

ROADMAP

towards a sustainable low-carbon economy

Region: Vidzemes planning region
English version

prepared by
Vidzeme Planning Region

PANEL 2050 – Partnership for New Energy Leadership 2050
Deliverable 3.5

Date: 25.10.2018



CENTRAL EASTERN EUROPEAN
SUSTAINABLE ENERGY NETWORK



This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 696173. Disclaimer: The sole responsibility for the content of this material lies with the authors. It does not necessarily represent the views of the European Union, and neither EASME nor the European Commission are responsible for any use of this material.

Roadmap scheme

About Panel 2050 project

The PANEL 2050 project has the aim to create durable and replicable sustainable energy networks at local (municipality/community) level, where relevant local stakeholders collaborate for the creation of a local energy visions, strategies and action plans. The aim of these networks is to contribute to and actively work for the transition towards low carbon communities in 2050. The PANEL 2050 partnership will provide support for the creation of first successful local energy networks in the CEE countries. In the course of the project, organisations from 10 CEE countries will collaborate on creating regional energy strategies and action plans. For more information visit <https://ceesen.org/panel2050/>

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The PANEL model

PANEL model is a comprehensive approach for implementing local long-term energy management, supported by the community. PANEL model consists of seven main elements: Stakeholder Engagement, Training Program, Guidebook, Long-term Energy Visions/Roadmaps/Action Plans and Central and Eastern European Sustainable Energy Network CEESSEN. These elements are developed by PANEL 2050 project to support the CEE communities on achieving their sustainability goals.

PANEL2050 model for Central and Eastern Europe Sustainable Energy Network CEESSEN



The Roadmap at hand is the output of the long-term energy planning process with the aim of plotting the regional transition towards a low-carbon community.

Attached to the Roadmap 10 specific Action Plans were developed, representing the first steps on this road toward low-carbon community by 2050.

Roadmapping process Vidzeme Planning Region, Latvia

1
Stage

Baseline – Regional Energy Profile, VPR

2
Stage

Vision

In 2050, Vidzeme Planning Region is the region of smart solutions and climate aware population. Based on ICT and smart technologies & networks the Region effectively utilizes all kinds of available renewable energy resources (RES) and widely implement energy efficiency (EE) measures. The economy of the region is based on circular economy principles and ensures competitive development and increased well-being alongside with minimal CO₂ emissions. The region in 2050 emit around 70% less CO₂ than in 2015, the emissions reduction is reached in all sectors of region economy. Regional and local governments implement highly competent governance aimed at sustainable use of natural capital and responding/adapting to climate change.

3
Stage

Roadmap

4
Stage

— Energy efficiency in public buildings —

Action 1

Energy Action Plan for Vidzeme hospital

Action 2

Energy Action Plan for Priekule municipality

Action 3

Energy Action Plan for Pārgauja municipality

Action 4

Energy Action Plan for Lubāna municipality

Action 5

Energy Action Plan for Lizuma secondary school

Action 6

Energy Action Plan for Jaunpiebalga municipality

Action 7

Energy Action Plan for Gulbene municipality

Action 8

Energy Action Plan for Cēsaine municipality

Action 9

Energy Action Plan for Ape municipality

Action 10

Energy Action Plan for Alūksne municipality

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1 Introduction

The presented Roadmap of Vidzeme Planning Region towards a sustainable low-carbon economy is based on initially elaborated region's Energy Vision and CO₂ emission reduction target set for 2050 incorporating the principles of low-carbon circular economy. The development of the Roadmap had included such steps as (a) comprehensive analysis of current state of the region's energy sector, (b) definition of alternative development scenarios and evaluation of their perspective implementation on meeting the set 2050 target. By substantiating on these results, the priority areas of the Roadmap had been selected, followed by identification of the particular activities and measures within each of the areas.

The activities and measures outlined by the Roadmap will serve as a framework/guideline for Vidzeme Planning Region to set future detailed targets, develop action plans and projects regarding energy supply-demand sector.

Vision

In 2050, Vidzeme Planning Region is the region of smart solutions and population supporting climate friendly consumption. Based on ICT and smart technologies and networks the Region effectively utilizes all kinds of available renewable energy resources (RES) and widely implements energy efficiency measures. The economy of the region is based on circular economy principles and ensures competitive development and increased well-being alongside with minimal CO₂ emissions. In 2050 the region emits around 65-70% less CO₂ than in 2015, the emissions reduction is reached in all sectors of the regional economy. Regional and local governments implement highly competent governance aimed at sustainable use of natural capital and responding/adapting to climate change.

The 2050 Vision of Vidzeme Planning Region is supported by well-grounded development projections based on the analysis of the current situation, comprising projections on regional population numbers, economic activity, technology development and its use, and takes into account changes in the behaviour of energy end user at the growing level of information, knowledge, awareness and motivation of society on the whole as well as definite target groups and change agents.

2 Priority areas

The Roadmap focuses on four priority sectors:

- **Development of energy information system in the Region**
- **Energy efficiency: Public buildings**
- **Energy efficiency: Residential buildings**
- **Bioenergy**

When selecting the priority areas, the following was taken into account:

- The share of buildings in the final energy consumption in the region currently and their energy efficiency potential.

- Availability of regional resources for ensuring the development of bioenergy as a priority area.
- The capacity of regional /local government institutions to implement measures aimed at the development of these areas.

Development of energy information system in the Region

Effective organization of the energy sector data, information gathering and flow in the region, improving energy efficiency and monitoring the policy of increased RES use are the main preconditions for further execution of measures, assessing of the implemented measures and organizing cooperation among the parties involved. Implementing the given activities in the area will foster the development of a medium term energy development plan based on a quantitative and exhaustive analysis, monitoring of the plan execution, wider involvement of interested groups and community in the execution of the selected activities.

Energy efficiency in public buildings and Energy efficiency in residential buildings

The fact that energy efficiency in public buildings of local governments is a sphere of their direct impact was considered when deciding on improving energy efficiency in buildings to be a priority area. Public buildings are a significant energy end consumer. The household sector with its 29% in 2015 was the biggest energy end consumer among the sectors in the region. The greatest part of energy was used for district heating. Renovation of residential buildings and construction of new energy efficient buildings have high energy efficiency potential. Regional /local governments can vitally promote improvement of energy efficiency in residential buildings by different informative, counselling and other support measures motivating the apartment owners and inhabitants at large to engage in activities aimed at improving energy efficiency.

Use of bioenergy

Considering the available bioenergy resources in the region, the local governments in cooperation with private sector and inhabitants may promote further development of using bioenergy resources in all sectors of energy transformation and consumption in the region. Bioenergy as a priority area is aimed at increasing the self-supply of the region with energy and more rational and sustainable use of the available bioenergy resources as well as strengthening the regional network of economic cooperation in the bioenergy sector.

3 Actions and development scenarios

To assess the ways for achieving the goals set in the Vision and define the priority areas in the Roadmap for Vidzeme Planning Region, several energy development scenarios were prepared and analysed. The given scenarios provide an opportunity to analyse development from the current situation to the goals set in the Vision. The energy scenario analysis served as a basis for defining priority areas in the Roadmap.

In its turn, analysis of the socio-economic scenarios developed for Vidzeme Planning Region Sustainable Development Strategy (Strategy 2030) served as a basis for creating these alternative energy development scenarios. Socio-economic forecasts from the Cooperation scenario in Strategy 2030, balancing competitive and cohesive approaches,

were used to create alternative energy development scenarios. The Cooperation scenario underlines developing cooperation between economic, knowledge and governance networks. Great attention is paid to ensuring availability to social services in remote and scarcely populated areas by a wide-scale use of information technologies. The Cooperation scenario envisages implementation of integrated inter-sectoral policy solutions, specialization of less developed areas, combining of material and immaterial development tools, good coordination between different governance levels and sectors. The Cooperation scenario sees cooperation between local governments as one of the vital factors to improve effectiveness of service costs and ensure efficient introduction and maintenance of infrastructure.

3.1 Status of R&D, innovations and technology

Global perspective

Implementation of the Energy Development Scenario 2050 for Vidzeme Planning Region is grounded on the current global scale development of energy efficiency and RES technologies resulting in the economic benefits when using these technologies alongside with competitiveness with the existing technologies.

Electricity production

The Scenarios foresee active implementation of **solar PV technologies**. The forecasts of these technologies' future cost clearly show the decreasing trend for the specific investment cost for the total system:

- **small residential PV installations, usually mounted on the roof:** in 2030 the specific investment, compared to 2020, will decrease by almost 25%. Significant decrease of the cost is expected after 2030; in 2050 the anticipated cost is per almost 50% lower, compared to 2020.
- **commercial PV systems** (with capacity up to 500kW, typically installed on service/public sector buildings): in 2030 the specific investment, compared to 2020, will decrease by 20%; in 2050, compared to 2020, the anticipated cost is per almost 40% lower. It has to be noted, the specific investment for the larger building-scale system will be lower, if compared to small residential installations, due to scale effect.
- **Large scale utility systems, mounted on the ground (PV parks):** in 2030 the specific investment, compared to 2020, will decrease by almost 20% as well; in its turn, in 2050, compared to 2020, the anticipated decrease of cost is slightly above 30%.

