PANEL 2050 – Partnership for New Energy Leadership 2050

REGIONAL ENERGY PROFILES

Deliverable: D3.1

WP3 ROADMAPS 2050

Objective: Analyze the Current Status of Regional Energy Supply and usage

Date: 31st of August 2017

WP leader: AgEnDa z.s.

Horizon 2020
European Union funding
for Research & Innovation

Deliverable D3.1 and description of its achievement

AgEnDa as a leader of dedicated WP3 has launched activities in cooperation with CPU, WWF HU and UTARTU towards developing local sustainable energy strategies (roadmaps). Before getting to roadmapping process in the regions there had been taken some initial necessary steps. As for the first task all partners have been provided with the template for execution of desk research focused on gathering all national, regional and local strategies, roadmaps or other related measures or guidelines linked to the regional energy planning.

AgEnDa has created forms and set up the procedures for collecting information about the current status in partner regions. Project Partners have started to identify the energy usage in their regions. CPU provided professional background with regard to energy statistics, also collaboration with AgEnDa on partner survey of existing energy strategies (T3.1) and research of national/regional energy strategies. The structure and methodology for the development of Regional Energy Profiles has been prepared by AgEnDa together with CPU (T3.3, D3.1) including the preparation of Template for PP to develop Regional Energy Profiles (T3.3, D3.1) based on a collection of local statistical data on energy supply and demand. A partner survey regarding existing energy strategies was already completed and presented during the 2nd partner meeting in Lithuania (M8).

The process of creating Regional Energy Profiles was divided into two stages. 1st stage was focusing on general statistics, geography and default conditions of each region. This first part was analyzed and the results were introduced at the consortium meeting in Tartu along with the methodology for the 2nd stage that was far more challenging in collecting specific data on energy demand / supply, renewable energy potential and energy efficiency. Dedicated statistical tool in xls was developed to help partners calculating some of the figures that were supposed to be missing from public sources. Majority of partners also engaged their stakeholders into the elaboration. The result is **10 Regional Energy Profiles in national language** and English which will be further utilised in defining Roadmaps and Vision plans.

As for the process of making REP we have used broad spectrum of data sources from regular statistics and publication by department of statistics, furthermore from publications of governmental institutions. Some of the data origins from thesis, scientific publications and regional analysis. Also some of valuable data related to RES potential of the region comes from findings of project other EU projects and tools. Few figures had to be calculated using some indirect values and estimations.

Starting September 2017, the creation of Synthesis Report has been launched on the basis on English version of Regional Energy Profiles. This synthesis report with title “Energy Efficiency Situation of Central and Eastern European Regions” will be ready by month 24 according to the plan.

Content

English version

REGIONAL ENERGY PROFILE

Province: Pleven

PANEL 2050 – Partnership for New Energy Leadership 2050
Deliverable 3.1

By: WWF-Bulgaria

Date: 29.08.2017

Table of Content

1. Methodology

The PANEL 2050 project has the aim to create durable and replicable sustainable energy networks at local (municipality/community) level, where relevant local stakeholders collaborate for the creation of a local energy visions, strategies and action plans. The aim of these networks is to contribute to and actively work for the transition towards low carbon communities in 2050.

The PANEL 2050 partnership will provide support for the creation of first successful local energy networks in the CEE countries. In the course of the project, organisations from 10 CEE countries will collaborate on creating regional energy strategies and action plans.

The present Regional Energy Profile was prepared in order to get a better understanding of the energy-related status quo in the **Province of Pleven**[1], analysing strengths and challenges with regard to the transition towards a low carbon community.
This energy profile constitutes the groundwork for the preparation of a Regional Energy Roadmap and related Action Plans and will be essential for the communication with regional stakeholders.

For completing this Regional Energy Profile the following sources were used:
Most of the information for this document was gathered from the annual statistics and publications made by the National Statistic Institute of Bulgaria. The „Regional Profiles: Indicators of Development" that are made by the Institute for Market Economics were also used for some of the information about Socio-Economic Development, Investments and Transport infrastructure.
A full list of the used sources can be found in the Annex.

