Sustainable Energy Action Plan

Zemgale region

December 2011

Content

1. Introduction

The European Union is leading the global fight against climate change, and has made it as top priority. Local authorities play a key role in the achievement of the EU's energy and climate objectives. The Covenant of Mayors is a European initiative by which towns, cities and regions voluntarily commit to go beyond the objectives set by EU for 2020, reducing the CO_2 emissions in their respective territories by at least 20 %. This formal commitment is to be achieved through the implementation of Sustainable Energy Action Plans (SEAPs).

Sustainable Energy Action Plan (SEAP) is a key document that shows how Zemgale region will reach its commitment by 2020. It uses the results of the Baseline Emission Inventory to identify the best fields of action and opportunities for reaching the target of Action Plan of the region - to achieve proportions 20-20-20 up to year 2020. That means that by 2020 region undertakes to reduce CO_2 emission at least per 20%, which is achieved by reaching 20% improvement in energy efficiency and by attraction of renewable energy resources per 20% from the volume of usable energy.

***Fig. 1** Structure of Covenant of Mayors*

Sustainable Energy Action Plan embraces initial overview of CO_2 emissions and prognosis, actions and measures for reduction of energy consumption, improvement of energy efficiency and development of renewable energy resources in administrative territory of Zemgale. In the Action Plan the main directions of development of sustainable energy of the region have been determined, which are to be taken into consideration when planning and implementing measures in provision of energy production and supply. Sustainable Energy Action Plan of Zemgale region for years 2010 – 2020 has been elaborated under the management of Zemgale Regional Energy Agency (ZREA) together with the project partner Kaunas Regional Energy Agency (KREA) in close cooperation of institutions of Zemgale region as well as energy supply organizations, service companies and experts.

2. EU main approaches for implementation of sustainable energy policy in the cities and regions

The global collaboration for diminishing the climate change was started by the United Nations Framework Convention on Climate Change (in Latvia adopted by law on 23 02 2005) and with KIOTO protocol of 2005 (summit of country leaders) with liabilities of the countries by 2012.The next summit of country leaders took place in Copenhagen in 2009 where the new liabilities for diminishing of the climate change until year 2050 were discussed, but the adoption of the new liabilities was postponed to the next years.

Implementing the new energy policy European Union in 9th March 2007 adopted a package of documents ”Energy to the Changing World”, where an initiative was set on Covenant of Mayors of Europe, which was prepared and signed in Brussels on 10th February, 2009. At the moment more than 2700 cities have joined the Covenant of Mayors. In the text of Covenant of Mayors the main approaches have been defined as well as tasks to municipalities regarding provision of sustainable energy of the cities, including:

- elaboration of Sustainable Energy Action Plan (SEAP) for the time period up to 2020;
- acceptation of liabilities to reduce CO_2 emissions by 2020 per more than 20 % from the volume of consumption, by improving the energy efficiency by 20% and increasing the share of renewable energy resources per 20% in the energy supply;
- organization of energy days in the city regularly – once per year;
- conclusion that many actions related to energy demand and renewable energy sources and what have to be done to fight the climate change are in the competence field of municipalities or that they cannot be realized without support from the municipality;
- cognition that municipalities, which is the closest structure to the citizens, should be in the front line and should show an example;
- cognition that the responsibility on fight against global warming is shared between municipalities and the governments of the countries;
- involvement of civil society of the city in the elaboration and implementation of the Action Plan.

European Commission in 3rd March 2010 has started to put into effect a new strategical direction: “Europa2020” the aim of which is to overcome the consequences of the world recession in Europe and to prepare EU economics for the next decade. Five objectives have been identified which determine what has to be achieved in EU by 2020 and on the basis of which the achievements can be estimated. One of the objectives determines: **the objectives 20/20/20 in the field of climate/energy should be achieved**.

During elaboration the Sustainable Energy Action Plan for Zemgale region the following main EU directives in the field of energy supply, energy efficiency, renewable energy resources and environment have been taken into consideration:

1. Directive of the European Parliament and the Council 2009/91/EC 916.12.2002.) on energy efficiency of the buildings;
2. Directive of the European Parliament and the Council 2004/8/EC(11.02.2004.) on promotion of cogeneration based on demand of useful heat in the internal energy market;
3. Directive of the European Parliament and the Council 2006/32/EC (5.04.2006) on energy end-use efficiency and energy services;
4. Directive of the European Parliament and the Council 2008/50/EC(21.05.2008) on ambient air quality and cleaner air for Europe;
5. Directive of the European Parliament and the Council 2009/28/EC on the promotion of use of energy from renewable energy resources.

Latvian norms and regulations have been developed in line with the EU directives.

3. Zemgale region

Total Area of the Territory

The Zemgale region is located in the central part of Latvia south of Riga, beginning with the Eastern Kurzeme Highland and Southern Kurzeme Lowland in the West (Dobele district) to the Augszeme Highland in the East (Jekabpils district). The region goes along the Latvia – Lithuania border and adjoins Latgale, Vidzeme, Riga and Kurzeme planning regions. Its central part (Bauska, Jelgava and part of Dobele district) is located on the Zemgale Plain.

Total area of Zemgale is 10 733 km^2, which is 16.6% of the total area of the Republic of Latvia. From the total territory the city territory comprises 1,3%, the land used in agriculture is 44.9%, forests – 40,2 %, bushes – 1.5%, land under water – 3%, swamps 3.6%, yards – 1.5%, roads – 2.2%, other land – 3.1%.

Fig. 2 *Location of Zemgale region in Latvia*

Zemgale region, source of information: ZREA

Population

In January 2010 the population of Zemgale was 280 494, which is 12.5% of the total population of Latvia. By nationality the largest share of the Zemgale population is Latvians – 68.5 %.

In 2010 the breakdown by age groups was as follows: percentage of the population under working age in Zemgale was 14.4 % (in Latvia – 13.8 %), of working age – 66.5 % (in Latvia 66.0 %) and over working age – 19.1 % (in Latvia 20.2 %).

Settling structure

Most of the inhabitants of the region live in rural areas – 50.3 %. In 2010 the average population density was 26.1 inhabitants per km^2, which is the second highest rate among Latvia regions

There are four development centre levels set in Zemgale:

- 2 centres of national importance: Jelgava and Jekabpils;
- 3 centres of regional importance: Aizkraukle, Bauska, Dobele;
- 27 centres of local importance ;
- 103 first level centres.

Transport Infrastructure

Zemgale Region is crossed by five magistral roads of state importance. Two magistral roads of state importance A6 (Riga-Moscow) and A12 form a part of one of the longest West-East EU international magistral roads E22, which is included in the Trans-European transport network (TEN-T), the development and improvements of which is planned at EU level. On its turn A7 forms a part of North – South direction of EU international magisterial road E67 (Via Baltica), but A8 forms a part of North-South direction of Europe international magistral road E77.

Zemgale is crossed by 28 roads of regional importance and by 237 roads of local importance. The density of motor roads in Zemgale is a bit higher than on average in Latvia.

In Zemgale partly or fully are 10 areas of Latvia Railway, which form also a part of main railway lines of Europe (AGC network) and Trans – Europe transport network. Region is crossed by several international magistral pipe lines – for petrol and gas (TEN-T).

Economic Activities

The Zemgale region is formed by 20 counties and 2 main cities: Aizkraukles, Aknistes, Auces, Bauskas, Dobeles, Iecavas, Jaunjelgavas, Jelgavas, Jekabpils, Kokneses, Krustpils, Neretas, Ozolnieku, Plavinu, Rundales, Salas, Skriveru, Tervetes, Vecumnieku, Viesites counties and Jelgava, Jekabpils cities.

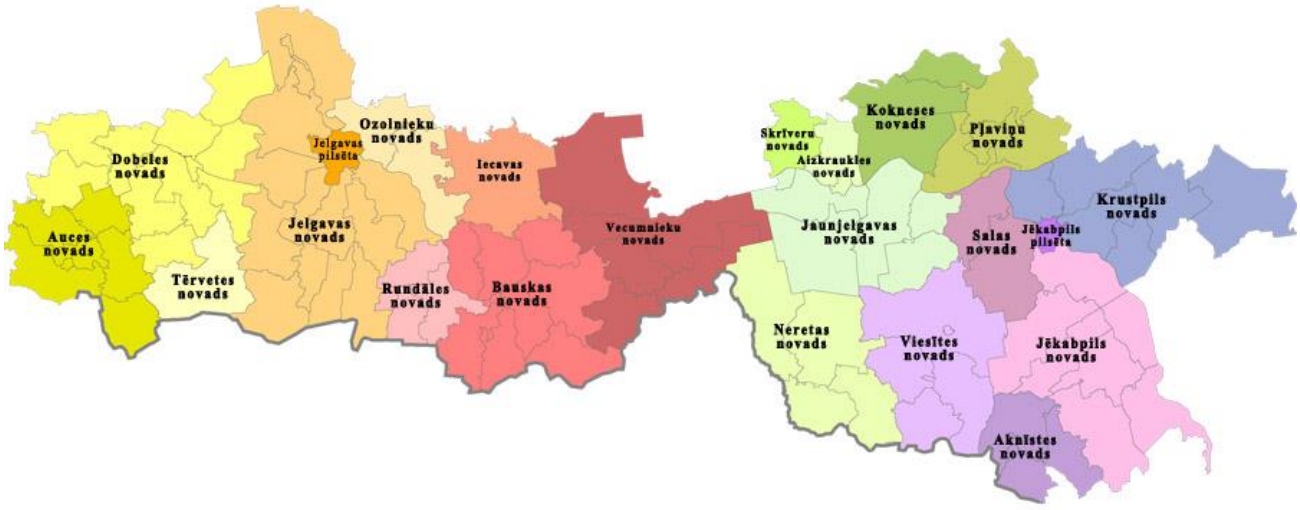


Fig. 3 *Zemgale region in 2010 (cities and counties)*

Zemgale region, source of information: ZREA

4. Overall strategy

4.1 Overall CO_2 reduction target

To reach the goals of Covenant of Mayors Zemgale region needs to reduce CO_2 emissions until year 2020, at least by 20 % comparing to baseline (2009) year.
It was calculated that **287 786 tones** of CO_2 emissions were emitted in baseline year in Zemgale region. Trying to reach goal of Covenant of Mayors, at least **57 557 tones** of CO_2 should be emitted less.

4.2 Long – term vision of Zemgale region

Main challenges in achieving goals of Covenant of Mayors in Zemgale region:

1. Renovation of residential buildings
2. Building new biomass CHP plants
3. Promoting of RES usage for space heating and hot water preparation.
4. Reduction of usage of transport fuel

4.3 Organizational and financial aspects

In order to reach goals of Covenant of Mayors, Energy group should be established in Zemgale region. Group should consist of different specialists from region administration (transport, development, finance, investment, economy, construction departments) and representatives from local stakeholders (local energy producers, local transport companies, etc.). Group that would consist up to ten members should have a chairman.
Energy group must create Energy Database for Zemgale region, define actions, implement schedule of actions and measures and organize monitoring of implementation.
As such energy group is not functioning in Zemgale region at the moment – ZREA helps counties and cities on sustainable energy planning actions.

5. Final energy consumption (in year 2009)

Category	FINAL ENERGY CONSUMPTION [MWh]										
	Electricity	Heat/ cold	Fossil fuels						Renewable energies		Total
			Natural gas	Liquid gas	Heating Oil	Diesel	Gasoline	Coal	Biofuel	Wood	
BUILDINGS, EQUIPMENT/FACILITIES AND INDUSTRIES:											
Municipal buildings, equipment/facilities	3912,48	18309,82	1840,02	129,12				704,2		178728,75	203624,39
Tertiary (non municipal) buildings, equipment/facilities	60563,65	283428,9	28482,81	1998,77	820,24			10900,75		203679,36	589874,47
Residential buildings	253202,43	1184949,72	119079,95	8356,4	3429,21			45573,46		851535,61	2466126,77
Municipal public lighting	6804	-	-	-							6804
Industries (excluding industries involved in the EU Emission trading scheme - ETS)	53144,64	248709	24993,68	1753,92	772,75			9565,41		13157,91	352097,33
Subtotal buildings, equipments/facilities and industries	377627,2	1735397,45	174396,47	12238,2	5022,2			66743,82		1247101,6	3618526,96
TRANSPORT:											
Municipal fleet						5798,47	3208,45				9006,92
Public transport				2235,91		40547,42	7667		45,01		50495,26
Private and commercial transport				10282,5		186468,58	35258,4		206,99		232216,46
Subtotal transport				12518,36		232814,47	46133,81		252		291718,64
Total	**377627,2**	**1735397,45**	**174396,47**	**24756,58**	**5022,2**	**232814,47**	**46133,81**	**66743,82**	**252**	**1247101,62**	**3910245,6**

5.1 Electricity production

Latvenergo AS is the leading producer of electricity and thermal energy in Latvia. More than half of required electricity is produced by Latvenergo. Almost 59 % of electrical energy consumed in Latvia were produced locally (~34 % form RES, ~24 % from fossil fuel) and ~41 % were imported (in year 2009). Electricity network of Zemgale region is integrated in the overall electricity supply system of Latvia.