Trend in research and development (R&D) activities on solar PV reflects a change of focus from manufacturing and scale-up issues (2005-2010) and cost reduction topics (2010-2013) to implementation of high efficiency solutions and documentation of lifetime/durability issues (2013-). In 2020-2030 crystalline silicon (c-Si) as well as thin film solar cells is expected to dominate the world market. In its turn, polymer/organic solar cells are emerging technologies where significant research activities are among others currently addressing efficiency and lifetime issues, these cells are expected to develop into commercial products by 2020-2030, but are currently not considered candidates for grid-connected

systems. Important, cost evaluations show, in 2030 the specific investment of solar PV technologies will be lower, compared to wind energy technologies.

Wind technologies. The forecasts of large scale on-shore wind technologies' future cost also show the decreasing trend for the specific investment for the total system, however this decrease will not be so significant, compared to described above solar PV technologies. In its turn, for small scale wind technologies (below 25 kW) rather high specific investment will continue. Global R&D activities will relate to reduced investment costs resulting from improved design methods and load reduction technologies, more efficient methods to determine wind resources, incl. external design conditions, e.g. normal and extreme wind conditions, improved aerodynamic performance, reduced operational and maintenance costs resulting from improvements in wind turbine component reliability, development in ancillary services and interactions with the energy systems, improved tools for wind power forecasting and participation in balancing and intraday markets, improved power quality, noise reduction (new technology will possible utilize good sites better, where the noise set the limit of number of turbines), repowering strategies, storage issues as well as public acceptance.

Biomass (wood) CHP technologies. The forecasts of biomass (wood) CHP technologies' future cost do not anticipate significant change in specific investment for the whole period up to 2050. Highly important task of biomass technologies development will be providing compliance with tightening regulation on air polluting emissions. Global R&D will relate to reduce the cost of fuel, by improved collection and pre-treatment, better characterisation and measurement methods, to improve combustion process and flue gas cleaning technologies to reduce emissions, to provide environmentally safe recycling of ashes, handling and combustion of new types of fuels (e.g., garden/park waste), etc. The research on solid biomass gasification and penetration of related technologies will continue. It has to be anticipated also penetration of such advanced technologies as solid oxide fuel cell CHP (natural gas/biogas) and Stirling engines (gasified biomass).

Biogas R&D activities will focus on a number of areas to increase energy production and improve the economy of the plants, better technologies of reducing storage of animal slurry before digestion, reduction of methane leakage from tanks and processing equipment, biological optimisation, use of material with higher dry-matter content, optimisation of logistics, etc. Due to the R&D, in 2050 the decrease of the specific investment cost of biogas CHP technologies per 10-20% (depending on type and configuration of the technology), compared to 2020, is anticipated.

Biogas Upgrading is an alternative technology to on-site combustion. Due to active R&D and competition among different upgrading technologies, the significant increase of technological performance as well as economical performance will take place. In 2050 the decrease of the specific investment cost of biogas upgrading technologies up to 25%, compared to 2020, is anticipated.

District Heating

District heating (DH) currently plays important role in the towns of Vidzeme planning region. The development of DH systems as a whole and their particular technologies/components demonstrates the long-term tendencies in urban heat supply. In 2020-2050 the transition to fourth and further generations of DH systems will take place. The clear trend for DH systems is to move to much lower distribution temperatures and distributed heat transfer

instead of combustion. The transition from load side district heating to source side district heating saves energy and accommodates the recycling of heat.

The **fourth** generation (4G) DH is based on a lower temperature water distribution to limit installation costs and heat losses to the ground, together with a higher contribution from local/regional renewable energy sources and secondary heat sources (such as waste heat or heat transfer from groundwater) in order to limit both CO₂ emissions and reduce air pollution. Reducing the operating temperature of heat networks allows the installation of less expensive distribution circuits between buildings, without the need for expensive insulation to restrict heat losses to the ground and allowing for absorbing heat from low grade waste heat sources. A 4G DH network is coupled with higher insulation standards for buildings to restrict the amount of heat needed and looks forward to the electrification of heat by using heat transfer instead of combustion to provide the heat and to integrate with smart electric networks to balance the demands on the electric grid by using the thermal mass of buildings to store heat, and to restrict demand for electricity when there is supply pressure on the grid. Thus, cost effective retrofit of existing buildings, including the buildings that are not currently on DH networks, so that they can be connected into scalable heat networks, and more efficient heat emitter systems within buildings to accommodate lower operating temperatures, are necessary pre-condition for implementing 4G DH network. The development of 4G DH also employs distributed heat transfer in building using heat pumps to achieve heating when buildings need heating, and to reject heat to the network when a buildings need cooling.

However certain restrictions related to development of such next generation DH system exist. As already underlined above, the one of key pre-conditions for implementation of 4G DH system is deep energy efficient retrofit of existing buildings. At the same time it might appear there is no economically justified to reach such high energy efficiency in case of renovating existing multi-apartment buildings. Thus, in particular areas with renovated multi-apartment buildings the previous DH systems with maximally improved efficiency could continue to operate. In its turn, the construction of new apartment and public buildings have to be considered in the context of perspective development of 4G DH system.

Regional capacity

The region is relatively rich in resources for bioenergy (wooded) and different wood processing companies operate successfully there. Use of low-value wood resources for generating renewable energy and first processing of wood is well developed in Vidzeme. The population ratio with specialization in wood processing is high, providing a potential use of logging and wood processing waste. Food manufacturing companies, operating in the region, also has biowaste that can be put to good use. Recycling of biologically degradable waste is one of the bioeconomy spheres for the region to be able to develop.

National perspective

Use of solid biomass for heat production

Latvia has considerable experience and local experienced companies regarding the use of all types of wood biomass (wood, wood processing waste, wood chips, briquettes and pellets).

At the same time, Latvia has relatively little experience as regards the use of straw; only one boiler house has recognized it as the basic fuel. Use of straw, including research about it as supplementary fuel, is one of the prospective tasks.

Grain processing residues accumulate in Latvia as well, consequently they might be used for heat generation. SC Rīgas dzirnavnieks used co-financing from the National Green Investment Scheme (NGIS) for the purpose. In the period 2014-2016 the company used as fuel about 2.6 thousand tons of grain processing residues.

Use of solid biomass for electricity generation

Latvia started accumulated experience as regards the use of wood biomass at the beginning of the 2000s. Currently, the average power plant electrical capacity is 1.36 MW_{el}. The average number of working hours (referred to total electricity generation capacity) is 5730.

In Jelgava, Ltd Fortum-Jelgava, a high capacity combined heat and power plant with electric turbine 23 MW_{el}, uses solid biomass.

Technologies used in Latvia:

- engines,
- ORC cycle,
- steam turbine,
- relatively little experience regarding solid biomass gasification technology¹.

Use of biogas for electricity generation

In the 2007-2013 EU funds planning period, from 2010, **biogas production from agricultural raw materials** started developing significantly, supported by the national Rural Development Programme.

The average power plant electrical capacity is about 1 MW_{el}. The average number of working hours (referred to total electricity generation capacity) is 6891h.

Attention needs to be focused on the following challenging issue. Today maize stems constitute most of raw material for biogas. In the future biogas power plants have to contribute increasingly in the development of sustainable agriculture. Thus, the challenge will be large-scale digestion of organic manure (prospectively up to 70% of all raw materials for biogas). The problem of food waste as admixture for biogas production is to be solved as well.

Biogas power plants on landfill sites. In Latvia there operate several biogas power plants in landfills already now; Ltd. ZAOO, operating in the Vidzeme Planning region, is one of them.

¹ Only one relatively high capacity power plant of 1MW_{el} was launched in the period 2007-2013, supported by the EU funding.

Biogas production from sewage sludge. It is not widely used in Latvia. Riga Waste Water Treatment Plant is one to use sewage sludge for biogas production. Sewage sludge and organic waste are used in Jaunkalsnava biogas power plant, too.

Biogas upgrading to biomethane quality. Latvia has no experience in this field up to now. Mainly it is because no strategic target has been set consistently at a national level regarding the use of biogas in vehicles. In the long-term perspective biomethane use as a vehicle fuel should be considered as a one of RES developments in the transport sector.

Research and technologies

National perspective

Important research on energy and mitigating climate change impacts is done within the framework of the National Research Programme. Separate themes are also investigated in the collaborative research projects and thematic research projects within the framework of national Fundamental and Applied Research Programme as well as in the projects for science and research co-financed by the EU Structural Funds.

Scientific research institutes and organizations of Latvia actively participate in the EU Horizontal Programmes: the EU Research and Innovation Programme Horizon 2020 (also *ERA-NET* projects), *LIFE* programme (the EU's financial instrument supporting environmental, nature conservation and climate action projects aimed at innovative and sustainable improvements) as well as developing solutions to be implemented in practice within the framework of the Interregional Cooperation Programme for Europe *INTERREG*.