[1] Bulgaria has 6 planning regions add they have 28 provinces. Pleven is one of those. Peven as province has 11 municipalities and they have 14 towns and 109 villages

2. General introduction of the region

Region Pleven NUTS- BG314

Geography

The region is located in the central part of North Bulgaria and the eastern part of North-East planning region of Bulgaria.

The landscapes in the Central, Northern and Eastern part of the region are mainly plains and hills. The relief in the Southern part is mainly hills and low mountains.

The climate is temperate continental. The average temperature is about 12-13°C.

Pleven region has big amount of water sources. The main one is Danube river on Its northern border. Other major rivers that flow through the region are Iskar, Vit and Osam. There is a big network of irrigation and drainage systems, protective dikes and many small and middle size dams on the watershed of Iskar, Vit and Osam.

The region has a small amount of mineral resources. The small deposits of natural gas and oil are exhausted.[2]

It has rich biodiversity of plants and animal species, although the majority of the territory is occupied by farmland.

Important energy facilities

The main source of electricity is the national electricity system, through electrical substation "Pleven".

TPP(Thermal Power Plant) "Pleven" has been built and its purpose is to supply the local industries.

There was a nuclear power plant project dating back to the turn of the century. Subsequently, the procedure that was launched for the realization of NPP "Belene", which would have transformed Pleven region into one of the main power utility centres of the country was finally canceled in early 2012.

There is also a gas pipeline passing through the region.

Lastly Pleven region has installed capacity of the RES as follow:

5 numbers of hydro power plants with total installed capacity of 6 MW.

4 numbers of wind turbines facilities with total installed capacity of 10 MW.

14 Number photovoltaic facilities with a total installed capacity of 56 MW, and one of them has an installed capacity of 50 MW

Energy planning on national and regional level

National strategies, plans and legislation regarding energy development are adopted in the recent years. They are based on the idea of clean, efficient energy development, using more renewable sources and limiting the negative impacts on the climate.

Regarding the regional plans, there is a lack of understanding about their importance and there are only municipal plans and strategies concerning mainly the energy efficiency.

[2] Geospatial analysis in the region of Pleven 2013, 9-15 p.

Features of field energy goals and difficulties

In the region of Pleven functions one TPP "Republic", which is destined for power of the industry concerned. All settlements in the area are electrified. The distribution grid was reconstructed and maintained a good level, but there are areas with impaired mechanical and electrical parameters. The construction of new substations met the needs for increasing capacity. The region doesn't have any future energy plans or goals at the moment.

3. Basic demographic data and figures

Regional demographic indicators:

Population	251 986	citizens
Area	4653.3	km^2
Density of population	54	citizens/km^2
Number of the municipalities	11	municipalities

Data from 2015

Demographics

In the last 20 years in Pleven region the density of the population had decrease and is getting older. Most - earliest data are from 2000. During this period in Pleven region have been living 314,965,thousands people. Under working age were 16.58%, 54.66% had working age and the over the working age are 28.76%. For comparison, in 2015 the children fell to 14.44%, while people of working age and over increased by respectively 56.38% and 29.18%.

Socio-economic development in recent 3-5 years

	2011	2012	2013	2014	2015	
Unemployment	12	10.3	12.1	9	9.2	%
Average annual salary per person (gross)	3225	3398	3602	3783	4036	EUR
Differences from the EU average (35 079 Euro gross)	90.55	90.01	89.37	89.01	88.5	%
Share of the employed in:						
Agriculture	6.46	6.64	6.77	7.10	6.87	%
Industry	35.86	35.46	35.21	33.57	34.63	%
Services	56.53	56.80	56.92	56.13	55.44	%
Share of population with university degree	18.5	21.7	22.9	23.6	24.6	%