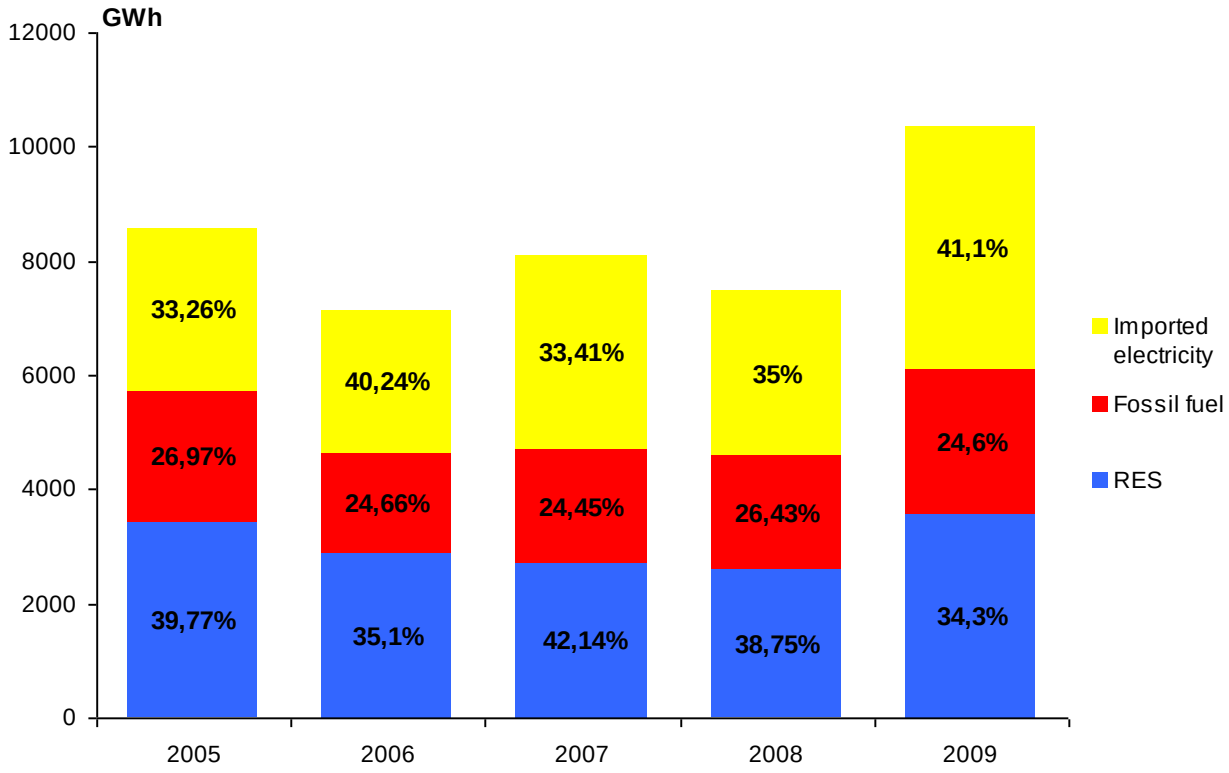


Fig. 4 *Electricity mix in Latvia*

Zemgale region, sources of information: JC Latvenergo

5.1.1 Electricity production from hydro energy

Most of Latvenergo energy produced is obtained in the three major hydroelectric plants in Latvia. Those three power plants produce on average 70% of total electricity generation. Ķegums HPP has a total capacity of 264.1 MW, Plavinu HPP – 868.5 MW and Riga HPP – 402 MW. Kegums and Plavinu HPP are located in Zemgale region. Those two power plants produced **2 599 GWh** of electricity in year 2009.

Along with Plavinu and Kegums hydro power plants there are fifteen small hydro power plants in Zemgale region that produce electrical energy: Aiviekste, Annenieku, Bērzes dzirnavu, Dobele, Grīvnieku, Gārsene, Kroņauce, Līču, Murmuiza, Neretas, Sankaļu, Skrīveru dzirnavu, Spridzēnu,

Viduskroģeru, Ziedlejas hydro power plants produce electrical energy in Zemgale region. In baseline year all those small hydro power plants produced **14,3 GWh** of green energy.

All together hydro power plants in Zemgale region produced **2 613,3 GWh** of electricity in baseline year.

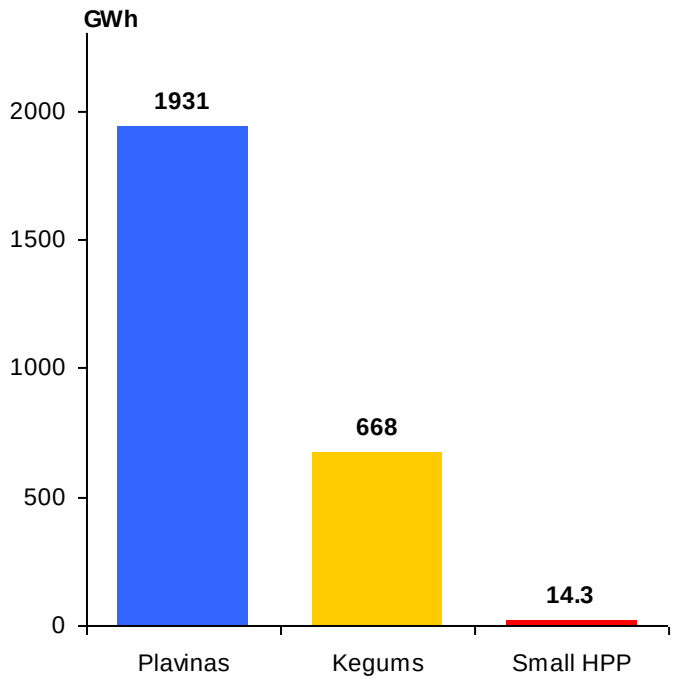


Fig. 5 *Electricity production in hydro power plants in Zemgale region, year 2009.*

Zemgale region, sources of information: JC Latvenergo

5.1.2 Electricity production from natural gas

Not only renewable energy sources are being used for electricity production in Zemgale region. There are three CHPs in Zemgale region that produce electricity. Natural gas is being used as main fuel in those CHP. CHPs in Bauskas, Ozolnieki, Koknese counties all together produced **26 242 MWh** of electricity in baseline year.

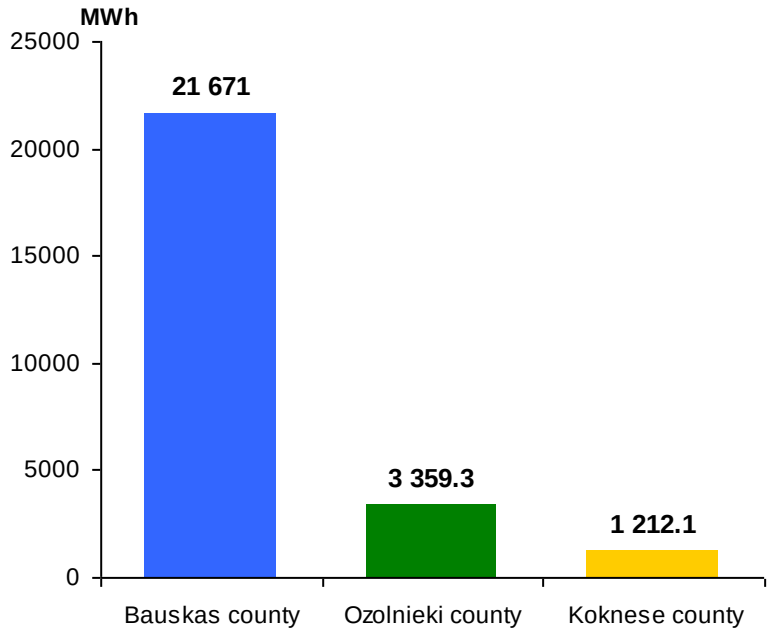


Fig. 6 *Electricity production in local CHPs in Zemgale region, year 2009.*

Zemgale region, sources of information: ZREA

5.1.3 Planned activities in energy production sector

It is planned to build new energy power plants that will produce energy from renewable energy sources:

- It is planned to build Biomass CHP plant in 2011 in Jekabpils municipality. Capacity of this new CHP would be – 1,4 MW_{el} and 6,715 MW_{th}. It is expected that it would produce **7 200 MWh** of "green" electricity per year.
- It is planned to build Biomass CHP plant in year 2012 in Aknistes county. Capacity of this new CHP would be – 1 MW_{el} and 2,4 MW_{th}. It is expected that it would produce approximately **4 000 MWh** of "green" electricity per year.
- It is planned until the end of 2012 to build bio fuel CHP plant in Jelgava. Installed capacity of this plant would be 23 MW_{el} and 45 MW_{th},. Expected that this CHP plant would produce up to **85 000 MWh** of electricity a year. For heat/electricity production it would use wood, peat, straw.

5.2 Electricity consumption

Electrical energy consumers in Zemgale region in year 2009:

- Municipal buildings – 3 912,48 MWh/year
- Tertiary buildings – 60 563,65 MWh/year
- Residential buildings – 253 202,43 MWh/year

- Public lighting – 6 947 MWh/year
- Industry – 53 144,64 MWh/year

Total – 377 770,2 MWh/year

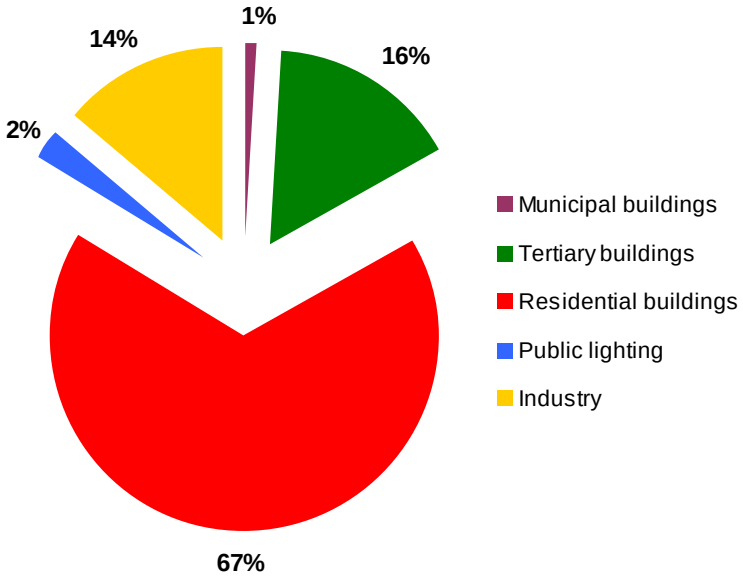


Fig. 7 *Electricity consumption in Zemgale region in year 2009*

Zemgale region, sources of information: LR bureau of Statistics

In total **377 770** MWh of electricity were consumed in Zemgale region in year 2009. In recent year's (2000 – 2008) increment of electricity consumption was noticed in Zemgale region. However in year 2009 electricity consumption slightly decreased. It can be linked to global financial crises, also to decrement of population in Zemgale region (decrement of 2,2 % over last years).

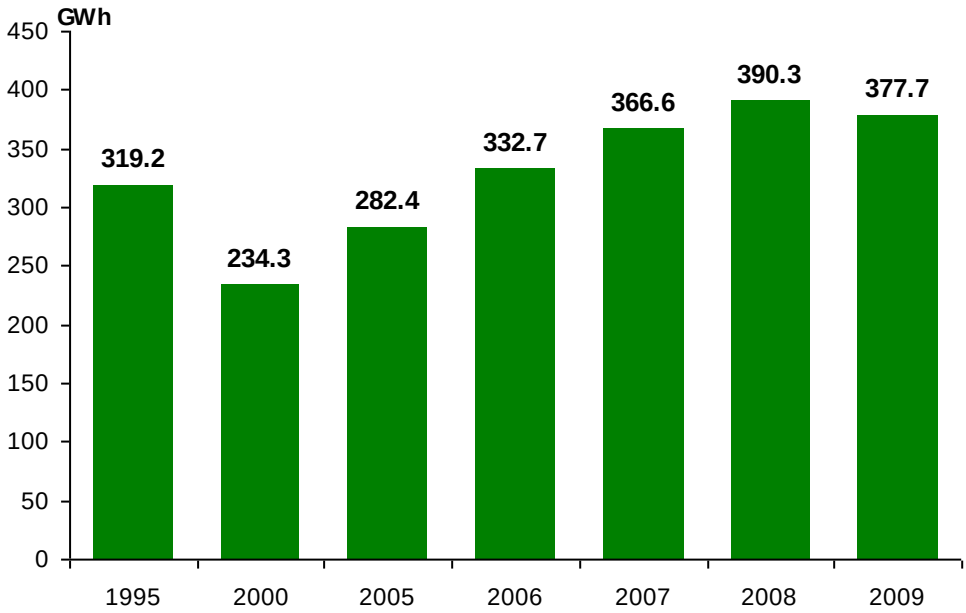


Fig. 8 *Electricity consumption in Zemgale region*

Zemgale region, sources of information: LR bureau of Statistics

5.2.1 Public lighting

16 261 public luminaries were installed in Zemgale region in year 2009. All those luminaries consumed **6 804 MWh** of energy in baseline year.

Majority of used lamps in Zemgale region in public lighting sector were efficient ones - 60 % of bulbs were sodium and 1 % were LED in year 2009. In Jelgava city, Vecumnieki, Dobele, Bauska, Akniste and Iecava counties sodium and LED bulbs took major part in public lighting.

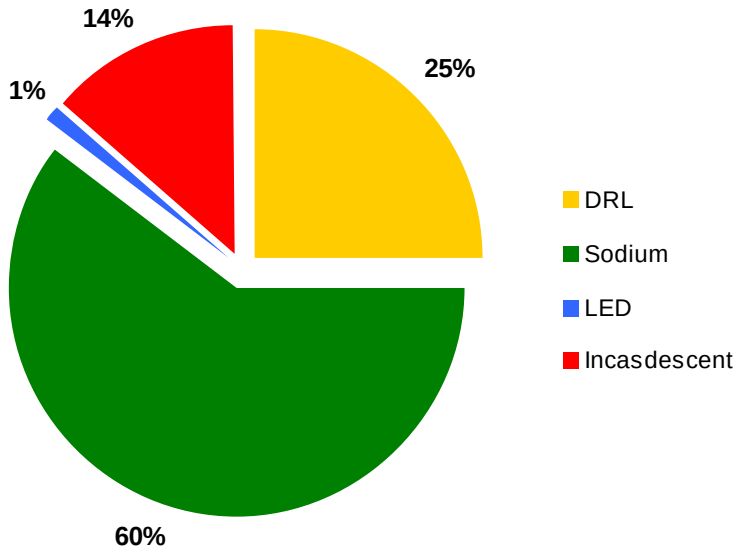


Fig. 9 *Repartition of type of lamps in Zemgale region*

Zemgale region, sources of information: ZREA

In recent years renovation of public lighting took place in several municipalities of Zemgale region – in Jelgava city, Vecumnieki, Iecava, Jelgava and Salas counties new sodium lamps were installed, lighting poles replaced.

But there is still big potential of energy saving in public lighting sector in Zemgale region. 39 % of lamps in public lighting sector are mercury and incandescent (Jekabpils city, Jaunjielgava, Koknese, Tervete, Salas and Ozolnieki counties use only mercury and incandescent lamps).