Regional capacity

Several higher educational establishments operate in Vidzeme Planning Region offering engineering and ICT study programmes:

- **Vidzeme University of Applied Sciences:** the 17 study programmes include also such as Information Technologies, Construction of Wooden Buildings and Ecobuildings, Mechatronics. In 2014 a modernized complex for engineering studies was launched.
- **Riga Technical University Cēsis Affiliate** (among the study programmes are such as Computer Systems, Computer Control of Electrical Technologies, Power and Electrical Engineering)
- **Riga Technical College, Vocational Education Competence Centre in Priekuļi.**

Research is also developed in these higher educational establishments. Vidzeme University of Applied Sciences has Socio-technical Systems Engineering Institute, Institute of Social, Economic and Humanities Research, and Knowledge and Technology Centre. Bioeconomy is researched at a research centre of national importance – **Agricultural Resources and Economics Priekuļi Affiliate at the Latvia University of Life Sciences and Technologies**. Priekuļi municipality houses also the **Institute for Environmental Solutions**, a foundation which utilising the latest information technologies, especially airborne remote sensing technologies, develops innovative environmental solutions for sustainable use of natural resources. However, the R&D potential in the region is not sufficient to ensure research in all the selected fields (climate policy, energy efficiency, RES technologies) and

developing active cooperation not only between the national research institutes, but also international cooperation is required.

3.2 Business-as-usual scenario

Synopsis on the current situation

Population. The population in Vidzeme region was 195998 inhabitants at the beginning of 2016. About 21% of the total regional population resided in the two biggest regional towns (Valmiera and Cēsis). At the beginning of 2016 in comparison with 2010 the population number in Vidzeme region was by 7.5% lower. The working age population constituted 61.5%.

Final energy consumption. The calculated final energy consumption in 2015 in Vidzeme region was 4900 GWh. Among the sectors, the household sector had the highest final energy consumption (29%), while the ratio of the services sector (public and private services) constituted 16%. As regards the other sectors: transportation – 26%, industry – 18%, agriculture – 11%.

Analysis of the primary energy supply allows concluding that RES constitute almost 50% of the total primary sources. They are made up by solid, gaseous and liquid biomass, hydropower and solar energy. Wood biomass constitutes about 85% of the total RES volume in Vidzeme planning region. About 50% of the primary energy resources are provided by imported fossil resources (oil products, natural gas and coal).

Heating. District heating systems are widely used in the region. About 56% of the supplied heat is produced by using local wood biomass as fuel.

Electricity generation. The capacity of fossil fuel and RES power plants in Vidzeme region is low if compared to the total power capacity generated in the state. Irrespective of the launched RES power plants in Vidzeme region in the last decade, in 2015 they provided only about 23% of electricity consumption in the region. Total RES power generating capacity in Vidzeme region is slightly above 34 MW. About 43% of the total RES generating capacity is produced by the biomass fuelled combined heat power plants (CHPP), 30% – by the small hydropower plants and the rest by the biogas fuelled CHPPs. Assessment of the power volume generated by RES allows concluding that the greatest part is produced by the biomass fuelled CHPPs (56%), ranking next are the biogas fuelled CHPPs (35%), and the share of the small hydropower plants is 19%.

Most of **CO₂ emissions** in Vidzeme Planning Region is due to the use of fuel in road transport (45%). Other sectors produce approximately an equal amount of the remaining share: the services sector – 15%, industry – 11%, the household sector – 14% and agriculture – 15%. A note should be made that in agriculture only those emissions are calculated which are produced from combustion of fuel in stationary and mobile equipment.

Baseline scenario

The baseline scenario for developing the energy sector presumes continuation of the current trends regarding improvement of energy efficiency and RES use. Energy consumption is projected on the basis of the following assumptions:

- Changes in the population number;
- Changes in added value in the sectors of economy;
- Changes in heat consumption per m² in residential buildings, based on the intensity of building renovation;
- Changes in the energy efficiency trends in the sectors of economy, services and transportation.

Population: until the year 2035 the current trends continue and the population number decreases. After 2035 the number stabilizes.

Economy: growth in all the most important sectors, i.e. manufacturing industry, services and agriculture. The economic development rate is similar to the projected development trends in the national economy. No rapid and cardinal structural changes in economy are predicted, i.e. material changes in the ratio of separate sectors, and the economic development is in line with the approach of balancing cooperation and cohesion as laid down in the Cooperation scenario in Strategy 2030.

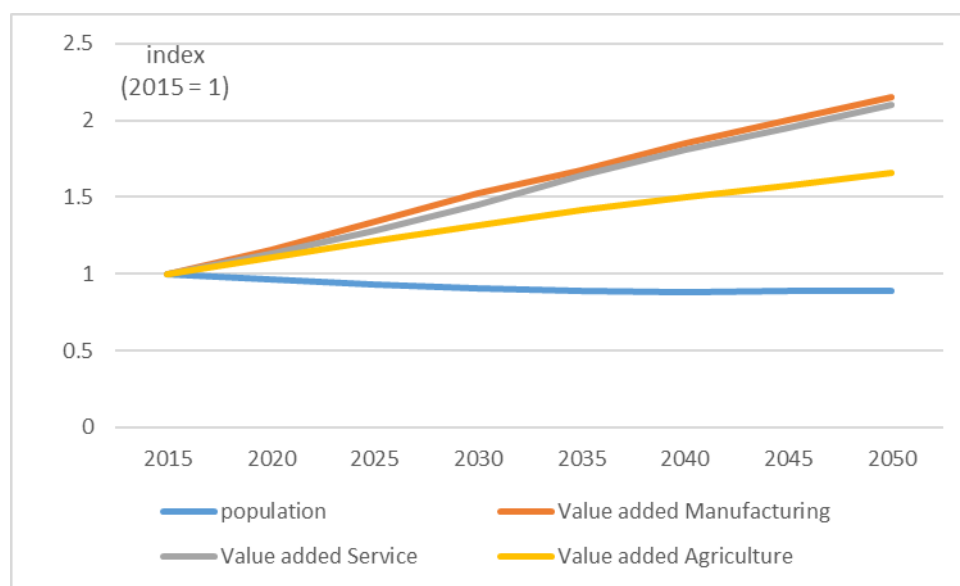


Figure 1 The main macroeconomic indices applied for calculation of energy demand in Baseline scenario

It is important to underline that the **baseline scenario is not a stagnant scenario**. It forecasts relatively high renovation of present houses and construction of new buildings which makes the reduction of specific heat consumption (kWh/m²/y) in households possible. RES use continues to increase by reducing the specific CO₂ emissions average factor (t CO₂/MWh) in the power and district heating systems. Consequently, it needs to be underlined that the implementation of the baseline scenario will require effort and specific actions to ensure sustainable further development of the current trends in the energy sector.

Preconditions for the reduction of specific heat consumption in residential buildings in the baseline scenario

The baseline scenario predicts the specific heat consumption in residential buildings by 50% lower in the year 2050 than in 2015. The target will be reached as about 25% of apartment blocks are houses constructed after 2015 and 50% of the present buildings are renovated. Similar trends, though with lower renovation intensity, are predicted for single-family residential buildings.

The baseline scenario predicts that the economy growth rate, competition and innovations ensure continuous improvement of energy efficiency in all economic sectors. Assumptions about the improvement of energy efficiency imply energy intensity in the sectors of industry and services to be by about 40% lower in the year 2050 than in 2015.

On the basis of the given assumptions, final energy consumption and CO₂ emissions were projected in the baseline scenario (see Figures below).

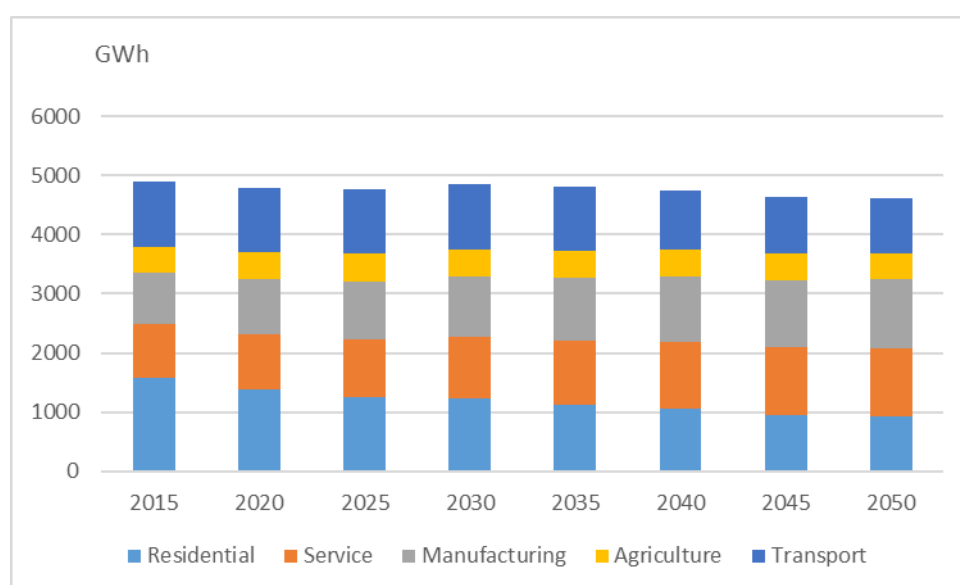


Figure 2 Projected Final energy demand in Baseline scenario, GWh

On the basis of the above described predictions on economic development and demographic indices the projected final energy consumption is by 6% lower in the year 2050 than in 2015. The greatest changes in the final energy consumption occur in households where it decreases by about 40%, considering the demographic projections and energy efficiency measures implemented in buildings. Reduction is projected also in agriculture and transportation, while in the sectors of services and industry, irrespective of assumptions about reduced energy intensity due to the increase of production and services rendered, final energy consumption is predicted to increase up to 25% in the year 2050, compared to 2015.

