that heat engineering characteristics of building envelope of standard buildings constructed during the USSR period are usually 0.8–1.2, but there are cases when the actual U value for outside walls is up to 2.0 [w/m² K)][52].

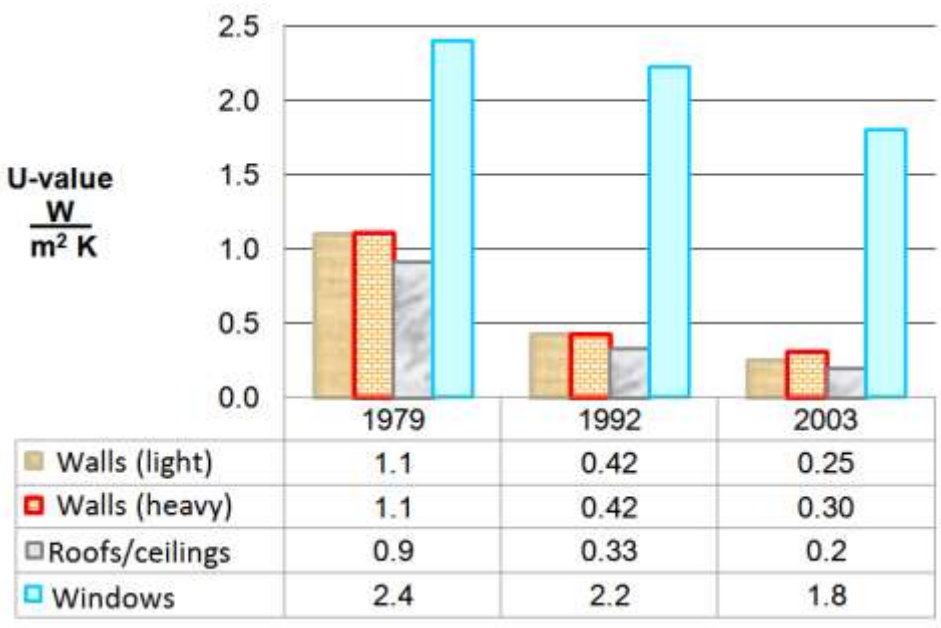


Figure 3. Changes in normative requirements regarding heat engineering characteristics of building envelope from 1979.

[52] A. Jakovičs, S. Gendelis, H. Truemmann. Analysis of heat losses from typical buildings in Riga. International scientific colloquium 'Modeling for saving resources' — Riga, 2001, pp 190–197

Only 3% of buildings according to number and 5% of buildings according to area have been built after 2003 and may be regarded as corresponding to the current effective requirements for heat engineering. The heat engineering characteristics of buildings constructed from 1993 to 2002 are only slightly lower. At the same time it should be marked that normative heat engineering requirements are not always fulfilled due to the low-quality construction works and errors made in the construction plans.

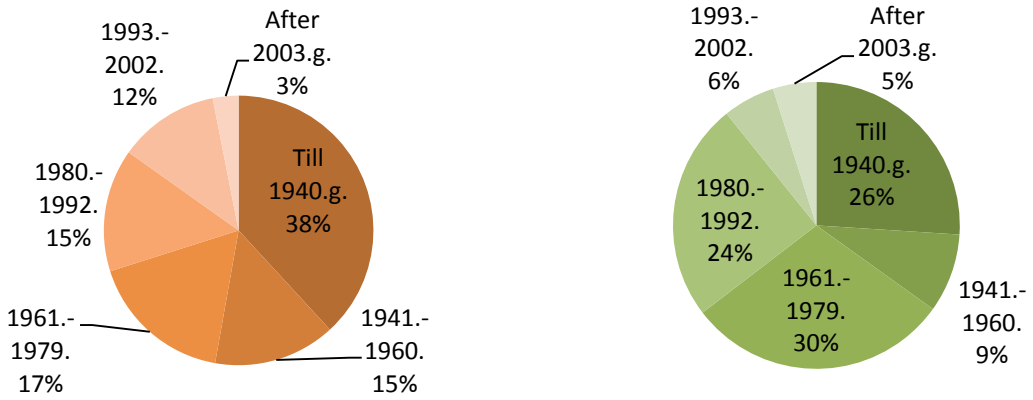


Figure 4. Multi-apartment residential buildings by number and area depending on the construction period. Source: NĪVK IS

From the previously constructed buildings, the buildings completely reconstructed or renovated after 2003 should comply with the current effective heat engineering requirements. Assessment of the CSB data on the number of building permissions issued for the reconstruction of residential buildings suggests that 2–3% of one-apartment buildings and 1–2% of two-apartment buildings have been renovated since 2003.