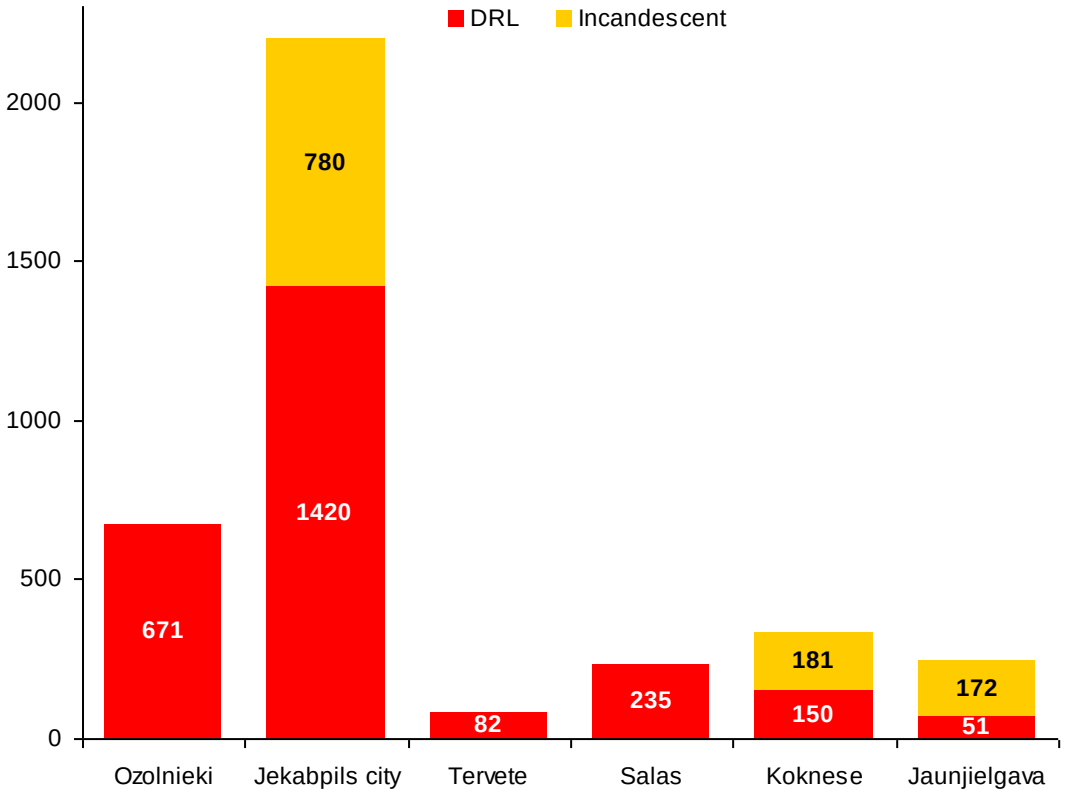


Fig. 10 *Municipalities where only DRL and incandescent bulbs were used in year 2009*

Zemgale region, sources of information: ZREA

Replacement of lamps is the most effective way to reduce energy consumption. By changing old mercury lamps and incandescent bulbs to sodium ones it would be possible to save electrical energy up to 50 %.

5.3 Heat production

19 from 20 counties in Zemgale region in baseline year had district heating systems (only in Nereta county there were no district heating system). In baseline year main fuel for energy production was wood – 1 852 836 MWh. Natural gas took almost fifth part in energy production in district heating sector – 426 213 MWh. Coal also been used for heat production in district heating sector – 4 368 MWh of energy were produced. Overall 2 283 417 MWh of heat energy were produced (in district heating) in Zemgale region in baseline year.

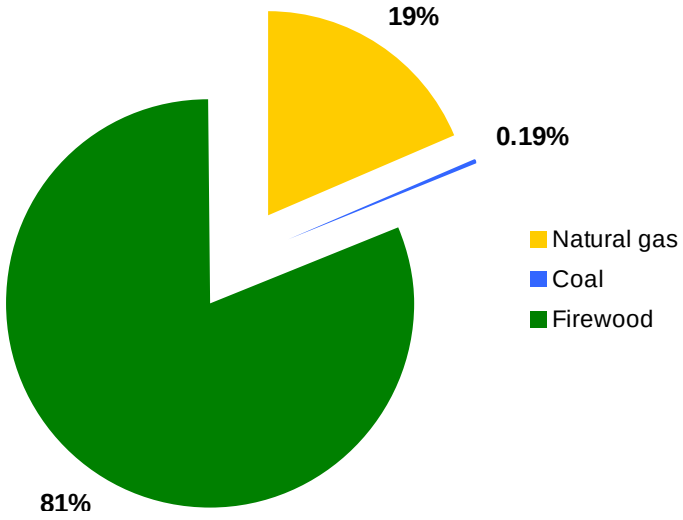


Fig. 11 *Fuel used in district heating sector in year 2009*

Zemgale region, sources of information: LR bureau of Statistics

Most users in decentralized heating sector in Zemgale region used wood (83 %). Natural gas was the second most used fuel for heating (12 %) – situation similar to district heating sector. Coal (4 %), liquid gas (1 %) and heating oil (0,3 %) also were used for heat production.

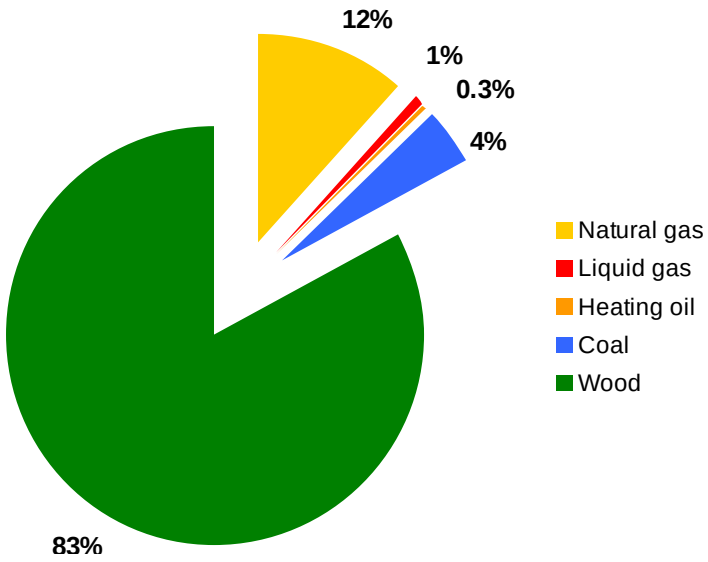


Fig. 12 *Fuel used in decentralized heating sector in year 2009*

Zemgale region, sources of information: LR bureau of Statistics

5.3.1 Heat production (district heating)

County	Name of boiler house	Capacity	Fuel
Aizkraukles county	Rūpniecības 2	19,2 MW	Natural gas
	Kalna 5a	1,4 MW	Natural gas
	Kalna 20	0,4 MW	Natural gas
Akniste county	Akniste city boiler house	2,0 MW	Firewood, chips, sawdust
Auce county	Tehnikas 15	3,5 MW	Wood chips
Bauska county	Mežotnes Parish Centre boiler house,	2 MW	Natural gas
	Ltd. "Īslīces water 'boiler room' Bērzkalni"	2 MW	Natural gas
	Bauska heat boiler house	17.14 MW	Natural gas
	“Windau" cogeneration unit	4.0 MW	Natural gas
Dobele county	Dobeles town	23,8 MW	Natural gas
	Annenieku parish	0,525 MW	Firewood, natural gas
	Krimūnu parish	0,3 MW	Firewood
Iecava county	Iecava	7.72 / 3.72 MW	Natural gas
Jaunjelgava county	Liepu street 17 boiler house;	4,9 MW	Firewood
	Uzvaras street 1 boiler house;		Firewood
	Mednieku street boiler house;		Firewood
	Jelgavas street 31 boiler house		Firewood
Jelgava city	Kalnciema ceļš 109	2,5 MW	Diesel
	Zāļu street 4	0,945 MW	Natural gas
	Skautu street 1a	0,33 MW	Natural gas
	Neretas street 10	1,035 MW	Natural gas
	Ganību street 71	132 MW	Natural gas
	Rūpniecības street 73	0,8 MW	Natural gas
	Filozofu street 50	51 MW	Natural gas
Jelgava county	24 boilers	5995 kW	Firewood, coal, pellets, liquid gas, electricity
Jekabpils city	Tvaika 4	43.38 MW	Gas, woodchip, chips
	Celtnieku 13a	3.36 MW	Chips, woodchips
	Darza 7	6.22 MW	Chips, woodchips
	Kiegelu 1	3.6 MW	Gas
	Rigas 237	0.12 MW	Firewood

	Rigas 104	0.3 MW	Firewood
	Madonas 53a	0.3 MW	Firewood
	Breku studenti	2 MW	Sawdust, chips
	Osukalns	5,67 MW	Wood
Jekabpils county	Leimaņi parish	230 kW	Firewood
	Dunava parish	1.2 MW	Firewood
	Ābeļu parish	1.2 MW	Firewood
	Zasas parish	0.65/0.5 MW	Firewood
Koknese county	Koknese	3.5 MW	Wood chips
	Iršu parish	-	Firewood
	Bebru parish	572 kW	Natural gas
Krustpils county	Mezares parish	1,2 MW	Firewood
	Variesi parish	2 boilers UK-500 kW	Firewood
	Krustpils parish	0,8 MW	firewood
	Kūku parish	1,05 MW	firewood
Neretas county	*No district heating system*		
Ozolnieku county	Boiler house Kastaņu street Nr.2	6,339 MW	Natural gas
	Āne boiler house	4,2 MW	Natural gas
Plavinas county	Rīgas boiler house	2 MW	Wood chips
	Raiņa boiler house	1,5 MW	Wood chips
Rundale county	Pilsrundale boiler house	1.2 MW	Natural gas
	Saulaine boiler house	1,36 MW	straw
Salas county	Salas	1,45 MW	Natural gas
Skriveri county	Skriveri	2 MW	firewood
Tervetes county	„Līdumi”,	1,0 MW	Firewood
	„Lāči”,	0,45 MW	Firewood
	„Labrenči”	0,5 MW	Firewood
Vecumnieki county	Vecumnieki Parish	5,1 MW	Wood chips, firewood, natural gas
	Misa	4,0 MW	Wood chips, natural gas
Viesite county	Viesīte	3,5 MW	Firewood, wood chips, sawdust
	Rites parish	400 kW	firewood

In baseline year nine counties in Zemgale region used only renewable energy sources (firewood, sawdust, wood chips etc.) for heat production in district heating sector. Six counties used only fossil fuel (natural gas, coal etc.) for heat production in district heating sector. Also six counties in Zemgale region used both fossil fuel (natural gas, diesel etc.) and renewable energy sources (firewood, sawdust, wood chips etc.) for heat production in district heating sector.

In recent years series of actions in order to improve situation in district heating (boiler houses) and to increase renewable energy usage were done. However there is still big potential of renewable energy sources integration in district heating sector. In Aizkraukles, Bauska, Ozolnieku, Salas, Iecava counties and Jelgava city only natural gas was used for district heating in year 2009. Also in Dobele, Jelgava, Koknese, Rundale, Vecumnieki counties and Jekbapils city natural gas along with wood were used for heat production in district heating system.

In rest counties of Zemgale region – Akniste, Auce, Jaunjielgava, Jekabpils, Krustpils, Plavinas, Skriveri, Tervetes and Viesite counties – only renewable energy sources were used for heat production in district heating systems.

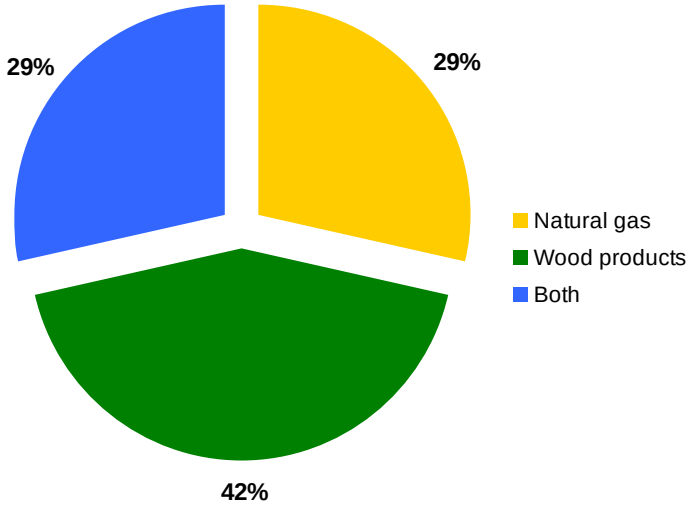


Fig. 13 *Fuel used in district heating sector in different counties*

Zemgale region, sources of information: LR bureau of Statistics

5.3.2 Heating consumption

The current centralized heat supply system in Zemgale region has been created during the 7th and 8th decade of the past century. However, during last years situation in heating sector, due to renovation of heating network and reconstruction of boiler houses, was improved. Heat consumption (district heating sector) in Zemgale region in 2009:

- Municipal buildings – 18 309,82 MWh/year
- Tertiary buildings – 283 428,9 MWh/year
- Residential buildings – 1 184 949,72 MWh/year
- Industry – 248 709,01 MWh/year

  Total – 1 735 397,45 MWh/year

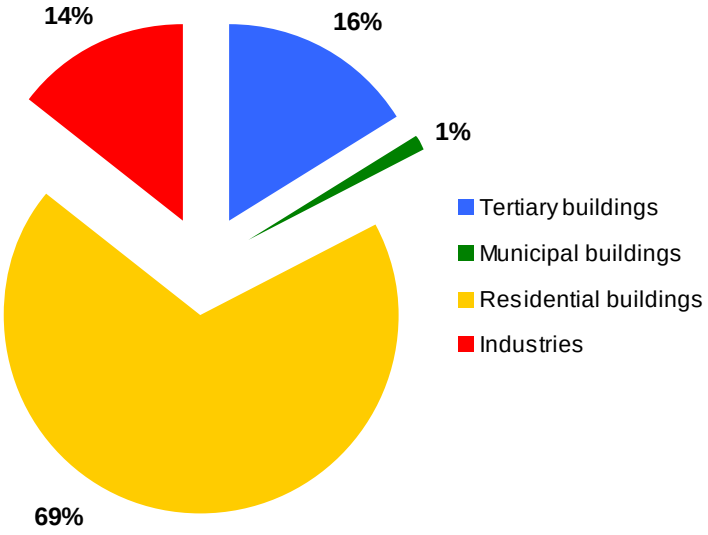


Fig. 14 *Heat consumption (district heating) in Zemgale region in 2009*

Zemgale region, sources of information: LR bureau of Statistics

5.3.3 Heat losses in district heating

Substantial energy saving in district heating sector could be reached by reduction of heat losses in network. Only seven counties of region district heating networks had low percent of heat losses. Heat losses in Aknistes, Dobeles, Koknese, Aizkraukle, Krustpils, Iecava, Skriveri, Jaunjielgava and Ozolnieki counties district heating networks were around 10 % – 13 % in baseline year.