The baseline scenario envisages a wider use of RES in electricity and heat production. The forecast includes an extensive use of electrical vehicles and alternative fuels (CNG, LNG, biofuels and biomethane) in the road transport sector. Taking account of the above, the

predicted CO₂ emissions are by 28% lower in all sectors, the greatest reduction being in the household and transportation sectors, 42% and 40% accordingly.

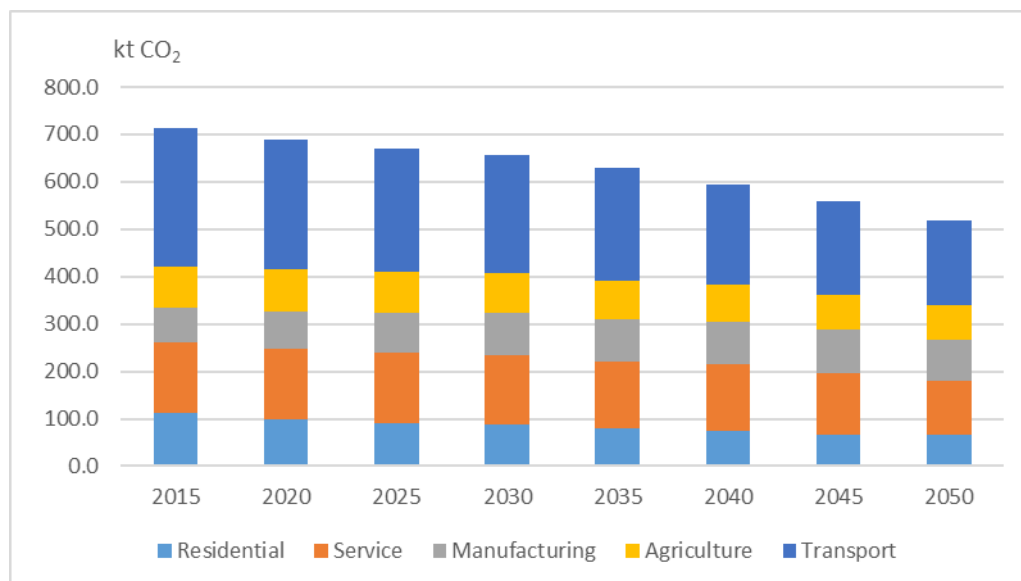


Figure 3 Calculated CO₂ emission projections under Baseline scenario

3.3 Development scenarios

Analysis of the baseline scenario reveals that the predicted development regarding the increase of energy efficiency and a wider use of RES is not sufficient for attaining the goals set in the Vision for the region. To assess the possibilities for reaching the targets, two alternative scenarios were developed containing the calculation of final energy consumption and CO₂ emissions:

- **Energy efficiency scenario** which offers high-intensity implementation of energy efficiency measures compared to the baseline scenario, and
- **Target scenario**, the precondition of its execution requires a wider use of RES in combination with the implementation of additional energy efficiency measures.

Energy efficiency scenario

Assessment of the energy efficiency scenario is vital as energy efficiency is recognized as the first leading principle for CO₂ emissions reduction. When developing the energy efficiency scenario, compared to the baseline scenario, a wider range of possibilities were analysed for implementing the energy efficiency measures in all energy consuming sectors. As regards RES use, the energy efficiency scenario retains the preconditions of the baseline scenario.

Residential buildings. According to this scenario, relatively vital renovation and construction of residential buildings take place, thus allowing the reduction of specific heat consumption (kWh/m²/y) in residential buildings by about 65% in the year 2050, compared to 2015.

Preconditions for the reduction of specific heat consumption in residential buildings in the energy efficiency scenario

To reach the specific heat consumption reduction in residential buildings in the year 2050 compared to 2015, about 40% of the apartment blocks are houses constructed after 2015 and about 90% of the remaining present apartment blocks are renovated. About 40% of the single-family residential buildings are constructed after 2015.

Other sectors. Introduction of new and replacement of old present technologies make it possible to reduce energy intensity in the sectors of industry and services by about 40% in the year 2050, if the energy efficiency scenario is compared to the baseline scenario.

Target scenario

The target scenario, compared to the baseline and energy efficiency scenario, predicts a much wider use of RES in electricity and heat production (the solar, wind, all types of biomass, etc.) and the use of electrical vehicles and alternative fuels (CNG, LNG, biofuels, biomethane) in the road transport sector. Alternative fuels (biofuels and biomethane) are also widely used in agriculture. Due to the wide-scale use of RES the specific CO₂ emissions average factor (t CO₂/MWh) in the electricity and district heating production is by about to 50% lower in the year 2050, compared to 2015.

Based on the assumptions made, final energy consumption and CO₂ emissions were calculated in the target and energy efficiency scenario. On the whole, assumptions about high-intensity implementation of energy efficiency policy and measures predict reduction of final energy consumption in the energy efficiency scenario by about 31% in the year 2050, compared to the baseline scenario. In the energy efficiency scenario the predicted CO₂ emissions in 2050 are by about 29% lower than in the baseline scenario and by about 49% lower than in the year 2015.

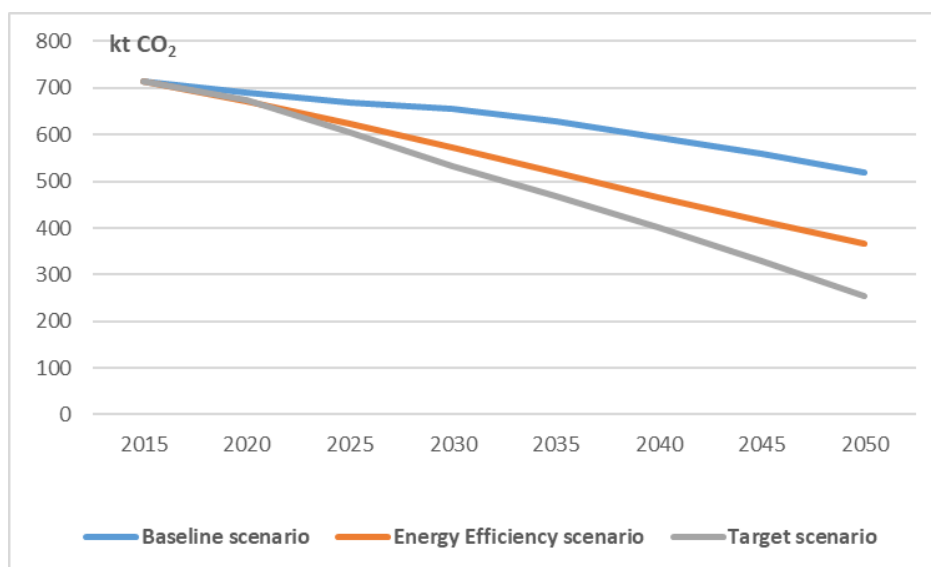


Figure 4 Calculated CO₂ emission projections under Baseline and development scenarios

The predicted CO₂ emissions in the target scenario are by 50% lower than in the baseline scenario in 2050 and by 65% lower than in the year 2015. In all sectors reduction of CO₂ emissions in the target scenario in the year 2050, compared to 2015, is within the range 50-74%.

In the target scenario in 2050 most of emissions are in the transportation sector (35%) and the services sector (20%). The remaining share falls in approximately equal parts between the sectors of industry, households and agriculture.