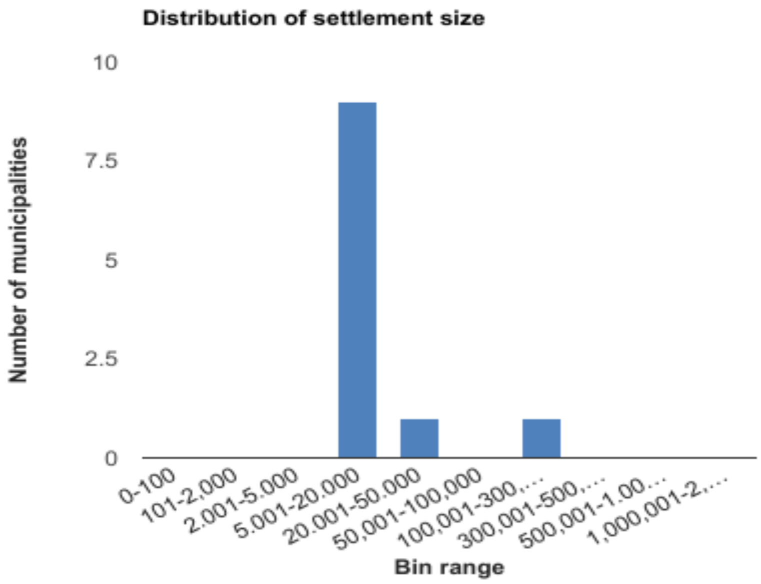
Overall living conditions in Pleven are better than the national average, due to relatively high income and recovery of the labor market. There is a reduction of workers in the industry due to closures[3]. Regarding education, although it is improving and the number of graduates has increased, the region still lags behind the national average.

Spatial distribution of the population, level of urbanisation

About half of the inhabitants are located in the municipality and city of Pleven - 123 673 people. They are followed by municipality and city of Red coast - 25 904 p., town and municipality of Dolna Mitropolia- 18 755 and 18 447 - town and municipality of Levski, while other municipalities have a

[3] Regional profiles, Pleven 2015

population of 5-10 thousand or less. Typical in Pleven region are medium-sized and large villages and small towns.



4. Economy in the region and economic trends

Economic indicators for the region:

GDP in total	886	million EUR
GDP per capita	3441	EUR/per capita
Human Development Index (HDI)	0.782	

Data from 2014

GDP in economic sectors:		
Agriculture	11.35	% of GDP in total
Industry	26.56	%
Services	62.08	%