In other regional district heating networks - higher losses were determined for year 2009. For example: 30,35 % in Plavinas county, 40 % in Annieku parish (Dobele county), 27 % in Jelgava county, 26,1 % in Jekabpils city. On the average **16,7 %** of heat losses were determinated in district heating in Zemgale region in baseline year. In comparison with year 2005 (19,9 %) losses were reduced by 3,2 %

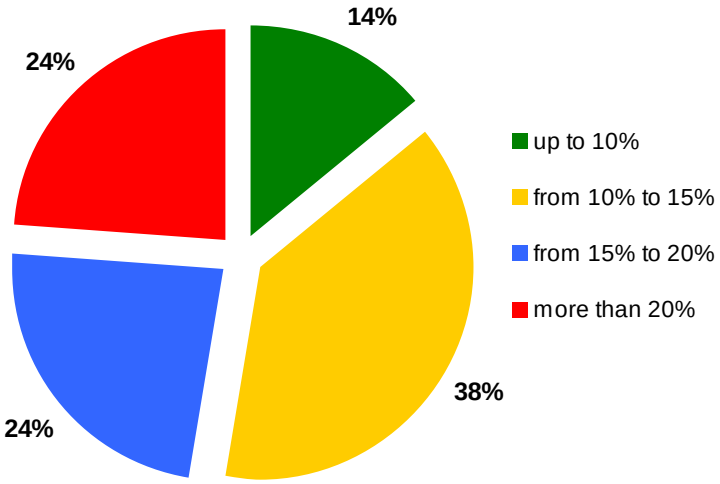


Fig. 15 *Heat losses in district heating systems in Zemgale region (2009)*

Zemgale region, sources of information: LR bureau of Statistics

Nevertheless there is considerable potential for heat losses reduction in district heating systems. By continuing renovation of district heating systems it would be possible to save up to **107 320 MWh** of energy if heat losses in district heating systems of Zemgale region would be reduced up to 12 %.

5.3.4 Planned activities in heat production sector

It is planned to build new energy power plants that will produce energy from renewable energy sources:

- It is planned to build new biomass CHP plant in Jekabpils city. Capacity of this new CHP would be – 6,715 MW_{th} and 1,4 MW_{el}. It is expected that it would produce **26 800 MWh** of "green" heat energy a year.
- It is planned to build biomass CHP plant in year 2012 in Aknistes county. Capacity of this new CHP would be – 2,4 MW_{h} and 1 MW_{el}. It is expected that it would produce approximately **9 600 MWh** of "green" heat energy per year.
- It is planned to build biomass CHP plant in Jelgava city until the end of 2013. Installed capacity of this plant would be 45 MW_{th}, 23 MW_{el}. This CHP plant would produce up to 230 GWh of heat and 85 GWh of electricity per year. For heat/electricity production wood, peat, straw will be used.

5.4 Transport and mobility

The transport sector represents approximately 30 % of the final energy consumption in the European Union. Cars, trucks and light vehicles are responsible for 80 % of the final energy consumed in the transport sector.

In year 2009 there were 154 557 vehicles registered in Zemgale region. It was calculated that all those vehicles used **291 718 MWh** of energy. It represented 7,4 % of final energy consumption in Zemgale region.

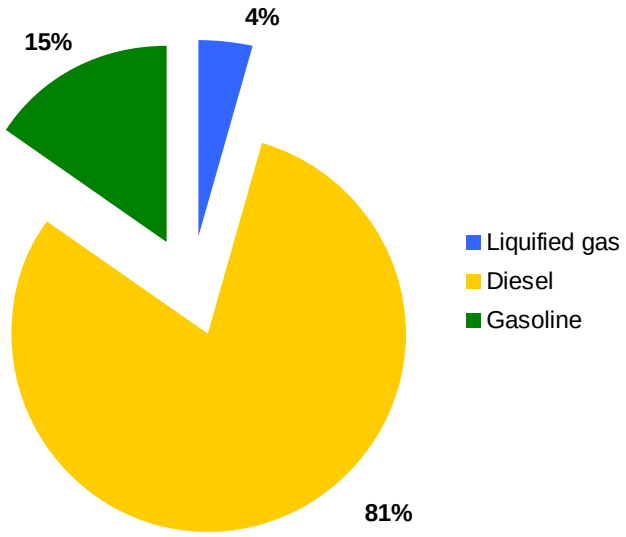


Fig. 16 *Fuel consumed in transport sector in baseline year*

Zemgale region, sources of information: LR bureau of Statistics

Municipal fleet in Zemgale region consisted of 569 vehicles in year 2009 (287 of them used petrol and 282 used diesel). Overall **9 006 MWh** of energy were used in municipal transport sector in year 2009.

In baseline year public transport (1 288 vehicles) in Zemgale region consumed **50 495 MWh** of energy. In recent years number of public transport units decreased (for example 1334 vehicles were registered in year 2005).

However total number of vehicles in Zemgale region had a tendency to grow – number of vehicles increased by 15 % (compared year 2005 to 2009). Due to consistent increment of vehicles in Zemgale region, it is expected that number of vehicles would increase on 10–15 % by 2020 compared with year 2009. Fuel consumption would increase in parallel.

It is necessary to pay serious attention to transport sector in Zemgale region and to take actions by promoting efficient driving, eco fuels, public transport etc.

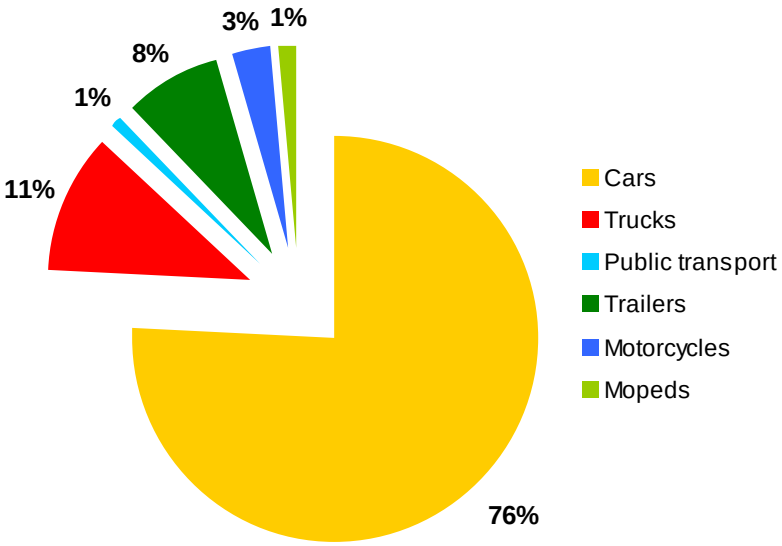
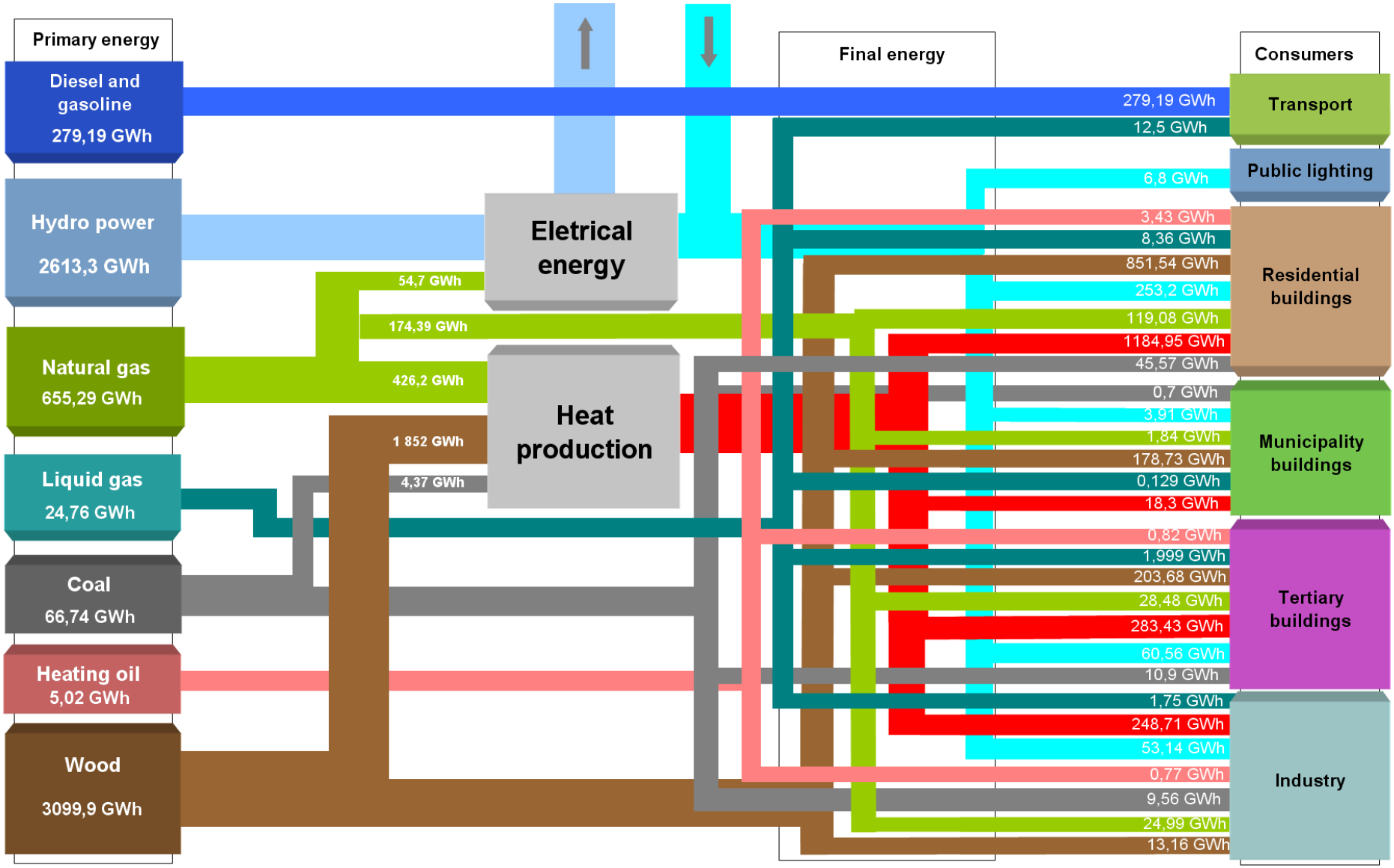


Fig. 17 *Type of vehicles registered in Zemgale region*

Zemgale region, sources of information: LR bureau of Statistics

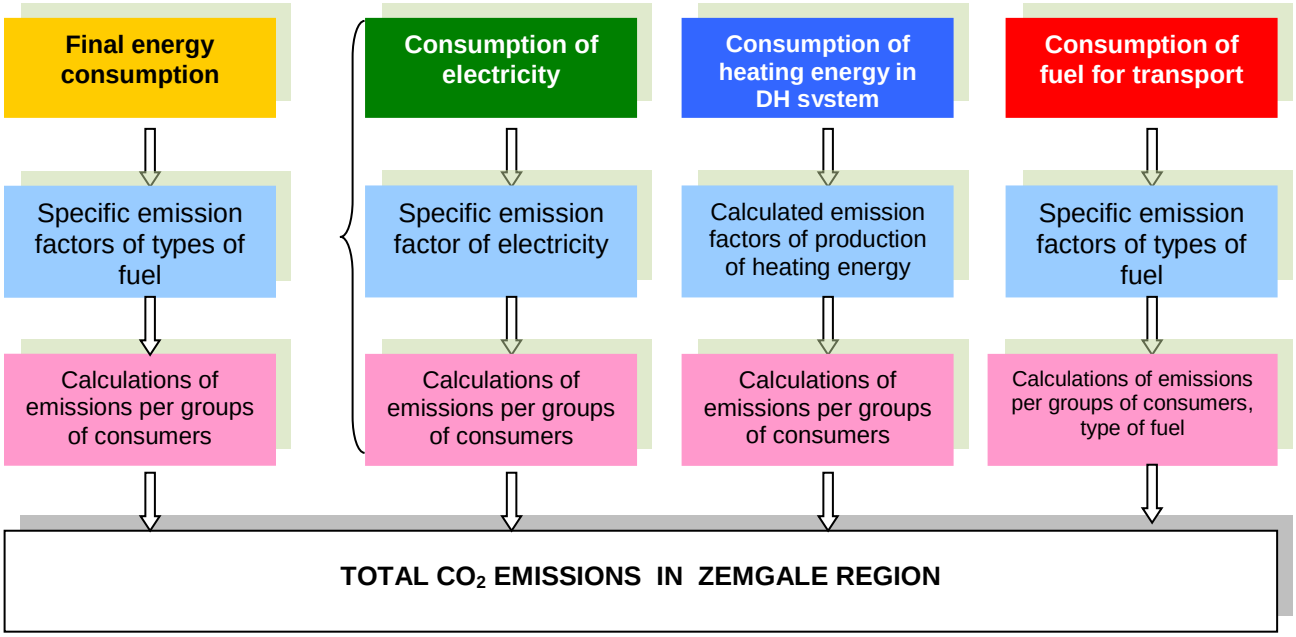
5.5 Energy production and consumption in Zemgale region (in year 2009)



6. Calculation of emissions

6.1 Methodology for calculation of emissions

As a basis for calculation of volume of carbon dioxide (CO_2) emissions all kinds of energy consumption in all the territory of Zemgale of all the year, irrespective of the place where this energy is produced. CO_2 emissions are calculated separately for electricity consumption, consumption of heat energy in district heating system, consumption of fuel for transport and final energy consumption in households, industry, state and municipal enterprises and in service sector. From the group of gasses creating greenhouse effect only CO_2 emissions are calculated. In calculation of emissions the "standard" methodology has been used and parameters from the guidelines elaborated by IPCC - Intergovernmental Panel on Climate Change. The algorithm used for calculation of CO_2 emissions in Zemgale region:



In calculation of CO_2 emissions the energy consumptions which cannot be influenced by municipality are not taken into consideration, and which are beyond competency of municipality, such as sea and rail transport, all kind of freight transit, aviation services, use of agricultural and construction technique. Also the emissions from the industry technologies, decomposition processes of natural organic substances, sewage treatment tanks and landfills as well as from open burning processes.

In calculation of CO_2 emissions the factors based on average physical properties of fuels used in Latvia are applied as well as methodological instructions of IPCC.

For calculation of CO_2 emissions from the electricity consumption the emission factor is used, which characterizes the average structure of production of electricity in Latvia (instructions from SEAP-guidebook) as electricity consumed in Zemgale region is provided from different sources of electricity production.

For calculation of CO_2 emissions from the consumption of heating energy in the district heating system the emission factor is used, which is calculated basing on structure of production of heating energy and structure of fuel in that particular year. Algorithm for calculation of CO_2 emission factor of production of heat energy in the district heating system:

$$E_F = \frac{CO_{2VES}}{V_{SA}}$$

Where :

E_F = CO_2 emission factor in district heating system [t/MWh]

CO_{2VES} = total amount of CO_2 in the heating supply produced by the local producers [T]

V_{SA} = total amount in district heating, that has been consumed [MWh]

Algorithm for calculation of CO_2 emission factor for production of heat energy in Cogeneration stations of district heating

$$E_{KO} = \frac{\frac{(V_S)}{K_S}}{\frac{(V_S)}{K_S} \quad \frac{(V_E)}{K_E}} * CO_{2k}$$

Where :

E_{KO} = CO_2 emission factor in cogeneration stations for heat energy [t/MWh]

CO_{2K} = CO_2 emission factor depending on the type of the fuel used in cogeneration station [T]

V_S = total amount of produced heat in the cogeneration stations [MWh]

K_S = typical efficiency coefficient in production of heat energy when not using cogeneration (assumed 90%) [MWh]

K_E = typical efficiency coefficient in production of electricity when not using cogeneration (assumed 40%) [MWh]

V_E = total produced volume of electricity at the cogeneration station [MWh]

Firstly the CO_2 emission factor of heat production in cogeneration stations is calculated, after which it is possible to calculate the total CO_2 emission factor for heat production in the district heating system.