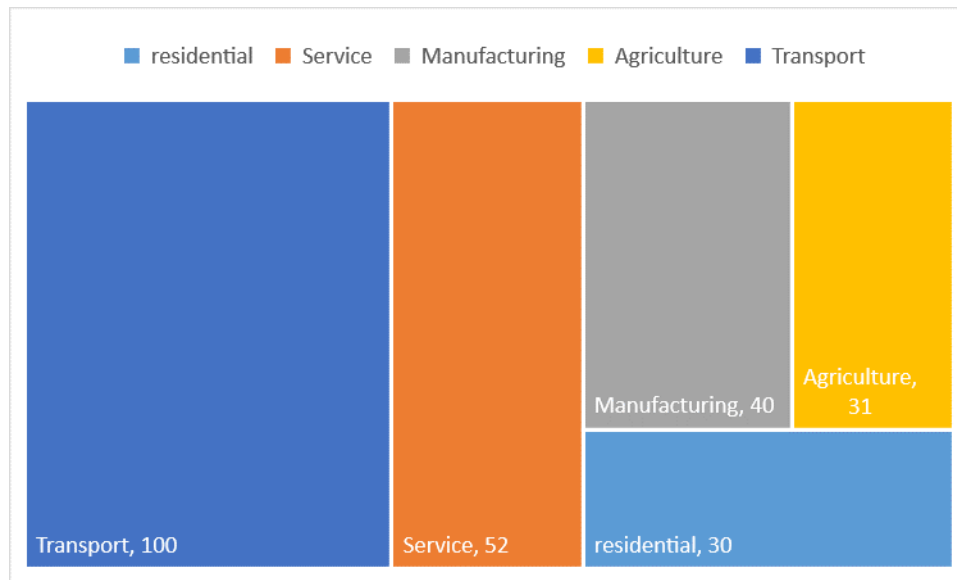


Figure 5 Calculated CO₂ emission under Target scenario in 2050 by sectors, kt CO₂

Preconditions for implementation of Target scenario

To implement the energy development direction and CO₂ emissions reduction outlined in the target scenario by 2050 in line with the priority areas, the following long-term actions are to be executed to ensure sustainable energy supply:

In **urban areas efficient district heating** is supplied, based on using bioenergy resources in combination with effective decentralized technologies.

Use of **high-efficiency** bioenergy and geothermal energy technologies, ensuring synergy for meeting air quality targets.

Use of smart technologies for ensuring construction of nearly zero energy new buildings.

Most of **public and residential buildings** are connected to **high-efficiency district heating systems** with an integrated feedback, ensuring flexible energy consumption.

Different **efficient energy saving technologies**, energy generating microtechnologies, energy storage technologies and solutions are combined in buildings.

Use of decentralized **solar energy technologies** in buildings (solar collectors and solar PV).

Public buildings with the installed smart technologies and solutions **serve as an example**.

An **energy management system** is installed in buildings, adapted to the demand and individual lifestyle of the inhabitants: smart and real-time power management tools enhance energy efficient lifestyle, flexible energy consumption and supportive infrastructure.

Public buildings have an **energy management system**, promoting versatility of their use according to the 24/7 principle.

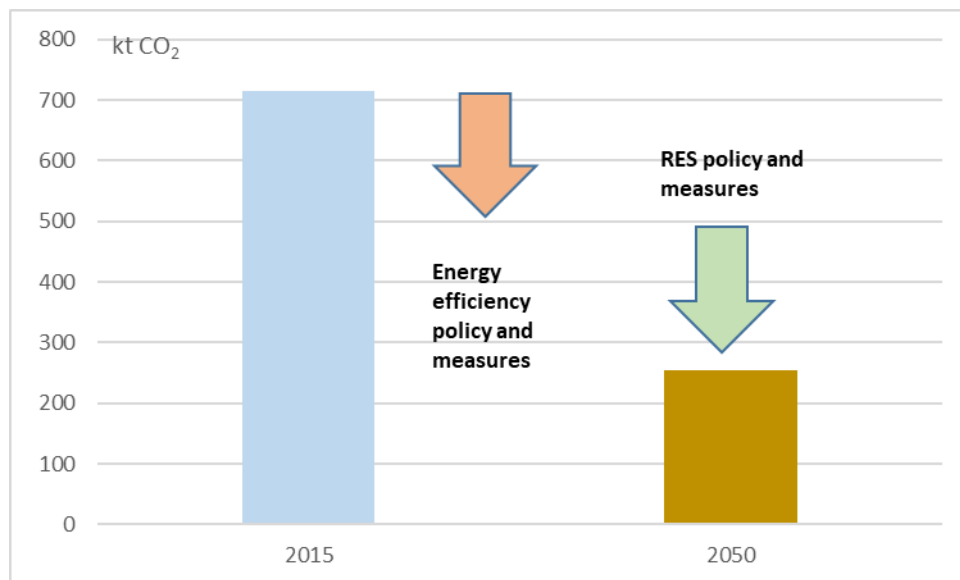


Figure 6 Actual (2015) and projected (2050) CO₂ emissions in Vidzeme planning region and potential of Energy efficiency and RES policy to reduce CO₂ emissions

Below in the chapter the overview of the *Roadmap's* selected priority areas and main activities and measures to be implemented in each of them are presented.

Priority area: Regional energy information and communication system

General Objective 2050:

Effective co-operation between administrative levels and stakeholders

Specific Objectives:

- an efficient energy information and communication system operates in the region, providing timely, targeted and high-quality information to diverse target groups in the region;
- an effective energy planning and energy management coordination system operates in the region.

Target Groups:

- energy end users target groups of the region
- energy generation utilities of the region
- administration system of the region and municipalities (institutions)
- population of the region as a whole

Measures:

Coordination of Energy Planning in the Vidzeme Planning Region

The main tasks in the planning coordination will be:

- Organizing co-operation in the energy-climate sector between different levels of administrative governance (state-region and region-local government); coordination of energy and climate policies and measures between administrative levels.
- Organizing co-operation in the energy-climate sector between stakeholders at different levels (state, region, municipalities) and areas of activity: renewable energy resources producers, energy (heat and electricity) producers (energy supply utilities), energy end-users in different sectors, construction companies acting at energy efficiency and the RES sector, investors and developers, funders, research institutes, and others.
- Defence of the interests of the region at national level energy strategies, programmes and regulatory documents; inclusion of topical activities of municipalities of the region in the national energy-climate management;
- Regional level planning in the energy sector; adaptation of national energy and climate policy objectives and tasks to regional and municipal policies, including the policy of the national low-carbon development plan, the allocation of activities and tasks at the regional level.
- Developing a Regional Climate-Energy Plan linking sectoral development issues with GHG emissions reduction and adaptation to climate change.
- Regional bioeconomic planning, demonstrating the impact of energy efficiency and RES on employment, local economy, land use, real estate value, etc.
- Organization of sub-regional (several local municipalities) co-operation on energy supply-consumption planning issues.

- Establishing of energy advisors network in the region, elaboration and coordination of the network's operating programme, provision of informative materials for network operation. Organizing events to inform building and apartment owners and tenants about the various methods and practices used to improve the energy efficiency in buildings.
- Reducing barriers to implementation of energy efficiency measures by offering innovative programmes, presenting them to decision makers at different levels, and actively proposing changes to national strategy documents to facilitate the implementation of energy efficiency measures.

Activities of the Regional Energy Forum representing the stakeholders

- Determining the functions, rights, tasks and work procedures of the forum (elaboration of a forum statute, in co-operation with stakeholders)
- Organization of a regular, structured, solution-oriented dialogue among stakeholders within the Forum framework
- Consultations with the Forum in the process of elaboration of regional development and planning documents
- Assessment and integration of Forum recommendations in regional development and planning documents, recommendations for integration in documents at local municipalities and national level.

Establishment and operation of regional energy information and communication system

Providing end-user target groups with qualified and relevant knowledge and training, advising, promoting their engagement in activities, and shaping new forms of social organization. This includes the following tasks:

- Establish a regional-local government advisory (advisers) network for households.
- Inform all target groups about national level advisory activities.
- Develop information materials and provide information through diverse forms of communication (single campaigns and regular events, information on heat energy bills, development of a long-term information campaign on energy efficiency in buildings, etc.).
- Provide information on the possibilities of reducing energy consumption, the economic indicators of energy efficiency measures, the possibilities to attract funding to households and other target groups.
- Provide high-quality individual consultations: interactive web-based tools, Energy Efficiency Phone, and other ICT tools.
- Regional/Municipal Energy days.

Demonstration project network and its operation in the region

- Establish a system for demonstration of almost zero energy buildings in the region (residential and public buildings).
- With positive and tangible results demonstrate to the public the possibilities of using the RES and take the first steps in the wider use of the RES - creation of project folders with different perspective types of use of RES in buildings in the

Vidzeme planning region and further development and submission of projects to various funding sources.

Development and operation of regional energy data and information circulation and monitoring system

- Establish a data and information system for fuel and energy consumption in residential and public buildings, in co-operation with local municipalities and energy suppliers.
- In the information system, register the energy efficiency measures implemented in renovated residential and public buildings as well as the time of implementation.
- Develop tools that provide the preparation and delivery of the necessary data to local governments and other interested groups for the use in elaboration of various planning documents.
- Develop online tools that enable residents to make energy consumption comparisons between different residential buildings.
- Provide residents an access to energy consumption data in public buildings using online tools.
- Develop online tools that enable interested groups to assess the economic performance indicators of different energy efficiency measures and the use of RES technologies.
- Establish a planning and monitoring tool for energy efficiency measures based on the energy consumption data system.

Funding model

Existing:

Planning Region Administration - budget of the administration and funding from attracted projects.

To be developed in perspective:

- A common budget made up of local municipality contributions to ensure the basis of the regional energy planning coordination activities.
- Resources attracted by the planning region from the EU horizontal programmes.
- State budget line for the support of regional energy planning institutions (it is necessary to lobby for the establishment of such a budget line).
- Establishment of a paid service system for the provision of services.