Data from 2014

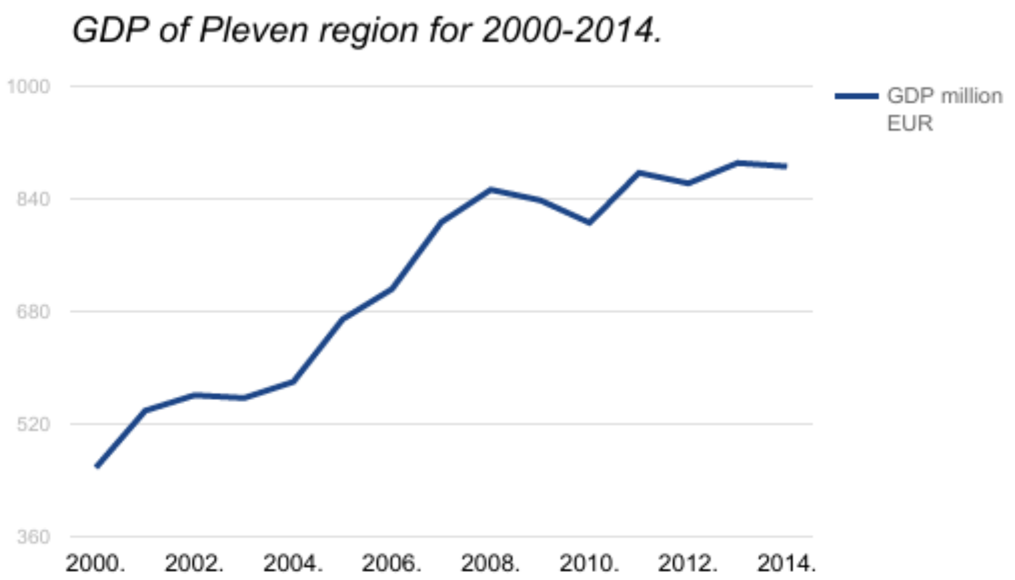
Regional economy

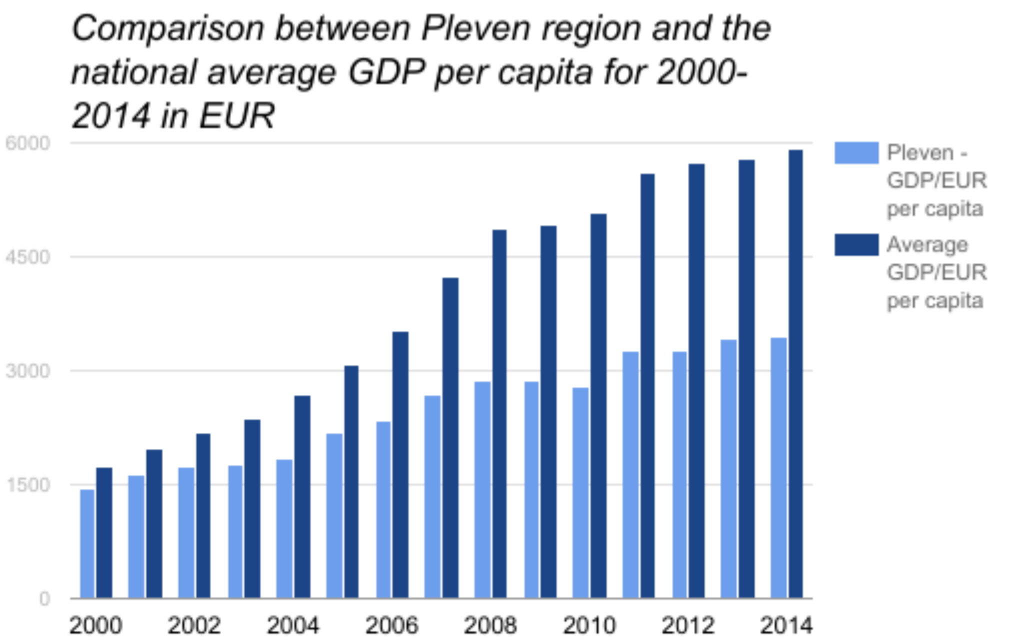
Pleven region recorded lower gross domestic product per capita for the period 2000-2014 than the national average. There is even the opposite trend - over the years, GDP per capita in the field are increasingly moving away from the national average.

Before 2008, and especially during the financial crisis, foreign direct investment in the area are extremely low. They barely reach 532 euros per 1,000 people in 2010 and far behind the national average € 2,935. Fortunately[4]*, in recent years, investment activity is improving and is higher than pre-*

[4] Regional profiles, Pleven 2015

crisis, but still remains below the national average. The managing of European funds is relatively good, but the level of local taxes remain among the highest in the country.





Number of operating enterprises*	9674	
Share of small and middle size enterprises*	7.9	%
Number of operating NGOs	15	
Funding by EU (2007-13)	35,469,973	EUR

***Data from 2015г.**

The most profitable economic sectors

The service sector is the leading one in the region with 490 million euro GDP for 2014 year. It's over two times more profitable than the next, namely the industry with 220 millions, which is also more unstable. Agriculture is third with 78 millions.[5]

Market labor

In recent years there has been an improvement in unemployment. The number of employed aged between 15-65g rose from 54.1% to 61.2%. The share of employees by sectors, the total number of employees is as follows: "Manufacturing" - 29.0%; "Trade; repair of motor vehicles and motorcycles "- 14.8%; "Education" - 9.9%; "Human health and social work activities" - 9.5%; "Agriculture, forestry and fishing" - 6.9% In number of persons employed under labor contract in 2015, the region occupies 10th place among the 28 regions in the country[6]*.*

5. National and local energy strategies

At national level :

- *Energy strategy of Republic of Bulgaria by 2020. - for secure, efficient and clean energy*
- *Law on Energy*
- *Energy Efficiency Act of the Republic of Bulgaria (since 15 May 2015)*
- *National Energy Efficiency Action Plan 2014-2020*
- *Renewable Sources Act*
- *National Renewable Energy Action (December 2012)*
- *Climate Change Mitigation Act*
- *Sixth National Communication report on Climate Change*

At Regional level:

There are no energy strategies at such level in Bulgaria. The focus is only on national and municipal level.

At Municipal level:

There are obligatory regulations for all the municipalities but at the same time only 11 of 265 municipalities already adopted such strategies. This is a result of the "black holes" in the national regulation, where indicative terms are missing and the responsibility is not fixed. There is not even one municipality in the Pleven region that had been adopted renewable energy development strategy and there is no members of Covenant of Mayors in the region.