6.2. Data for calculation of the emissions

Information about the total heat consumption in the district heating system in Zemgale region and per different consumer groups was received from the main heat supply operators. As basis for electricity consumption were taken data from joint stock company ”Latvenergo”. To estimate the structure of energy end consumption in Zemgale region the information received from different the municipalities was used (type of buildings and structure of property).

For the calculation of consumption of the primary energy resources the data provided by LR Central Bureau of Statistics were used. In those data information has been compiled about total amount of gas, wood, coal, petrol, and diesel used in region. LR Central Bureau of Statistics provided data on the consumption of the primary energy resources in boiler houses as well as in cogeneration stations.

By use of primary energy resources the consumed energy for heat supply and transport was calculated, using conversion factors from mass to energy in units. Thus the total consumed volume of energy was calculated. Distribution in separate user groups was done basing on the information provided by the municipalities on the total structure of property in Zemgale region, volume, type of use and ownership.

For estimation of energy end consumption in the household sector the data were used on structure of energy consumption, number of consumers and characteristics of households from the LR Central Bureau of Statistics. In these data there is separately shown information on energy consumption structure in households in Zemgale region.

All calculations were made under Sustainable Energy Action Plan preparation guidelines.

6.3 CO_2 emission baseline inventory (in year 2009)

Category	CO_2 emissions [t]/ CO_2 equivalent emissions [t]										
	Electricity	Heat/ cold	Fossil fuels						Renewable energies		Total
			Natural gas	Liquid gas	Heating Oil	Diesel	Gasoline	Coal	Biofuel	Wood	
BUILDINGS, EQUIPMENT/FACILITIES AND INDUSTRIES:											
Municipal buildings, equipment/facilities	426	989	371,68	26,08				240,13		1787,29	3840,46
Tertiary (non municipal) buildings, equipement/facilities	6601	15307	5753,53	403,75	216,54			3717,15		2036,79	3403571
Residential buildings	27599	63993	24054,15	1687,99	1169,36			15540,55		8515,36	142559,38
Municipal public lighting	742										742
Industries (excluding industries involved in the EU Emission trading scheme - ETS)	5793	13431	5048,72	354,29	204			3261,81		131,58	28224,64
Subtotal buildings, equipments/facilities and industries	41161	93719,69	35228,09	2472,12	1589,91			22759,84		12471,02	209401
TRANSPORT:											
Municipal fleet						1548,19	798,9				4694,19
Public transport				2334,12		10826,16	1909,06		7,02		15076,36
Private and commercial transport						49787,11	8779,35		32,29		58598,75
Subtotal transport				2334,12		60613,27	10688,41		39,31		78369,31
Total	**41161**	**93719,69**	**35228,09**	**4806,23**	**1589,91**	**60613,27**	**10688,41**	**22759,64**	**39,31**	**12471,02**	**287771,72**

Zemgale region has commited to reduce CO_2 emissions in it's territory at least by 20 % until year 2020. To reach this goal at first it is necessary to define baseline emission inventory in region. Emissions in different energy sectors were calculated and shortly described below.

6.4 Electricity

Latvenergo AS – the leading producer of electricity and thermal energy in Latvia, supplies electricity to Zemgale region. **377 770 MWh** of electrical energy were consumed in Zemgale region in baseline year. Therefore **41 176 tones** of CO_2 emissions were emitted.

Major part of electricity in baseline year in region was consumed in residential buildings (67 %). Tertiary buildings sector along with industry sector were responsible for 30 % of CO_2 emissions in Zemgale region.

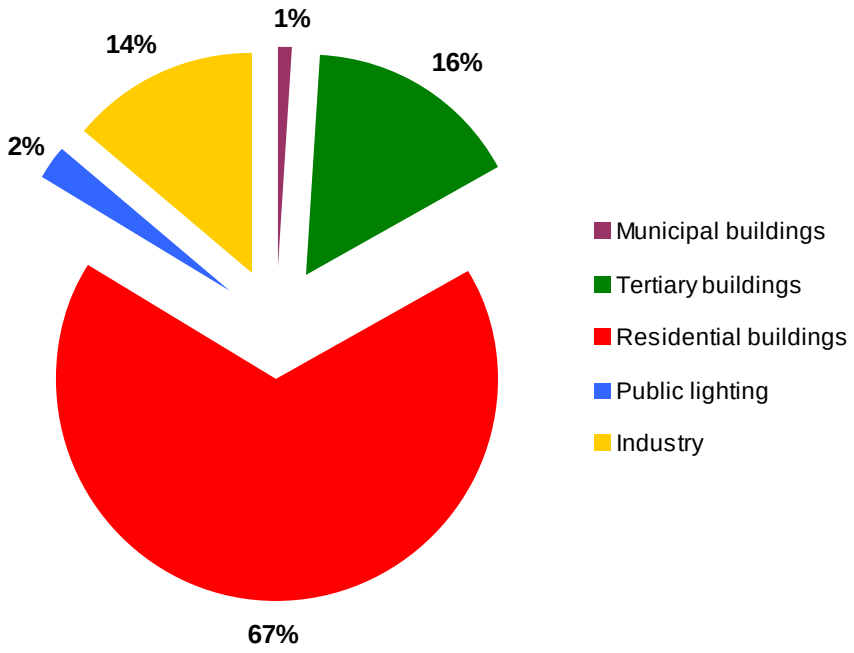


Fig. 18 *CO_2 emissions in electricity sector in Zemgale region*

Zemgale region, sources of information: ZREA

Most electricity was consumed in residential buildings sector in baseline year; therefore this sector has the biggest possibilities of CO_2 reduction. Decrement could be reached via changes of citizens' behaviour – stimulation of efficient energy appliance usage; promotion of energy saving at home etc.

Potential of CO_2 reduction

- *There is a potential of electricity saving in public lighting sector. By changing old mercury lamps to sodium ones it would be possible to reduce CO_2 emissions by **50 %**.*
- *It is planned to build new biomass CHP in Jekabpils municipality in 2011. Planned capacity for the new plant is 1,4 MW_{el} and 6,715 MW_{th}. Planned amount of electricity produced in this new CHP plant is 7 200 MWh per year. By producing "green" electricity it would be possible to reduce CO_2 emissions by **784 tones**.*
- *It is planned to build Biomass CHP plant in year 2012 in Aknistes county. Capacity of this new CHP would be – 2,4 MW_{th} and 1 MW_{el}. Planned amount of electricity produced in this new CHP plant is 4 000 MWh per year. By producing "green" electricity It would be possible to reduce CO_2 emissions by **436 tones***

6.5 Heating

Most heat energy in Zemgale region in baseline year was consumed in residential buildings sector. Therefore, most emissions were emitted in this sector. **114 960 tones** of CO_2. In tertiary buildings sector – **27 434 tones** of CO_2 emissions were emitted in year 2009. **22 431 tones** of CO_2 emissions were emitted in industry sector in baseline year. The least quantity of emissions was emitted in municipal buildings sector – **3 414 tones**. Overall **168 240 tones** were emitted in heating sector in baseline year.

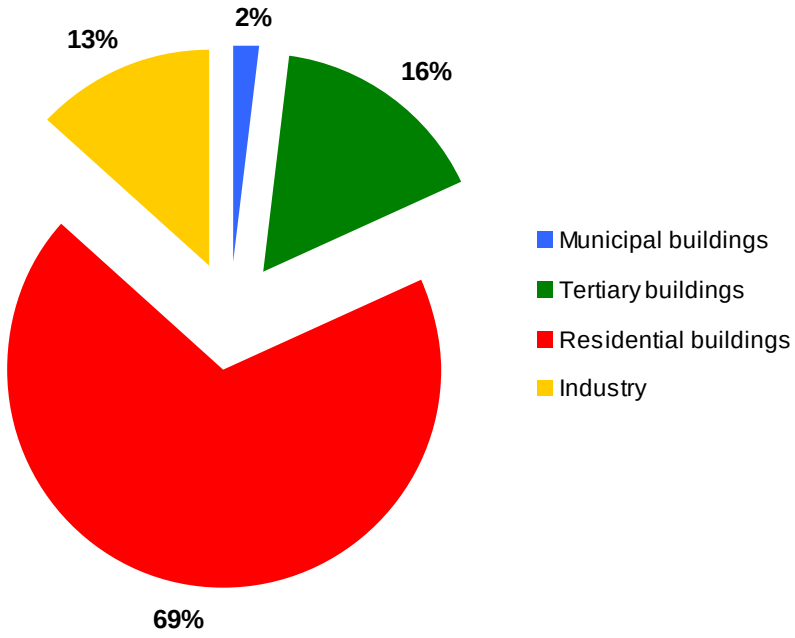


***Fig. 19** CO_2 emissions in heating sector in Zemgale region*

Zemgale region, sources of information: ZREA

Potential of CO_2 reduction

- *By renovating district heating network, replacing old pipes to new, till year 2020 it would be possible to reduce average heating losses in Zemgale region from 16,7 % to 10 % and reduce CO_2 emissions by **1 510 tones.***
- *By renovating half of residential buildings, that are connected to district heating until year 2020, it would be possible to reduce energy consumption by 40 % and reduce CO_2 emissions by **12 800 tones.***
- *It is planned to build new biomass CHP in Jekabpils municipality in 2011. Planned capacity for the new plant is 1,4 MW electricity and 6,715 MW heat. Planned amount of heat energy produced is 26 800 MWh per year. In this case it would be possible to reduce CO_2 emission up to **2 840 tones.***
- *It is planned until the end of year 2013 to build bio mass CHP plant in Jelgava. Installed capacity of this plant would be 45 MW_{th}, 23 MW_{el}. Expected that this CHP plant would produce up to 230 GWh of heat and 85 GWh of electricity a year. For heat/electricity production it would use wood, peat, straw. This CHP will cover 71 % of heating energy demand of Jelgava. In this case CO_2 emissions will be reduced by **28 038 tones**.*

Buildings are responsible for 40 % of total EU energy consumption and are often main (most important) energy consumer and CO_2 emitter in urban areas. Therefore, it is crucial to plan efficient polices to reduce energy consumption and CO_2 emissions in this sector. Here are some suggestions of policies that can be implemented at the local level in order to boost energy efficiency and renewables in buildings.

Regulations for new/renovated buildings

- Adopt stricter global energy performance standards than those applicable at national/regional level, especially if such standards are not particularly demanding. Depending on the national/regional regulatory context, local authorities may be able to adopt such standard in their urban planning rules and regulations.
- Adopt specific standards for building components (thermal transmittance of the envelope, of windows, efficiency of the heating system, etc.). This option has the advantage to be simple to understand, and guarantees the minimal performance of the components, even if the overall performance cannot be achieved.
- Impose the inclusion of some components that will help to improve the energy efficiency (shading devices, presence of meters that record the energy consumption, heat recovery devices for mechanical ventilation etc.). This can be done as a general rule that would apply to all new buildings, or could be imposed on a case by case basis, according to the

building characteristics (e.g. impose shading devices to buildings having a significant glazing surface oriented to the south).

- Impose a certain quantity of renewable energy production/ usage, in particular in public buildings.
- Adopt energy performance standards for renovation works which are not considered as 'major renovation' by national/regional law, and for which no energy performance standards apply.

Information and training

- Make the relevant stakeholders (architects, building developers, construction companies, citizens) aware of the new energy performance requirements for buildings, and provide them some motivating arguments (the savings on the energy bills can be highlighted, as well as the benefits in terms of comfort, environmental protection, etc.).
- Inform the general public and key stakeholders about the importance and benefits of behavior favoring the reduction of energy consumption and CO_2 emissions.
- Involve local companies: they may have an economic interest in the energy efficiency and renewable energy business.
- Inform the stakeholders about the resources available: where can the information be found, what are priority measures, who can provide proper advice, how much does it cost, how can households do proper work by themselves, what are the tools available, who are the local competent architects and entrepreneurs, where can the necessary materials be purchased locally, what are the available subsidies? This could be done via info days, brochures, information portal, information centre, helpdesk etc.
- Organize specific info and training sessions for the architects, workers and construction companies: they must become familiar with the new design and constructing practices and regulations. Specific training could be organised to cover basic issues (basic building thermal physics, how to install properly thick insulation layers) or more specific issues that are often neglected (thermal bridges, building air tightness, natural cooling techniques, etc.).
- Make sure the tenants, owners and managers of new and renovated buildings are informed about the building's features: what makes this building energy efficient and how to manage and operate the equipment and facilities offered in order to obtain a good comfort and minimize the energy consumption. All the technical information needs to be passed to technicians and maintenance companies.

Promote successes

Encourage people to build efficient buildings by offering them recognition: buildings significantly above the legal standards of energy performance could be made visible by a label, open day visits, an exhibition in the town hall, an official ceremony, signposting on the loca authority's website, etc. The energy performance certificate, which is a requirement of the Energy Performance of Buildings Directive, could be used for that purpose (e.g. the local authority could organize a contest for the first 'Label A' buildings built in the municipality).

Demonstration buildings

Demonstrate that it is feasible to build energy-efficient buildings or to make renovation with high-energy performance standards. Show how it can be done. Some high performance buildings could be open to the public and stakeholders for this purpose. It does not necessarily need to be a high technology building – the most efficient ones are sometimes the simplest ones: the problem with energy efficiency is that it is not always quite visible (think about thick insulation for example). However, listening to the owner and the occupants talking about their experience, their reduced energy bills, their improved comfort, etc should already be worthwhile.

Promote energy audits

Energy audits are an important component of energy efficiency policy, as they enable identifying, for each audited building, the best measures allowing to reduce energy consumption. Therefore, the local authority could promote such audits via proper information, ensuring the availability of competent auditors (training), financial support to audits (see part III of the Guidebook of Covenant of Mayors for more information on energy audits).

Urban planning

As explained in the dedicated section, urban planning is a key instrument to boost and plan refurbishments. In addition to setting energy performance standards, as mentioned above under 'regulation', urban regulations should be devised in such a way not to deter energy efficiency and RES projects. For instance, long and complex authorisation procedures to install solar panels on roofs of existing buildings will be a clear obstacle to RES promotion and should be avoided.