Priority area: Energy Efficiency in Residential Buildings

General Objective 2050:

Energy-efficient and comfort providing residential buildings

Specific Objectives:

Decrease of specific energy consumption for heating in buildings, % vs 2015

Year 2030	Year 2050
By at least 30%	By at least 60%

Target groups:

- owners of apartments in multi-apartment residential buildings, owners' associations;
- tenants of apartments in multi-apartment residential buildings (non-privatized apartments);
- owners of single-family houses and residents of single-family houses in general;
- social risk/vulnerable social groups;
- society as a whole.

Sequence of implementation of strategic activities:

- **Information.** Includes the acquisition of data and information, the summarising of information, the creation of databases, organization of information in the target group-friendly manner, etc.
- **Organization of target groups.** Measures taken (i) to achieve a higher level of internal organization of the target group (e.g. multi-apartment residential building owners' associations and better organization of their work); (ii) at the same time, it also includes measures that provide organizational support within the municipality's structure (for example, a technical consultant for the building renovation projects in a municipality's administration structure).
- **Information for target groups, education, building-up the motivation.** Based on the established and improved organization of the target groups, information, advising, etc. measures are carried out creating incentives for the target group to undertake energy efficiency measures. Target group oriented information development, public availability of energy efficiency databases of buildings, including targeted user-friendly tools for evaluating the benefits of energy efficiency, including economic benefits, etc.
- **Local municipality financial support and immovable property tax credit programmes** for owners of existing housing stock for energy-efficient renovation of buildings
- **Local government** activities for the creation of a new energy-efficient housing stock.
- Providing highly qualified energy efficiency improving **renovation specialists in the region.**

Measures

Information on energy consumption

- Energy certification of multi-apartment residential buildings, municipal support programme for the energy certification of multi-apartment residential buildings.
- Creation of an energy consumption database of multi-apartment residential buildings, user-friendly tools for analysis of information included in the database.

Organization of target groups

- Establishment/development/improvement of work organization of apartment owners' associations of multi-apartment residential buildings
- Training and networking of energy managers of multi-apartment residential buildings (exchange of experience)
- Technical consultant for energy efficiency renovation projects in municipalities administration

Information for target groups, education, building-up the motivation

- Establishment of a regional energy efficiency advisory network (municipal co-operation programme and funding), provision of information and advice to residents, motivation of residents for participation in national level programmes (in co-operation with the national responsible organization)

Local municipality financial support and immovable property tax credit programmes

- Local municipality co-financing programme for small-scale investments in building elements/engineering systems/building energy management systems in multi-apartment residential buildings.
- Local municipality small-scale support programmes for the energy audit of single-family houses – both for buildings and for the evaluation of the efficiency of the equipment in buildings (e.g. boilers).
- Local municipality support programmes for specific social risk target groups for implementation of energy efficiency measures.
- Local municipality support programme for demonstration projects of energy efficient technologies and smart energy management tools in residential buildings².

Local municipality activities for creation of new energy efficient housing stock

- A municipal programme for the construction of new low-energy tenement houses (in municipalities with demand for housing space)
- Voluntary agreements with real estate developers on energy efficiency indicators in newly built residential buildings
- In the binding municipal regulations for the planning, use and building of the territory provide for favourable norms / numerical values to those owners / developers of buildings that renovate / develop highly energy efficient residential buildings (including the use of RES micro-technologies in them), in so far as this is not contrary to the public interest.

Providing highly qualified energy efficiency improving renovation specialists in the region

- At the regional level, in co-operation with professional associations and vocational education institutions, training is organized on the best available practice.

Funding model / possibilities

Existing

- Co-financing from EU funds (up to 2022 inclusive)
- Local municipality budget - municipal co-financing programmes
- Self-financing by owners
- Financing off the cost of energy savings

² The task of the programme is to establish a regional scale demonstration network for small-scale solutions in residential buildings. It is necessary to test both the possibilities of new technologies in practice/regional conditions, and to carry out this kind of demonstration close to the **people** of the region.

To be developed in perspective

- **Co-financing from EU funds for the next planning period**
- **Financing of municipal heat supply utilities.** Develop a mutually beneficial system (both for the utility and the consumer) where municipal heat supply utilities invest in energy efficiency improvements on the side of the heat final consumer.
- **Third-party financing - ESCO companies.** To develop an offer for the large-scale renovation of multi-apartment buildings to ESCO company(s).
- Develop and apply a credit of immovable property tax for investments in energy efficiency: the buildings have been renovated in accordance with the energy efficiency requirements of the renovated building, the reduction rate of the property tax according to the exceedance of minimum energy efficiency requirements.
- Develop a system (model) of attracting of funding from tenants, taking into account the future benefits from an energy efficient building.

Parties involved in the implementation of the measures:

Public sector

- National level: Implementers of a national support programme for residential buildings
- Regional level: Planning Region Administration, regional energy issues coordinating institution
- Municipal level: Municipal Council, municipal administration specialists, local municipality institutions, municipal capital companies
- Energy service provider level: municipal heat supply utilities

Research & Development sector – organization of co-operation with regional and national education and research institutions

Private sector:

- Residents-owners
- Energy managers of multi-apartment buildings,
- Financiers.

Priority area: Energy Efficiency in Public Buildings

General Objective 2050:

Energy-efficient public buildings

Specific Objectives:

Decrease of specific energy consumption for heating in buildings, % vs 2015

Year 2030	Year 2050
By at least 25%	By at least 60%

Main target groups:

- municipalities, municipal institutions, capital companies - owners of public buildings
- private sector - service providers in public buildings
- users of public buildings (service recipients / visitors)
- employees of institutions / companies located in public buildings
- society in general.

Measures

Information

- energy audit and energy certification of public buildings (meeting normative requirements and additional voluntary measures)
- creation of energy consumption database for public buildings
- public access to energy consumption data on the internet (for major public buildings)
- demonstration of renovated and new public buildings as a leading example for other target groups.

Organization

- Implementation of energy consumption management system in public buildings, including promoting the diversity of their uses according to the 24/7 principle.
- Development of renovation schedule for the public buildings (setting the minimum annual amount to be renovated).

Technical requirements and solutions

- When carrying out the renovation of the buildings owned by the municipality and/or the construction of new buildings, higher energy efficiency standards than specified in the national regulations are set.
- Installation of solar PV when renovating or constructing new municipal public buildings (schools, kindergartens and others).
- complying with high energy efficiency requirements in the building design of new public buildings: a combination of intelligent technological solutions (various efficient energy-saving technologies are combined in buildings, including energy recovery technologies, micro-technologies for energy production, especially solar PV, and energy storage technologies and solutions).

Financing model/possibilities

- Renovation, using co-financing from EU funds
- Budget of local municipality - a municipal programme for public building renovation.
- Financing off the cost of energy savings.

- Attracting the third-party funding (ESCO companies).
- Public-private partnership (PPP) models.
- Creating motivation for employees employed in public buildings, for finding the addition energy saving opportunities.
- Models for attracting financial resources of local / regional population: residents' co-operatives for the installation of RES technologies in public buildings³.
- Implementing the economy of funds based on the scale principle - organizing regional procurement ensuring larger volumes purchases of equipment, devices and technologies.

Parties involved in implementation of measures:

Public sector

- Regional level: Planning Region Administration, regional energy issues co-ordinating institution
- Municipal level: Municipal Council, municipal administration specialists, local government institutions, municipal capital companies
- Energy service providers: municipal heat supply utilities
- Energy managers of public buildings.

Research & Development sector – organization of co-operation with regional and national education and research institutions

Private sector:

- Involvement in public procurement in accordance with the conditions specified in the national legal normative documents.
- Public-private partnership model.

Priority area: Bioenergy

General Objective 2050:

Sustainable utilization of the region's bioenergy resources in general, implementation of circular economics in the bioresources sector

Specific Objectives:

- At least 90% of the heat energy constitutes RES
- At least 90% of the electricity produced in the region constitutes RES

Main target groups:

- Owners/producers of biomass primary resources,
- Producers of energy and fuel by utilizing biomass resources,
- End-users of energy and fuel ,
- Society as a whole

³ This kind of inhabitants co-operatives can be established for the attraction of funds to install renewable energy technologies such as solar PV, in public buildings of high-importance and used by significant numbers of people, such as schools.

Priority measures have been developed to cover the full range of the bioenergy resource chain, which ensures both the availability of bioenergy resources and the efficient use of bioenergy resources.

The sequence of implementation of strategic activities:

- Provision of information and organization.
- Energy planning in the municipality and integration of energy plans in municipal development planning documents.
- Spatial planning: promotion of bio-energy resources (RES resources in general) acquisition and use by developing the regional and municipal spatial plans and the municipal regulations for the planning, use and building of the territory
- Target group organization, including the establishment of a forum for mutual co-operation between the stakeholders and promotion of its work.
- Technical measures to expand the possibilities of using of bioenergy resources.