APPENDIX II

Certified Distributors of Passive House Construction Elements in Latvia

	Product	Representative	Contact information
Wall systems	EnerPHit wall systems	SIA Saint-Gobain Celtniecības Produkti	Daugavgrīvas iela 83, Riga, LV-1007, Latvia www.isover.lv
	STEICO-Bausystem	SIA VIDES TEHNIKA	Maskavas iela 322D, Riga, LV-1063, Latvia www.videstehnika.lv
	ISOVER Massivbausystem für Passivhäuser (mit hinterlüfteter Fassade) ISOVER Holzbausystem für Passivhäuser (mit hinterlüfteter Fassade) etc.	SIA Saint-Gobain Celtniecības Produkti	Daugavgrīvas iela 83, Riga, LV-1007, Latvia www.isover.lv
	Rockshell	SIA Rockwool	Ropažu iela 10 Riga, LV-1039, Latvia www.rockwool.lv
	Knauf WARM-WAND Systeme	SIA Knauf	Daugavas iela 4, Saurieši, Stopiņu nov., LV-2118 www.knauf.lv
Floor heat insulation	PC Perisave system	SIA Putustikls	Aleksandra Čaka iela 68-34 Riga, LV-1011, Latvia
Parapet roofs	Schock Isokorb AXT-Typen	SIA Materiāli	Miera iela 12, Jūrmala, LV-2015, Latvia http://www.betonam.lv/
Solutions of thermal bridges	Schöck Isokorb ® QXT 200 mm Schöck Isokorb ® QS + KS 180 mm Schöck Isokorb ® K 180 mm Schöck Isokorb ® KXT 200 mm Schöck Isokorb ® QXT 180 mm etc.	SIA Materiāli	Miera iela 12, Jūrmala, LV-2015, Latvia http://www.betonam.lv/
Glass facade systems	Rehau-Polytec 50 S, efficiency class phA+,	SIA REHAU	Daugavgrīvas iela 83/89, Riga, LV 1007 http://www.rehau.com/LV_lv/
	AOC 50 ST. SI, efficiency class hA+ FW 50+ SI, efficiency class phA FW 60+ SI, efficiency class phA u.c.	SIA Schuco Latvija	Plieņciema iela 14 Mārupe, Mārupes novads LV-2167 www.schueco.lv
Frames	Rehau GENEO PHZ efficiency class phB	SIA REHAU	Daugavgrīvas iela 83/89, Riga, LV 1007 http://www.rehau.com/LV_lv/
	TermoPlus. SI, efficiency class phB AWS 112.IC efficiency class phB	SIA Schuco Latvija	Plieņciema iela 14 Mārupe, Mārupes novads LV-2167, Latvia www.schueco.lv
	Roof windows GGK-6265, efficiency class phB	SIA Velux Latvija	Matīsa iela 103, Riga, LV-1009, Latvia www.velux.lv

Ventilation equipment, <600 m3/h	Logavent HRV 31, heat recovery82% Logavent HRV 21 V2, heat recovery86%	Representative in the Baltic States — SIA Robert Bosch	Zeltiņu iela 131, Mārupes pag., Mārupes nov., Latvia www.buderus.lv
	Danfoss w2, heat recovery81%, Danfoss a3, heat recovery83%, Danfoss w1, heat recovery80%, Danfoss a2, heat recovery81%	SIA Danfoss	Vienības gatve 198 Riga, LV-1058, Latvia http://www.danfoss.com/Latvia
	Aerastar Comfort 82, heat recovery82%, Aerastar Compact LP 150-1, heat recovery86%,	Representative in the Baltic States — SIA Robert Bosch	Zeltiņu iela 131, Mārupes pag., Mārupes nov., Latvia www.junkers.lv
	Climos 150DC, heat recovery82%, Multi 150DC, heat recovery79%, Santos 370DC, heat recovery84%, Novus 300, heat recovery93% and other equipment	SIA Artiva	Sila iela 9 Riga, LV-1057, Latvia www.artiva.lv
	LWZ 100. LWZ 100 plus, heat recovery87%, LWZ 270. LWZ 270 plus, heat recovery83%	Partners in Latvia: Baltijas Elektro Sabiedrība SIA EVA-SAT SIA Eva Sistēmas	http://www.evasat.lv/ http://www.se.lv/
	Vitovent 300 F, heat recovery88%, Vitovent 300 W, heat recovery84%,	SIA Viessmann	Āraišu iela 37 Riga, LV-1039, Latvia www.viessmann.lv
	ComfoAir 160 HRV, heat recovery89%, ComfoAir 160 ERV, heat recovery85%, ComfoAir flat 150, heat recovery82% And other equipment	SIA Zehnder Latvia	Raiņa iela 14 Iecava, Iecavas nov., www.zehnder.lv
Ventilation equipment, >600 m3/h	ComfoAir XL 800, heat recovery80%, ComfoAir XL 2200, heat recovery80%, ComfoAir XL 3300, heat recovery85% And other equipment	SIA Zehnder Latvia	Raiņa iela 14 Iecava, Iecavas nov., www.zehnder.lv
Heat pump equipment	LWZ 304 heat recovery87%	Partners in Latvia: Baltijas Elektro Sabiedrība SIA EVA-SAT SIA Eva Sistēmas	http://www.evasat.lv/ http://www.se.lv/