Increase the rate of refurbishment

By accelerating the rate of buildings undergoing energy efficient refurbishments, the impact of the above measures on the energy and CO_2 balance will increase. Some of the above measures, and in particular urban planning, financial incentives, loans or information campaigns about the benefits of energy efficient renovations are likely to have such an effect.

6.6 Transport

In Zemgale region transport sector represents approximately **27 %** of total CO_2 emissions. It was calculated that **78 369 tones** of CO_2 emissions were emitted by different vehicles in Zemgale region in baseline year. Major part of CO_2 emissions came from private and commercial vehicles – **58 598 tones**. Public transport in year 2009 emitted **15 076 tones** of CO_2 emissions. Municipal fleet emitted **4 694 tones** of CO_2 in baseline year.

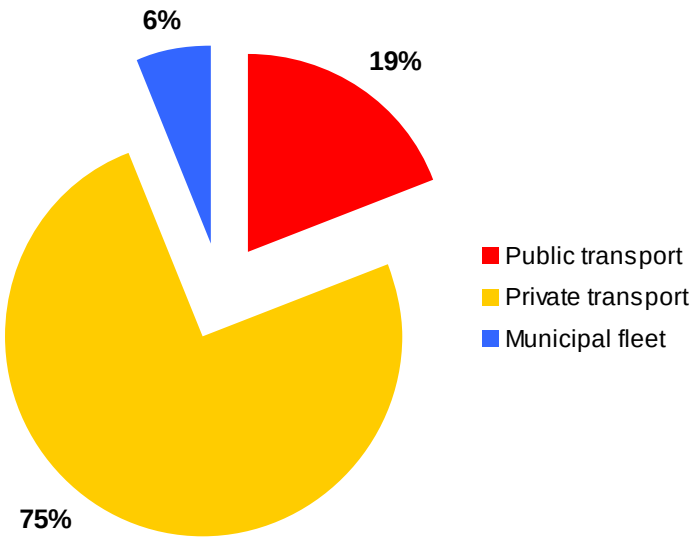


Fig. 20 *Repartition of CO_2 emissions in transport sector in Zemgale region*

Zemgale region, source of information: ZREA

Potential of CO_2 reduction

- *By promoting efficient driving, travel by foot and bicycle (also laying new bicycle and foot ways), promoting "car pooling", "car sharing", public transport and etc. it would be possible to reduce energy consumption and CO_2 emissions at least by 5 %. These measures would reduce CO_2 emissions by **3 684 tones**.*
- *The use of biofuels in vehicles, according to the 2009/28/EC Directive, will reduce GHG emissions in the range 30% - 80% in comparison with fossil fuels over the entire life cycle. It*

*would be possible to decrease CO_2 emissions in public transport sector from **4 522 tones** up to **12 060 tones**.*

It is calculated that efficient driving behavior may reduce CO_2 emissions that are emitted by cars up to 15 %. However, in order to change current situation it is necessary to implement complex means that would help to reduce CO_2 emissions in transport sector. Solutions need to be tailor-made, based on wide consultation of the public and local stakeholders. Different possibilities of CO_2 reduction in transport sector listed below.

Reducing the need for transport

- Providing door-to-door access choices across the urban agglomeration. This objective may be reached through an appropriate combination of less flexible ways of transport for long and medium distances and other more flexible ways, such as bike hiring for short distances.
- Making efficient use of space, promoting a 'compact city' and targeting the urban development to public transport, walking and cycling.
- Strengthening the use of information and communication technologies (ICT).
- Protecting existing short-routes in the network in order to diminish the energy consumption of those less efficient or more necessary means of transport (i.e. massive public transport)

Increasing the attractiveness of 'alternative' transport modes

Increasing the modal share for walking, cycling and public transport can be achieved through a wide variety of plans, policies and programmes.

- *Public transport.* Increasing the modal share for public transport requires a dense network of routes that meets the mobility needs of people.
- *Cycling.* Increasing the modal share for cycling also requires a dense network of well-maintained routes that are both safe to use and perceived by the public as such. Spatial and transport planning should treat cycling as an equal mode of transport, along with cars and public transport.
- *Walking.* Spatial planning should reserve the space that is necessary for the 'walking infrastructure' and ensure that local services are sited within walking distance from residential areas. For example, 'Pedestrian only zones' and 'low speed zones' with lower vehicle speed limits that allow pedestrians and cars safely share the same space. In these areas pedestrians always have priority over cars.

Information and marketing

Local marketing campaigns that provide personally tailored information about public transport, walking and cycling alternatives have been successful in reducing car use and increasing levels of public transport use.

Reduce municipal and private vehicle fleet emissions

Municipal and private vehicles emission reductions may occur by using hybrid or other highly efficient technologies, the introduction of alternative fuels and promoting efficient driving behaviour. Among the main uses of green propulsion in public fleets are the following:

- Use of hybrid or totally electric vehicles in public fleets. Make use of fully electric vehicles in public transport and recharge them with renewable electricity. *"According to the European Commission Directive 93/116/EC relating to the fuel consumption of motor vehicles, CO_2 emissions for two equivalent vehicles (combustion and hybrid) can be reduced by 50 %."*
- Use of biofuels in public fleets and make sure that vehicles acquired through public tenders accept the use of biofuels. Biodiesel and bioethanol can be used in mixes in diesel and gasoline engines respectively, whereas biogas can be used in natural gas vehicles.

6.7 CO_2 emissions summary

It was calculated that in total **287 786 tones** of CO_2 emissions were emitted in Zemgale region in baseline year (2009). Major part of CO_2 emissions in Zemgale region were emitted from heating sector – **168 240 tones**. **78 369 tones** of CO_2 emission in region came from transport. The least part of CO_2 emissions came from electricity used in Zemgale region – **41 176 tones**.

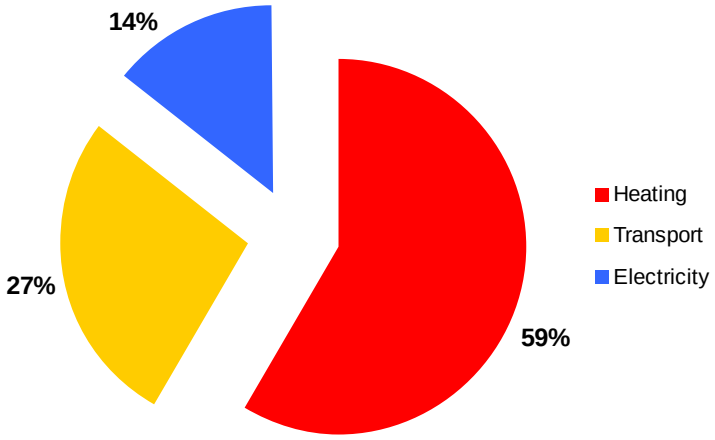


Fig. 21 *CO_2 emissions in different sectors*

Zemgale region, sources of information: ZREA

The main goal for all cities and regions of “Covenant of Mayors” is to reach 20 % reduction of CO_2 emissions till year 2020 (comparing with baseline year).

As it was mentioned before – **287 786 tones** of CO_2 were emitted in baseline year. In order to achieve goal of “Covenant of Mayors” region should reduce emissions by **57 557 tones** until year 2020.

Despite the fact that many improvements were made in Zemgale region already, it is necessary to continue sustainable development in Zemgale region.

7. Ways of CO_2 reduction in Zemgale region

1. It is planned to build new biomass CHP in Jekabpils municipality in 2011. In this case it would be possible to reduce CO_2 emissions up to **3 624 tones** *(electricity and heat).*
2. It is planned to build biomass CHP plant in year 2012 in Aknistes county. Capacity of this new CHP would be – 2,4 MW_{th} and 1 MW_{el}. Planned amount of electricity produced in this new CHP plant is 4 000 MWh per year. By producing “green” electricity It would be possible to reduce CO_2 emissions by **436 tones**
3. By renovating district heating network, replacing old pipes to new, till year 2020 it would be possible to reduce average heating losses in Zemgale region from 16,7 % to 12 % and reduce CO_2 emissions by **5 795 tones.**
4. By renovating half of residential buildings, that are connected to district heating until year 2020, it would be possible to reduce energy consumption by 40 % and reduce CO_2 emissions by **12 800 tones.**
5. By promoting efficient driving, travel by foot and bicycle (also laying new bicycle and foot ways), promoting “car pooling”, public transport and etc. it would be possible to reduce energy consumption and CO_2 emissions at least by 5 %. These measures would reduce CO_2 emissions by **3 684 tones**.
6. The use of biofuels in vehicles, according to the 2009/28/EC Directive, will reduce GHG emissions in the range 30% - 80% in comparison with fossil fuels over the entire life cycle. It would be possible to decrease CO_2 emissions in public transport sector around **4 500 tones**
7. It is planned until the end of 2012 to build bio fuel CHP plant in Jelgava. Installed capacity of this plant would be 45 MW_{th}, 23 MW_{el}. Expected that this CHP plant would produce up to 230 GWh of heat and 85 GWh of electricity a year. For heat/electricity production it would use wood, peat, straw. This CHP will cover 71 % of heating energy demand of Jelgava. In this case CO_2 emissions will be reduced by **28 000 tones**.

8. It was found that some boiler in Zemgale region still use hard coal for heat production. By changing fuel from fossil fuel to bio fuel it would be possible to reduce CO_2 emissions by **25 000 tones**

It was calculated that **287 786 tones** of CO_2 emissions were emitted in Zemgale region in 2009. Using all mentioned measures it would be possible to reduce CO_2 emissions by **83 839 tones,** or on 29 % in comparison to baseline year.

8. Use of renewable energy sources (RES) in energy production

Resource to renewable energy resources will not result in a reduction of energy consumption, but could ensure that the used energy has a lower impact on the environment. RES potential in Latvia is big and so far it has not been used sufficiently. This has happened due to inadequate planning, the lack of knowledge and poor availability of technologies. Besides the use of renewable energy resources has been hindered by the socially economic factors, like nearness of Russia with its vast fossil resources, which just a few years ago were available in Latvia and very cheap.

In this chapter potential of renewable energy source (RES) in Zemgale region is reviewed.

8.1 Biomass energy

Straw

Since grain cultivation in Zemgale is the main sector of agriculture, the straw here is available in bulk. This is also reflected in figures below.

	Grain	Rape	Total
Riga	17 705	2 830	20 535
Vidzeme	19 871	4 125	23 996
Zemgale	***42 410***	***11 489***	***53 899***
Kurzeme	31 977	3 706	35 683
Latgale	20 976	2 830	23 806
Latvia in total	132 939	24 980	157 919

Fig. 22 *Straw potential available for use as source of energy (thousands of tons)*

Zemgale region, sources of information: Analysis of the Regional and Renewable Energy Resources Potential

The total amount of straw that could be used in future is ~ 158 thousand tons, which is unequally distributed among regions (Zemgale – 34 %, Kurzeme – 23 %, Vidzeme – 15 % in Latgale – 15 %, Riga – 13 %). With the richest potential of straw has the middle part of Zemgale region (Bauska, Jelgava and Dobele counties), which has ~ ¼ of the entire potential of Latvia.
It was evaluated what contribution to regional development could provide the development of district heating in Zemgale region based on straw. The available potential of straw was taken 34% of the total Latvia potential - although this potential exceeds a little the potential of Zemgale central part, but here we can take into consideration that next to that there are Saldus and Tukums conties, which are active in agricultural production. The evaluation was done by assuming the use of both cereal straw and rape straw.

Possibilities to use the straw potential in the aspect of regional development

Results of the model	Cereal straw	Cereal and rape straw
Potential of straw biomass, TJ	588	755
Potential of straw biomass, GWh	2 116	2 718
Potential production capacity of heat, MW	46	59

Fig. 23 *Possibilities to use the straw potential*

Zemgale region, sources of information: Analysis of the Regional Renewable Energy Resources Potential

Wood

Zemgale counties – Bauska, Dobele and Jelgava – are not rich in forests. Fertile soils free of the woods have always been a precondition to see the agricultural production as a priority.
Forest areas in the region occupy 425,928 ha with forest cover of 39.88%. By the forest proportion Aizkraukle and Jēkabpils counties stand out in Zemgale region. It suggests thinking of new ways of farming and use of forest opportunities to business needs.

No.	District	Total area of the district, ha	Forest area, ha	Woodland, %
1.	Aizkraukle	256 678	140 268.4	54.65
2.	Bauska	188 058	58 698.2	31.21
3.	Dobele	163 145	48 900.3	29.97
4.	Jēkabpils	299 731	130 895.5	43.67
5.	Jelgava region	160 520	47 165.1	29.38

6.	Jelgava	6 030	1 094.0	18.14
Total:		**1 068 132**	**425 928**	**39.88**

Fig. 24 *Forest areas and their share in the territory of Zemgale region (2005)*

Zemgale region, sources of information: Analysis of the Regional and Renewable Energy Resources Potential

The total area of bush in the region (after data of 2005) occupies 15,567 ha. The major scrublands in the region, which could become a potential tree-growing areas are in Jekabpils county – 5 494.4 ha; Aizkraukle county – 4 026.5 ha, while the least in Jelgava county – 1 394.8 ha. The largest bush areas are in Vecsaules parish - 573.9 ha (21.88%) by Bauska.

In Latvia conditions chips after the wood chips should be seen as the cheapest type of fuel. The costs of production of one MWh of thermal energy (Ls), by burning different fuels are given in figure below (year 2010).