Measures

Provision of information and organization

- Mapping the territory of the region and municipalities regarding availability and volume of bioenergy resources (solid, liquid and gaseous bioenergy resources) and bioenergy production.
 - (a) Traditional (already in large scale) bioenergy resources and their sites / production facilities,
 - (b) New bio-energy resources (they are currently not used at all or used only in insignificant amounts) and their sites / production facilities,
 - (c) Evaluation of the amount of the bioresidues in different sectors and their current uses, identification of new processing possibilities.
- Acquisition and analysis of information about the companies, both the bioenergy resources owners/producers and final energy consumers, development plans.

Energy planning

- Mapping of energy consumption of municipal territories (cogeneration potential, unused industrial heat potential, consumption according to types of energy resources, etc.) for the use of bioresources (for RES resources in general).
- **Analysis of a specific, previously unused bioenergy resource usage framework according to the scheme:** available potential of the resource in the region/subregion; the degree of development of the processing technologies; analysis of a specific target group (end users who will use this new energy resource or energy produced from it); a special emphasis on the use of bioenergy in the transport sector, particularly in public transport.
- Identification of sectoral bioenergy targets in different sectors.
- Development of municipal energy plans, linking them with the municipal energy management system.
- **Specific plans for the use of priority bioenergy resources with high processing need⁴**
- Integration of energy plans into the municipal integrated development planning system.

⁴ As an example of such a specific plan is the processing of residues from food production and catering enterprises at biogas plants.

Spatial planning

- Thematic plan of bioenergy (RES in general) resource extraction/availability and bioenergy (RES in general) production units - regional and municipal level plans
- When planning new construction areas, it is recommended to include norms in municipal regulations for the planning, use and building of the territory that will promote the using of bioenergy (RES in general).
- Zoning of district heating based on bioenergy resources in regional municipalities (major cities).

Organization of target groups

Promote awareness among stakeholders of the benefits of bioenergy and foster mutual co-operation between them

- Public-private partnership planning. Integrated planning of three components "Production and supply of bioenergy resources - energy production - energy consumption" based on the co-operation of the parties involved. The involvement of local bioenergy resources owners/processors among the owners of the district heating companies, or the concession approach might be used.
- Social acceptance creation programme. The aim of the measure is to identify among the population of the region the main obstacles perceived and to carry out a well-considered campaign and information providing to increase the social acceptance for bioenergy (and RES in general) technologies.
- Development of a broader content regional bioeconomics plan, elaboration of a benefit-loss analysis.
- Establishment of a regional bioenergy (RES in general) stakeholder forum ⁵.
- Based on the work of the forum – establishing of bio-clusters in the region/sub-regions
- Coordination of the biomass logistics center.
- Promote co-operation between education and research institutions (national and regional level) and entrepreneurs on the development of bioenergy (RES in general) technologies in the region.
- Establishment of regional bioenergy technology demonstration center (in co-operation with national and regional research institutions),
- Promote the development of the region's smart specialization potential in the field of wood and biomass use.

Measures to ensure the consumption of bioenergy resources

- Efficient centralized production of heat energy from bioenergy resources - combining boiler houses into a single bio-energy network and, where appropriate, closing small / inefficient boiler houses.
- Effective transfer of heat energy from bioenergy resources – heating network renovation/replacement to reduce heat loss.
- Connecting new consumers to district heating networks using bioenergy resources.
- Efficient decentralized production of heat energy from bioenergy resources – promotion of replacement of inefficient heat-generating boilers with biomass-efficient boilers (as far as decentralized production is efficient) in the households and services sectors (municipal support programme might be considered).

⁵ The forum's task is to create a regional framework for the use of bioenergy in the region, as well as the promotion of a concrete form of co-operation between consumers-suppliers and the public sector – private sector operators.

- Biogas upgrading to biomethane quality and utilization in the region's public transport.
- Green public procurement - the inclusion of green energy requirements in public procurement performed by the region and its municipalities, including green procurement in the public transport sector.

Financing model/possibilities

Existing

- Co-financing from EU funds (up to 2022 inclusive)
- National green investment programme (Emissions Allowances Auction Instrument)
- Financing from municipal capital companies - heat supply utilities.
- Local municipality budget - municipal co-financing programmes
- Self-financing by owners: owners of residential buildings, private sector - services, manufacturing sectors
- active use of EU horizontal programmes, available for applied biomass energy research and implementation issues.

To be developed in perspective

- Develop funding programmes combining various available resources - EU financial support programmes, national budget programmes, local governments budgets, planning region financial resources, private funding.
- Public – private funding models.
- Cooperative funding: residents cooperatives for the implementation of bioenergy projects in the region and its municipalities.
- Centralized regional purchases of the bioenergy technologies and their components (scale effect, allowing for a reduction in the unit cost in the procurement).
- Immovable property tax credits for investments in high bioenergy (RES in general) technologies.

Promotion of national framework conditions

Development of new framework for the promotion of use of RES

Parties involved in implementation of measures:

Public sector

- National level: implementers of a national support programmes for bioenergy
- Regional level: Planning Region Administration, regional energy issues coordinating institution
- Municipal level: Municipal Council, municipal administration specialists, local government institutions, municipal capital companies
- Energy service providers: municipal heat supply utilities

Research & Development sector – organization of co-operation with regional and national education and research institutions













Private sector:

- residents-owners
- service and manufacturing sector companies

3.4 Milestones

Table 1 Summary of the sequence of implemented measures

Groups of measures	Year 2020	Year 2025	Year 2030		Year 2050
Priority area: Regional energy information and communication system					
Coordination of Energy Planning of the Vidzeme Planning Region					
Activities of the Regional Energy Forum representing the interested/involved parties					
Establishment and operation of a regional energy information and communication system					
Demonstration project network and its operation in the region					
Regional energy data and information circulation system, monitoring system development and operation					
Priority area: Energy efficiency in residential buildings					
Information on energy consumption					
Organization of target groups					
Information for target groups, education, creating motivation					
Municipal financial support and immovable property tax credit programmes					
Priority area: Energy efficiency in public buildings					
Information about energy consumption					
Development of a time schedule for renovation of public buildings					
Technical requirements and solutions					
Priority area: Bioenergy					
Provision of information and organization					
Energy planning					

Spatial planning					
Organization of target groups					
Measures to ensure the consumption possibilities of bioenergy resources					
 The programme for the implementation of the measures has been developed and implementation of measures has started			 The activity is implemented in accordance with the developed programme		

4 Impacts on regional economy

In all scenarios, including the Baseline Scenario, there is an increase in energy efficiency and expansion of the use of local RES. Thus, all scenarios have a predictable positive impact on the region's economy. Increasing energy efficiency has a positive impact on reducing energy intensity of manufactured products and services, thus increasing the competitiveness of companies in the regional. The greatest positive impact is expected in the Target Scenario.

Impact on employment

In the region, new jobs are created as direct jobs, as indirect jobs and as induced employment.

Direct employment is the jobs created (i) in the design, manufacturing, supply of RES or energy efficiency technologies; (ii) in the construction of RES plants or the implementation of energy efficiency technologies, including the management of the project implementation, (iii) in the direct operation of the constructed RES plants or new energy efficiency technologies, as well as in produced energy trading operations. **Indirect employment (supply effect)** means jobs created to: 1) produce the materials required for the supply of RES or energy efficiency technologies ("downstream" delivery effect); and (2) provide supplies for the operation of existing RES or energy efficiency technology ("upstream" delivery effect). **Induced employment (induced effects on the general economy)** are jobs created by increased economic activity, spending on employees in direct and indirect jobs.

Induced employment is a very important factor in assessing the impact of energy efficiency measures. In this case, a large part of the induced effect arises from the reduction of energy consumption by households thus earning additional funds for the consumption of other goods and services, thus contributing to economic activity in the region. In this respect, it is essential to make energy-efficiency investments in high-energy consumption households and to develop appropriate support instruments. Induced employment significantly increases the cost-benefit justification of energy efficiency measures.

It is important to point out that jobs, taking into account the supply chain and the mobility of population, occur at the regional, national and international levels (international supplies).

A conservative assessment shows that the introduction of RES technologies could generate around 400 direct jobs and around 800 indirect jobs. By contrast, the

implementation of energy efficiency measures in buildings could lead to around 800-1000 direct jobs and around 1200 - 2200 indirect jobs. Taking into account the scale of Latvia, part of these jobs will be attributed to the whole of Latvia, but most, of course, to the planning region.

The other important positive benefits are:

- The prices of RES (biomass) and produced energy are less susceptible to fluctuations than fossil fuel prices, which are determined by global trends,
- The use of local RES resources significantly increases energy security in the region,
- The use of local RES resources contributes to the region's positive import-export balance, as payments for local biomass resources are mostly kept in the region (instead of being paid off, as is the case with fossil resources),
- Since there is already a computer science and engineering study base established in the region at the regional (Vidzeme) university, the use of local resources and the demand for energy efficiency technologies will contribute to the further development of regional knowledge.

Regional economic specialization

Priority areas of smart specialization provided by the Regional Sustainable Development Strategy 2030:

A. In the traditional areas of the region

- high (higher) value added products, especially high added value timber products,
- production of healthy food and beverages
- recreation and sustainable tourism

B. In areas related to the existing specialization

- use of biomass for chemical processing and energy,
- rehabilitation and health services,
- smart materials.