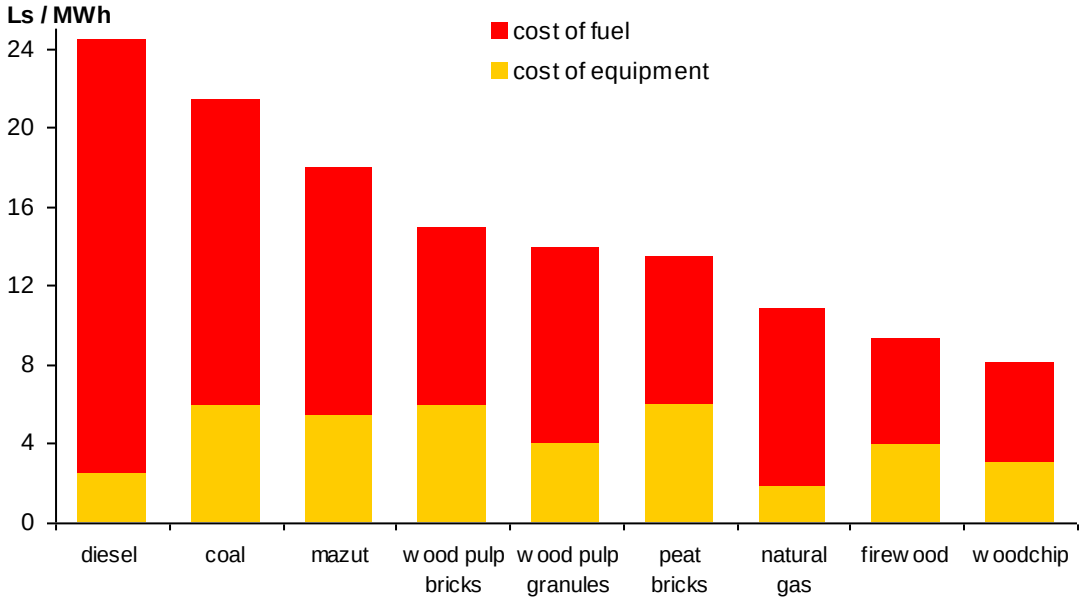


Fig. 25 *Comparison of heat production costs for obtaining 1 MWh of heat at the boiler outlet*

Zemgale region, sources of information: Analysis of the Regional Renewable Energy Resources Potential

In general Zemgale municipalities use wood, chips and natural gas as fuel. Gas, oil prices increases every year and their stocks are limited. Meanwhile in all wood processing enterprises continuously wood by – products are produced. Depending on the type of processing the remains are bark, slabs, beads, pieces of veneer, cores, wood chips, peel chippings and other wood residues, generated during production. This wood waste depending on their quality can be used for pulp and paper industry, wood panel manufacturing as well as energy production

8.2 Wind energy

Unlike the production of biofuels or solar power technologies wind power is unlikely to experience large technological leaps but gradual improvements can certainly strengthen the already very strong wind power competitiveness. The power of currently produced turbines is now 3 MW. If the technological solutions are being improved, then the turbine standing still due to technical faults could be reduced, which previously used to be a significant problem.

Unfortunately in Zemgale energy production by using wind power is economically unjustified as it can be seen from picture below – there is no intense wind. This would not be cost effective as turbine will not be turning with full capacity or will be standing still.

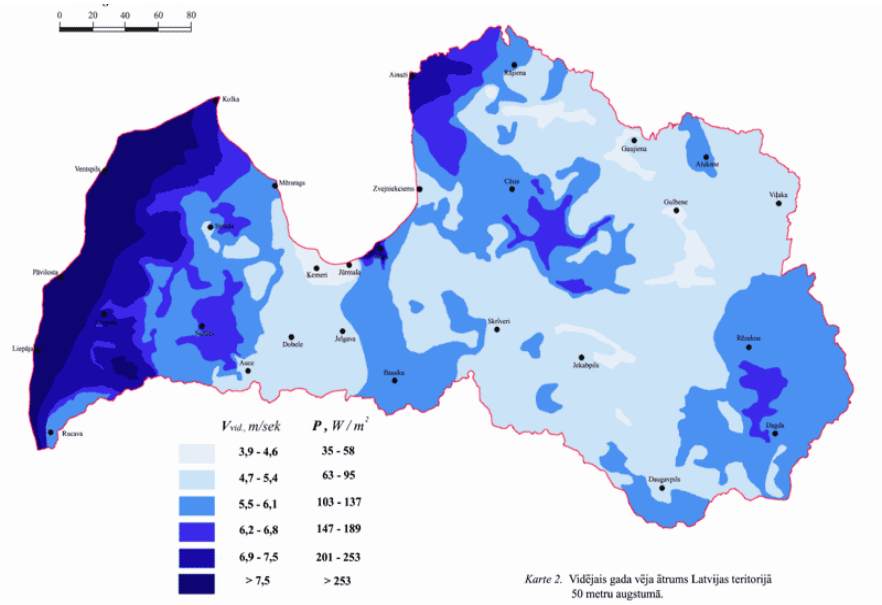


Fig. 26 Latvia wind map

Zemgale region, sources of information: Analysis of the Regional Renewable Energy Resources Potential

8.3 Hydro energy

In 2007 in total Latvenergo hydropower plants, including Aiviekste hydro power station, produced 2 668 GWh, which was 65% of the total electricity produced by Latvenergo. Today 150 small hydroelectric power stations are in operation in Latvia, the produced energy in them represents more than 50 MWh of electricity per year. Also in Zemgale the small hydro power stations creates both jobs and added value.

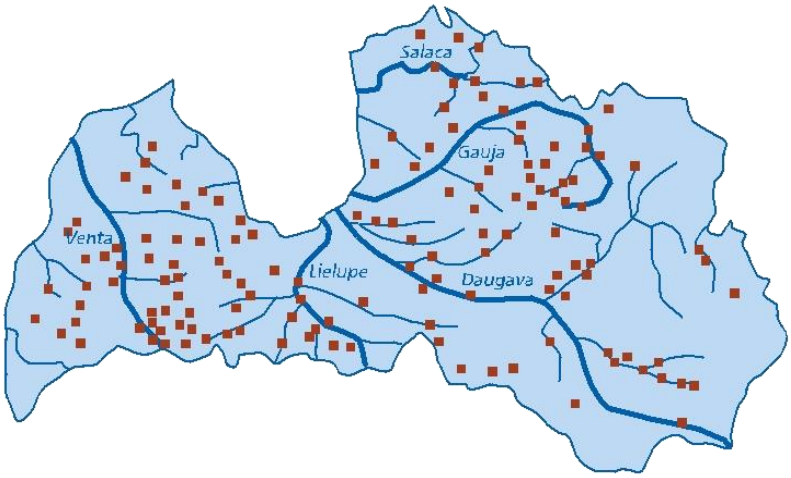


Fig. 27 *Location of Latvia small hydro power stations*

Zemgale region, sources of information: Analysis of the Regional Renewable Energy Resources Potential

8.4 Solar energy

Currently in Zemgale solar energy technologies are not widely used for obtaining the energy. Aizkraukle is the first city in Zemgale, Latvia, where the part of the necessary heat for the city is produced by solar collectors. It was a project implemented by Aizkraukle District Council with the help of Denmark government.

On the roof of Aizkraukle Gymnasium solar collectors have been installed with a total area of 33 m². They provide water heating for the school. On the roof of the boiler house solar collectors have been installed with a total area of 120 m² and they are connected to the district heating.

Currently the production of solar panels is very expensive, so investments pay off in a longer period of time. Consequently it is more rentable to invest in other types of energies.

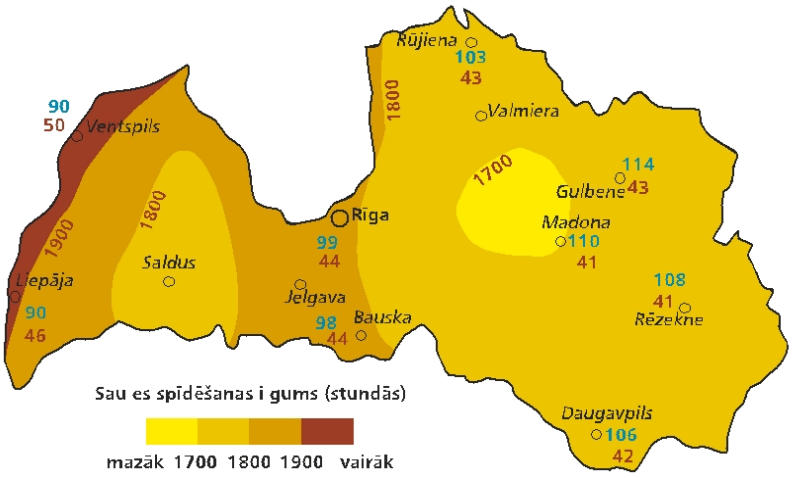


Fig. 28 *Intensity of sunshine in Latvia*

Zemgale region, sources of information: Analysis of the Regional Renewable Energy Resources Potential

8.5 Geothermal energy

In Latvia there are quite large sources of geothermal energy. The temperature of underground waters varies from 30-60 ^{o} C, which is low potential thermal waters but can be used for heating needs. There is also potential of hot rocks. The best potential in Zemgale is considered to be in one of the Latvia two geothermal anomalies - around Eleja, Dobele, Jelgava Bauska, which goes also via Kalnciems and Jurmala and then disappears in Riga Gulf, - where the hot rocks layer (100^{o} C) is at the depth of 2750-3000 m.

The temperature of hot rocks at the depth of 6km could reach 160-180° C, which could be used for production of electric energy.

In Zemgale geothermal energy (with heat pumps) currently is used only in small buildings. They are usually private houses, in some cases schools, nursery schools and office buildings. Around Bauska geothermal energy can become a significant advantage it could become the main fuel for the district heating systems.

8.6 Summary

In Zemgale region we can divide three main groups of renewable energy resources:

- renewable energy resources the use of which is wide and very effective already;
- renewable energy resources the use of which could be very wide, but at the moment this potential is not used;
- renewable energy resources the use of which is not and will not be effective and useful in the near future

The first group includes:

- Wood and wood products;
- Hydro Resources

The second group includes:

- Straw and agricultural biomass products;
- Geothermal resources;
- Bio fuels.

The third group includes:

- Wind;
- Solar energy

Consequently in Zemgale region the main focus would have to be on the renewable energy sources shown in the first and second group. Particular attention should be given to straw and agriculture biomass products. The potential of Zemgale region, especially in Jelgava and Bauska counties is very high. We have to take into account that in the region there are bigger cities that need heat and electricity. In this case cogeneration plants are very beneficial the efficiency of which is much higher than to the simple boiler houses or power stations. Parishes and towns would have to plan the cogeneration plants of the necessary capacity.

Local authorities in the region can contribute to the use possibilities of renewable energy resources by means of tax reductions for energy producers, who use the local renewable resources. This would create jobs, which by means of taxes would compensate in double the tax reductions given to the entrepreneur. Besides, the socially-economic situation in Zemgale would improve. It is possible to attract the structural funds of European Union to invest in production of renewable energy. In each individual municipality as well as for Zemgale region the policy for development of renewable energy resources would have to be developed, that would clearly define the objectives which are to reached as well as it would give a signal to entrepreneurs - what is supported and what is not, also showing how can the municipality benefit by implementing one or another project.

9. Possibilities of financing attraction for energy saving in Zemgale region

Renovation of multi residential houses is mainly done in three ways:

1) renovation is carried out by energy service enterprises - ESCO companies (further in the text ESCO);

2) state or municipal energy enterprises established especially for renovation of public or residential buildings (further in the text – PEKO);

3) society of apartment owners.

In other countries of European Union there are also public –private partnerships operating in the field of increasing of energy efficiency for public and residential houses which have not been developed in Latvia.

In countries of European Union the most common way of renovation of residential houses is involvement of **energy service companies – ESCO** in the provision of this service. Energy service company is an enterprise and entrepreneurship providing services in the field of energy, including implementation of energy saving projects, establishment of energy infrastructure, production and supply of energy services by undertaking also risk management and attraction of financing in this sector.

ESCO carries out a deeper analysis of a property with a target to find the best solution in terms of energy efficiency, organizes the renovation and management of the property and regaining of investments within 5 to 20 years. It manages the regain of investment together with the savings gained due to implementation of energy efficient measures. To ensure successful and mutually favourable collaboration ESCO concludes a terminate contract with the receiver of the service, for instance, the society of apartment owners. During this contract ESCO undertakes all the liabilities related to preparation, financing, implementation of energy efficiency measures by guaranteeing the anticipated energy efficiency result, and by providing the management of the object during the lifetime of the contract. After the end of the contract all the gains obtained as a result of renovation become the property of the service receiver – the owners of the apartments.

When concluding an ESCO contract, two strategies can be applied:

1) The Contract stipulates that the service provider receives fixed percents from the saved means all the duration of the contract. It motivates the service provider to ensure the maximum energy savings straight after the implementation of the project and to maintain the saving of energy up to the end of the contract, even increasing the saved energy with additional measures.
2) The Contract stipulates that residents are paying a fixed monthly payment per square meter according to the amount of square meters.

The successful operation of ESCOs during several decades have gained recognition both in the world and European Union countries as by attracting the private collaboration partners municipalities have managed to improve the energy efficiency in the buildings owned by them even in the case when there is insufficiency of their own means.

Municipal energy service company PEKO is an enterprise owned by municipality, which operates according to principles of energy service company for its operations using finance means of municipality and attracted financing. Usually the objective of municipality is not obtaining of profit but energy efficient refurbishment of public houses and residential fund owned by the municipality, if due to any reasons this cannot be done by residents or ESCO. PEKO can ensure renovation of also those multi residential houses, which due to high risk not to pay off is not done by ESCO or residents.

In Latvia there are no traditions for establishment of state or municipal energy service companies, there is no PEKOs established in Latvia. Still in Latvia biggest cities there are housing companies managing residential houses, to which the relevant municipality could delegate PEKO functions.

Societies of apartment owners – the establishment of such societies is regulated by law adopted by Saeima in 28.09.1995. “On Ownership of an Apartment” („Par dzīvokļa īpašumu”)

and Civil Law adopted in 1997. The operation of the society is regulated by Law adopted in 30th October 2003 “Law on Societies and Foundations”. The main objective of establishment of such society is to ensure the management of common parts of the residential houses or on behalf of apartment owners to delegate its management to other person.

In case of energy efficient renovation of multi residential house the society of apartment owners is to be considered financially the most favourable model for the apartment owners. In this case energy efficient refurbishment of the house is managed by the owner itself which is personally interested in the results.

Establishment of societies of apartment owners in Latvia is happening very slow, as apartment owners have lack of knowledge, understanding about management of the houses and energy efficient refurbishment of houses. Due to economic recession in Latvia from year 2008 apartment owners are afraid of risks related to credit taking.

For apartment owners also practical side of establishing societies of apartment owners seems complicated. Organization of a meeting of all the apartment owners and obtaining support of more than 50 % for establishing of a society of apartment owners, election of a chairman of the board, preparation of statutes. After making of the decision of establishing of a society of apartment owners a stamp of the society is to be obtained, the signature of the chairman of the board is to be approved as well as the society is to be registered in LR Register of Enterprises, submitting the minutes of the meeting of the apartment owners, decision of the meeting on establishment of the society, list of members of the board, statutes of the society, application for registration. If all the documentation is filled correctly then registration of the society takes about one month, but usually this process is longer as the submitted documentation, especially if prepared by residents without lawyers’ education, is with mistakes.

After establishment of the society and its registration the apartment owners in the common meeting should make a decision whether to improve heat insulation of their house or not. If 50 % (+ one voice) vote for it, then the project application is to be prepared and all the other documentation related to that.

In other countries of European Union residents receive support from the state or municipalities for establishment of the societies and energy efficient refurbishment of houses – there are educative seminars organized, which help to identify the most favourable financing model for the energy efficient refurbishment of the house, as well as energy certificates of the houses being issued.

As alternative to the establishment of the society can be delegating these responsibilities to a person or legal entity on the basis of authorisation agreement. This person or legal entity then deals with the issues which are in the competence of such societies as determined by law “On Apartment Property”, as well as organizes all the necessary steps to prepare the refurbishment

process (energy audit, technical inspection of the house, preparation of the technical design for refurbishment) and ensures its implementation (credit, hiring of construction company and technical supervisors).

As shown by the above examples, in many places in Europe apartment owners authorise other person or house managing company to do the renovation of the house. This can be attributed to the residents' lack of knowledge in energy field and the possible gains, as well as their busyness, which would hinder full supervision of the works, assessment of results, preparation of technical design documentation, and preparation of reports.
Municipalities in Zemgale region together with the biggest house management companies would have to analyse all the ways of organizing the energy efficient refurbishment of the houses and would have to choose the most favourable way.
Due to fact that energy efficient refurbishment of multi residential houses in Latvia, also in Zemgale is quite new activity, we cannot talk about the traditions of attraction of financing. Further the ways of financing the energy efficient refurbishment of houses available in Latvia are described, as well as the ways used by other European Countries have been mentioned.

In Latvia from 2000 – 2008 the possibilities to receive **support from state or municipalities** for energy efficient refurbishment of residential houses has been limited. As turning point can be considered year 2008 when in accordance with LR Regulations of Cabinet of Ministers No.59 of 05.03.2008. "Regulations on volume of state budged co-financing and its allocation procedure for energy efficiency measures for residential houses" („Noteikumi par valsts budžeta līdzfinansējuma apmēru un tā piešķiršanas kārtību energoefektivitātes pasākumiem dzīvojamās mājās") a state support programme was made, managed by LR Ministry of Economics.
Programme works intensively since April 2009 and the supported measures are as follows:

1) For energy audit of multi residential houses – 80% of energy audit costs but not more than 400 LVL;
2) For precising/corrections of energy efficiency assessment in accordance with the laws and regulations if energy audit has been done by year 2008 – 100 LVL;
3) For elaboration of the technical design of multi residential house or preparation of simplified renovation documentation, if a standard solution is not possible – 80% from the costs of elaboration of technical design or costs of preparation of simplified renovation documentation, but not more than 2 500 LVL;
4) For preparation of the Statement of Technical Inspection of the multi residential house– 80% from the costs of Statement of Technical Inspection, but not more than 400 LVL;
5) For renovation of multi residential house – 50% from the costs of total eligible costs of renovation project.

Within the framework of the energy audit eligible expenses are: remuneration of auditors, transport expenses, drafting costs of the report and the thermo-graphic analysis. Within the framework of the multi residential building renovation eligible expenses are: drafting costs of the building design, costs of the energy audit, if it is not performed with the state or municipal financial support, costs of construction supervision, costs related to measures with the aim to minimise energy consumption.

In order to receive the state co-financing for the energy saving measures, a decision has to be adopted in the meeting of the owners of the apartments in the building and granting an authority to a definite legal entity to submit the relevant application and to perform other activities related to it. The authorised entity shall submit the application to the Ministry of Economy together with the copy of the Minutes from the meeting of the owners of the apartments in the building containing the decision on the type of support, the copy of the Minutes and the Contract, the transfer and acceptance act on transfer of the management rights to the society of owners of the apartments of the building or to the person authorised by mutual agreement of the apartments' owners, if the residential building is privatised under the law "On privatisation of the state and municipal residential buildings", the copy of the contract on the management of the residential building, , if the residential building is privatised under the law "On privatisation of the cooperative apartments" or the law "On privatisation of the fishing companies and fishing collective farms".

From this programme the renovation costs in amount of 20 % were covered for the renovated buildings in a limited range – only for those the renovation of which was performed on their own initiative already in 2008, without waiting for a state support or a support by the EU Structural funds.

Since year 2004, when Latvia joined the European Union, the EU financial **support for promotion of the national growth and competitiveness** has become available. During the period from 2007 to 2013 as one amongst the first priorities that were determined for attracting funding in the national level was also introduction of energy efficiency measures in the production companies, public and residential buildings. In 2010 one of the main financial instruments in this respect has become Activity 3.4.4.1 "Measures to improve heat sustainability of multi-residential buildings" under the programme "Infrastructure and measures". This activity started in February of 2009 (Regulation of the Cabinet of the Republic of Latvia N0. 138, 11.02.2009). 138). The funds available under this activity in amount of LVL 44 337 000 are targeted to cover 50 % the eligible expenses of the renovation project of the building if the result of this renovation brings at least 20 % saving of the total heat consumption.

Within the framework of this activity it is possible to recover costs spent for the energy audit (which must be performed before submission of the project proposal), preparation of the technical evaluation and technical design of the building as well as the renovation works aiming to improve the energy efficiency of the building. If these activities are financed from the EU funding other

financial support instruments, such as state support programme or EU programme, may not be attracted unless the activities funded from them are separated.
Since the beginning of 2010 the funding available under this activity has been considered as the most serious of the existing support instruments in the sector of energy effective renovation of buildings since by this funding it is possible to reduce the amount of funds borrowed from the commercial banks in the form of mortgage credits.

The major instrument for financing the energy efficiency measures of buildings is the **credits granted by the commercial banks**. Credits for renovation of multi-residential buildings are provided by the Latvian commercial banks since 2003 (JSC "*Latvijas hipotēku un zemes banka*"), especially actively since 2007. In opposite to the widely spread long-term financing, i.e. the mortgage credit, to receive this loan in the largest commercial banks of Latvia the collateral for the reception of the credit can be the cash flow of the building's property management entity. The mandatory requirement by the commercial banks for granting the credits to renovation of multi-residential buildings is the consent by 75% of the building's apartment owners on the reception of the credit.
Since 2009 the loans given by the commercial banks for renovation of multi-residential buildings may be combined with the EU support (ERDF) in such a way gaining a sufficient reduction of the effective interest rate.

In 2010 in Latvia the credits for renovation are granted by *Swedbanka*, *Nordea*, *SEB* and *DnB Nord Banka*.
Summing up the practice of crediting the multi-residential building renovation in Latvia the conclusions are the following:

In order to receive the mortgage credit for renovation these three conditions are essential:

1. The decision by the meeting of the owners of the apartments in the building on reception of the credit determining the kind of the credit repayment – annuity or differentiated, confirming the renovation works to be performed and rise in the property management fee as the collateral for the credit. Although every bank has determined its own threshold for the consent by the owners of the apartments on the renovation, i.e. 60 – 75 % of the apartment owners, it is still advisable to reach at least 90 % consent.
2. The exact information on the unpaid debt amount by owners of the apartments for property management, water and heat supply services. It is essential that all the bills were paid within the limits of 95 – 100 %.
3. The bank account of the society of the owners of the apartments and the frequency of payments in the bank granting the credit.

Depending on the quality of the project proposal submitted in the bank as well as the showings of the criteria mentioned above, the interest rate fluctuates from 3.00 + EURIBOR till 4,65 + EURIBOR. In exceptional cases when the project proposal is of a very good quality, the client is of high credibility level and there is no concern regarding a timely repayment of the credit, it is possible to receive 2.5 + EURIBOR.

The standard credit agreement requires a deposit in the crediting bank in amount of one to three months' payments and the credit period is restricted – 15 years.

Several international banks which provide credits for the development projects have determined energy saving and energy efficiency as their priorities. The drawback is the fact that international banks provide credits for projects of a major financial scale, besides they require a national energy efficiency development programme, such as "Guidelines in energy of the Republic of Latvia 2007 – 2016", "Energy efficiency action plan of the Republic of Latvia 2008 – 2010".

Till 2011 **European Bank for Reconstruction and Development** (EBRD) is providing support under the initiative of Sustainable Energy by financing activities to promote energy efficiency of municipal infrastructure, including residential buildings, water and heat supply systems and the industrial infrastructure. The funding is ensured by granting loans on low interest rates for credits targeted to projects related to promotion of energy efficiency.

Until now Latvia has not made use of the support by EBRD funds under this initiative.

European Investment Bank (EIB) in addition to the provision of finances under the JESSICA initiative is issuing low interest credits to EU member states and developing countries for credits related to the issues of environment quality, including energy efficiency as well as introduction of EU policy guidelines. In 2009 EIB provided support in the energy sector amounting to 3,4 billion EUR, including the loan 100 million EUR for modernisation of the co-generation plant TEC-2 of the JSCo *Latvenergo*.

The **Nordic Investment Bank** (NIB) ensures loans for energy efficiency measures under the priority of environment improvement targeted to protect environment and reduce pollution. NIB supports activities targeted to reduction of CO_2 emissions, usage of renewable energy resources and introduction of environmentally friendly technologies. The energy efficient renovation of buildings falls under type C of Priority 3 projects, having a facilitated funding procedure (the environmental effect evaluation is not necessary). The bank mainly finances projects above 50 million EUR covering 50 % from the project costs. Likewise in the case with the EMBRD and the EIB the NIB is also oriented towards crediting of activities via the local banks.

KfW Bankengruppe (KfW) is the development bank of the German government providing an immense support in the sector of environment protection and issues concerning the climate,

including renovation of houses with an aim to improve their energy efficiency by granting credits to their cooperation partners. In Latvia its partner of cooperation is JSC "*Hipotēku banka*".
In cooperation with the European Commission and EBRD *KfW* is one pf the financers of European Energy Efficiency programme which is targeted to cut the CO_2 emissions.
In cooperation with other banks *KfW* has established a number of initiatives to support less developed countries. For instance, EIB together with *KfW* has established South East European Energy Efficiency Fund under which support is granted to the countries in this region to promote energy efficiency and usage of renewable energy resources. The bank has also set up a special programme for renewable energy and energy efficiency under which loans are granted to the developing countries.

The **Revolving funds** developed as a tendency in the European Union new member states after their accession in 2004.
A revolving fund is a long-term financial instrument created for implementation of cost-effective investment projects providing funding on low interest rates. The fixed capital of such funds is made of the donations by the respective state and self-governments, funding by the financial donor institutions and in separate cases – funding from the EU support funds.

Under the revolving funds the financial support is granted only for the projects which ensure the repayment of funds within a definite period of time and using the repaid funds for financing of next projects. This is a globally wide spread financial scheme for promoting of different activities (e.g., development of SME, modernisation of water or waste management systems), but one of the most visible directions is the promotion of energy efficiency in the state or municipal as well as private properties.
In case of renovation of a multi-residential building the beneficiary of the credit by the fund can be a society of the building's apartment owners who use the credit to cover their part of the co-financing of the renovation project or a municipal energy service companies – for the implementation of the renovation project. The credits are granted for a definite period of time and on a fixed interest rate. The credit repayment starts after the end of the renovation when the saved energy begins to manifest itself by economic return.
In Latvia this kind of fund in not created neither in the state nor the municipal level. It is clear and sure that such a fund could be established by Zemgale region.

10. Foreseen projects

No.	Name and a brief description of the project	Department or person responsible	Project-term (start-end)	Cost	Expected energy savings,%	Production of renewable energy,%	CO_2 reduction
Aknistes County							
1	Heating systems and the simplified reconstruction Akniste county, Akniste town and Ancenes village	Vija Dzene or Ingrid Vendel - Akniste County Municipal Council Vice-Chairman, Mayor	2010 02 – 2011 12	325 522.34 LVL	-	-	-
2	Reducing greenhouse gas emissions Akniste preschool Bitītes and Akniste School	Vija Dzene or Ingrid Vendel - Akniste County Municipal Council Vice-Chairman, Mayor	2011 02 – 2011 11	212 721 LVL	-	-	113,33 t/year
3	Biomass cogeneration plant construction Akniste (pellets) 1 MW power, 2.4 MW - heat.	Private company	2011 – 2012	-	-	9 600 MWh_{th} 4 000 MWh_e	-
Bauskas county							
4	Bauska district heating system efficiency" application, which envisages renovation of 0.46 km district heating network and construction of 3 new intelligent individual substations in 2011.	-	2010 12 – 2011	-	1) Heat loss reduction 3.12%; 2) gas consumption reduction 4.16%		
Dobeles County							
5	Measures of district heating systems more efficient in Dobele'	Ltd. "Dobeles Enerģija'' Ģ.Ozoliņš	2011 – 2012	-	-	-	-

Jelgava County							
6	Technology transition from fossil to renewable energy Jelgava county government buildings	Anita Skubiļina	2010 11 – 2011 12	452 299 LVL	-	-	821,84 t CO_2/year
Krustpils County							
7	Simplified renovation of the heat supply system	Krustpils county municipality	2009	24 167,54 LVL	-	-	-
8	Varieši primary school area and pedestrian path lighting of buildings	Krustpils county municipality	2009 10 – 2010 04	3 000 LVL			
9	Sūnu Primary school renovation	-	2011	-			
Nereta County							
10	Street lighting and construction in Ziedu, Lodzina streets	Nereta county	2011 08	8 434,47 LVL			
Salas County							
11	Increasing energy efficiency in the Salas county government office building		2009 – 2010	646 130 LVL	30%		0,428 kgCO2/Ls year
Koknese County							
12	Iršu parish Street lighting	Kokneses County Executive J. Baltmane	2011	8 300 LVL			
Iecava County							
13	Increasing energy efficiency Iecava nursery school "Cālītis"	Iecavas County Council, the Executive Director M. Veinbergs	2009 11 – 2010 11	125 656.39 LVL	~ 40%	-	51,54 t/year
14.	Insulation of Iecava Zalite special boarding school.	Iecavas County Council, the Executive Director M.	2010-2011	74 054 LVL	~20%		

		Veinbergs					
Skriveri County							
15	Increasing energy efficiency A. Upīša Skrīveru School	Skrīveru County Council	2009 – 2010	206 340.28 LVL	25%		50,41 t CO2/year
16	Solar energy hot water in Skrīveru County	Skrīveru County Council	2011 04	69 440 LVL	127,536 MWh year		33,67 t CO2/year
Jekabpils county							
17	Simplified reconstruction of recreation center houses of Jēkabpils region Zasa parish	ELFLA	2009 04 – 2009 12	32 943.68 LVL	15%		
18	Simplified reconstruction of recreation center houses of Jēkabpils region Zasa parish	ELFLA	2009 12 – 2010 07	58 010.81 LVL	15%		
19	Zasa administration building insulation		2011	-	40%		62,8 t CO2/year
Ozolnieki county							
20.	Boiler installed in the Kastaņu Street No.2 French company`s Totaleco economizers.	-	2010	-	Heat energy savings 274 MWh		
Viecumnieki county							
21.	Ground source heat pumps – Bārbele parish “Tīrumi”	Vecumnieki County Council	2011	-			
22.	Ground source heat pumps – Skaistkalne parish, Skolas street 1	Vecumnieki County Council	2011	-			

11. Sources of the used literature

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