C. In the knowledge economy sectors

- information and communication technologies
- cultural and creative industries,
- remote work and services

There is a joint development of different areas of specialization and interindustry co-operation, for example, products and services are created by linking with ICT, cultural and creative industries, etc.

As we see, the implementation of the Vision of the development of energy sector will contribute to areas of smart specialization in the region, such as the use of biomass for energy, information and communication technologies, smart materials and technologies. Significantly, increasing the use of production residues for energy production will contribute to the creation of a regional circular economy.

Implementing the Vision of the energy sector, there are no predictable major target conflicts with other regional development strategies.

One of the potential risks could be potential competition between the use of biomass for the production of high added value products and the use of biomass for energy production. At the same time, taking into account the diversity of biomass resources and the adequate planning of their use, it is possible to meet the interests of both parties.

5 Involvement of stakeholders

Regional Municipal Management and expert working group/groups.

At least 2 times a year, local municipality experts meet to discuss topical issues and develop and agree on common solutions. Specific working groups are:

- municipal management / executive management
- municipal development planning experts
- municipal project managers
- municipal energy managers
- municipal energy supply (heat supply) utilities

Regional stakeholder forum

Provides support for implementation of energy efficiency and the use of RES in the region. A regular, structured, solution-oriented dialogue takes place within the Forum. The Forum provides advice and recommendations in the process of elaboration of regional development and planning documents. The Forum provides recommendations for the region's climate-energy plan and its activities. The Forum also provides advice and recommendations to particular municipalities related to the energy sector development in their administrative areas. The forum meets at least once a year. The second meeting of the Forum Group is scheduled to be combined with the annual Regional Thematic Seminar "Vidzeme Energy Days".

The Forum will actively use modern IT communication forms for the completion of its tasks, thus ensuring regular work of the Forum, summarising opinions of the Forum members on topical issues, active communication with all other interested parties. The forum's coordinator in the IT environment will contribute to a high efficiency of the forum work.

The Forum will support the creation of energy clusters in the region.

The forum is intended to invite the following **stakeholders in the region**:

- Producers of RES and energy efficiency technologies or their components,
- RES technology project developers
- Energy efficiency project implementers
- Innovative companies in the region
- Regional business associations
- Regional farmers' associations
- Professional organizations in the region
- Local municipality leaders and development planners, municipal energy managers
- Municipal energy (heat) supply utilities
- Representatives from higher education / research institutions in the region
- Local NGOs
- Local action groups (LEADER groups)

Conflict Pro-active Identification

In order to promote the development of RES technology in the region, the Vidzeme Planning Region Administration, its energy planning specialists will have a task to identify

potential barriers and conflict points for the implementation of this kind of projects in a timely manner in co-operation with the Forum of Stakeholders and local authorities, and by proactively addressing them, facilitating social acceptance of the introduction of RES technologies among the various target groups in the region; identify those groups of population whose interests may be affected by the realization of such projects and proactively organize meetings, other types of advisory and mediatorial work to proactively resolve such conflicts.

Communication of the residents of the region and their specific target groups

Based on the 4 components of the general Environmental and Climate Communication cycle:

- provision of information
- offer of deeper non-formal education on specific topics
- provision of participation opportunities for the society target groups in order to promote energy efficiency and the use of RES in the region,
- climate-friendly behaviour of the society target groups.

Taking into account the specifics of the sector, the last two components are often merged in practice.

Specific measures are planned within the framework of the priority areas described above

Information provision and advisory assistance for target groups

Possible institutional solutions to be considered

- Energy expert or department in the administration structure of Vidzeme planning region
- Regional Energy Agency
- Regional/sub-regional (comprising several municipalities) Energy advisers
- Regional on-line/telephone advisory service

An important event will be the **regional club for the general society discussions on energy efficiency and the use of RES in households**. The administration of the Vidzeme planning region creates an organizational model of this club and a model of mutual communication. The club's goal is to disseminate information about projects and events implemented in the region. The club will place particular emphasis on the dissemination of information provided by the beneficiaries of energy efficiency and RES measures (for example, concrete benefits to inhabitants as well as other issues related to the energy-efficient renovation of apartment buildings). The club operates on both a regional scale and at the level of municipalities or several municipalities (in co-operation with the administration of local municipalities). There are both face-to-face meetings and seminars, as well as active club activities in the IT environment. There are also specific site visitations where innovative solutions for energy efficiency and/or use of RES technologies have been implemented.

Promoting new forms of population co-operation:

Most likely, that the creation of such forms of funding will not be possible in the near future, but can be considered in the long term perspective.

- Local savings and loan associations and their involvement in financing of small-scale energy efficiency and renewable energy resources projects

- An energy co-operative, created by the local/regional inhabitants, as the owner of renewable energy technologies (installation of technologies, management of them, etc.).

Broad-scale regional events

- Annual thematic seminar "Vidzeme Energy Days"
- Annual Energy Efficiency Award "Vidzeme Energy Efficiency Award" (prize categories for different target groups)
- Annual Innovative Renewable Energy Award "Vidzeme RES" (prize categories for different target groups)

Engagement of external stakeholders will include potential investors, national energy supply companies, national renewable energy associations, coordination with public administration institutions (national level), co-operation with national and international research. Participation is facilitated by the administration of the Vidzeme planning region in co-operation with local governments and the Forum of Stakeholders.

Overview of activities on development of the Roadmap

Date,place	Participants	Content/Results/Conclusions
18.05.2018, Valmiera	Entrepreneurs of Vidzeme region	The main goal was to interview entrepreneurs of Vidzeme region to get more information about their needs and obstacles to implement more energy efficiency measures in their production facilities.
14.06.2018, Valmiera	Municipalities of Vidzeme Planning Region	Presentation of Sustainable Energy Development Strategy in Europe and in Vidzeme Planning Region, Discussion on developed Action plans.
25.06.2018., social network	Followers of Vidzeme Planning Region Facebook account	The main goal of this survey was to find out what needs to be done in the near future and in the long term in order to ensure sustainable energy development in the region. We received 10 completed questionnaires with deep insight, what priorities are currently most significant in Vidzeme region.
10.09.2018., Liepa	– Municipalities of Vidzeme Planning Region	Discussion on roadmapping process and next steps in energy transition and stakeholder engagement.

6 Endorsement by implementers and political decision-makers.

The Roadmap will be approved by the decision making authority of the planning region - Vidzeme Planning Region's Development Council. After the approval, the Roadmap will have binding force for all of planning region's local municipalities which should take its priority areas, activities and measures into account when developing in future their local plans for energy sector development.

7 Financing

The implementation of the measures is based on several considerations:

1. Financial support for implementing measures
2. Tax considerations.
3. Payback time of the measure.

Sources of Funding

External financial support

- **Co-financing from EU funds, including the national Rural Development Programme –** energy efficiency of multi-apartment buildings, energy efficiency of public buildings, bio-energy in district heating systems, as well as other programmes. Currently available until the year 2022 inclusive (some activities can be completed sooner). After 2023 (the programming period of the EU funds 2021-2027), the financing model is currently under development, however, it is expected (National Climate Plan 2030, published 1st version, September 2018) that activities such as increasing the efficiency of district heating systems, the energy efficiency in multi-apartment buildings will be continued. During the programming period of the EU funds 2021-2027, it is planned to develop a support programme for the implementation of a district cooling system, which is an essential element in public buildings, and until now there have been no support programmes for this type of investment in Latvia. Taking into account the large number of single-family houses in Latvia, consideration is also given to the possibility of developing an energy efficiency improvement programme within the programming period of the EU funds 2021-2027 for this target group. It is planned to implement in the 2021-2027 planning period a similar type of energy efficiency programme for businesses. The type of support (grant, financial instrument) that will be provided to businesses is still under consideration.
 - In 2021-2027 Latvia will have an access to the EU **Innovation Fund**. The amount of funding available to Latvia is unpredictable, as the funds of the Innovation Fund will be applied by the Member States themselves after evaluating and approving the submission of projects from the project applicants in the country.
 - Member States whose GDP per capita in 2013 (at market prices) is less than 60% of the EU average, will be eligible for funding from the **EU Modernization Fund** after 2020. The Modernization fund will be available to finance energy efficiency improvement and energy sector modernization projects (including small-scale projects) in ten EU Member States, including Latvia. The amount available to Latvia for the implementation of projects could range from 54 MEUR to 112 MEUR.

- **EU horizontal co-operation programs for research and promotion of a supportive environment.** An increase in the available funds (in the EU as a whole) in these programmes is expected.
- **ES horizontal municipal co-operation programmes.**
- **National budget.**

Internal sources of financing

- National budget provided financing for the Planning Region.
- Local government shared financing for regional activities.
- Local government financing (for small-scale projects).
- Immovable property tax credits for target groups.
- Internal self-financing of target groups.

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This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 696173. Disclaimer: The sole responsibility for the content of this material lies with the authors. It does not necessarily represent the views of the European Union, and neither EASME nor the European Commission are responsible for any use of this material.



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