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[5] National Statistical Institute, regional statistics, GDP and GVA for 2014

[6] Employees and average gross annual salary in Pleven in 2015

6. Energy Production

6.1. *Conventional energy production capacities (fossil fuels and nuclear power)*

Name & Location (city, town)	Owner	Year of commissioning (refurbishment)	Type of plant & fuel	Capacity in MW	Annual energy production in MWh	Annual CO_2-emissions in t	Utilization rate (qualitative assessment)
Pleven - Pleven city	Public / private SME		TPP - natural gas	36MW electr; 466MW - heat	421, 317MWh	14,06	Constantly used

As stated earlier the region relies mainly on the national electricity system for its electricity. The only TPP in the region - "Pleven" produces electricity for the local industrial needs and it also supplies the city of Pleven centrally with heat. The heat transmission network has a total length of 180 km.

6.2. *Renewable energy production*

Energy production capacities

Name & Location (city, town)	Owner	Year of commissioning (refurbishment)	Type of plant & fuel	Capacity in MW	Annual energy production in MWh	Annual CO_2-emissions in t	Utilization rate (qualitative assessment)
Rakita - Rakita village	private SME	1968	HPP - water	3,15MW			Constantly used
Espe Energy - Milkovica village	private SME	2012	PV system	5MW			Constantly used
Development - Somovit village	private SME	2012	Wind turbine	4,5MW			Constantly used

The region has one of the better results in the country at transitioning to renewable energy production. Due to the big water resourses five hydro power plants, with a total capacity of 6MW, were built in the last century. The larges one being "Rakita" HPP with 3,15MW.
In recent years around 20 small-scale PV and wind turbine facilities (3-5MW) were built with the help of EU funds. Their total capacity is 66MW. Most of them are PV and are owned by private SME.
The trends suggest bigger increase in the use of solar and wind energy. With the main focus on small PV facilities with 1-3MW capacity.
All of hydro power plants were built in the 60s-70s of the previous century. They are maintained well but still require some modernisation.

6.3. *Transmission and distributions*

The transmission and distribution system is constituted by electrical substations, transformer stations and transmission lines. Currently the Electricity System Operator is owning these systems. As for the operators ,"CEZ Distribution Bulgaria" is responsible for that at the moment.
The territory of Pleven region is crossed by a "South Stream" gas pipeline carrying gas from Russia through Bulgaria to Central Europe. There is also a local pipeline system, which is mainly supplying large industrial consumers, including the TPP "Pleven"
The energy produced in Pleven region is mainly used for local needs. The only facility that would supply with energy the rest of the country had its project shut down.

6.4. *Jobs in the energy sector*

The energy sector is one of the least developed the region right now. There are however more and more renewable energy facilities built and a big growth potential. The sector had 513 employees as for 2013, according to the last available data[7]. This doesn't include the green jobs, because a statistic for them is not kept on regional level.
There aren't coal and lignite deposits in the region. As for the fossil fuel mining, the oil and natural gas fields are already exhausted and the region is dependant on supplies from elsewhere.

[7] National Statistic Institute, Macroeconomic statistics, Employment and Hours worked by regions , Employed Persons by regions

7. Final energy consumption

7.1. *Households*

Regional final energy consumption of household sector	1390	GWh

Heat consumption

Total heat energy consumption of households sector (heating and hot water consumption)	1004	GWh
Average heat energy consumption per household	8765	kWh/hh

Most of the available building statistics are on national level. The buildings in Bulgaria are mainly built in five ways:[8]

- *panels that are assembled together(22%)*
- *reinforced concrete structure with slab and columns(9%);*
- *bricks with a concrete slab between the floors(37%)*
- *bricks with beamwork without reinforced concrete(26%)*
- *others(6%) - buildings built of stone, brick, wood, boards, wooden boards.*

The share of residential buildings by the year of construction is as follows.

- *15% of the buildings are built between 1919-1945*
- *27% between 1946-1960*
- *19% between 1961-1970*
- *15%- 1971-1980,*
- *12%- 1981-1990,*
- *5%- 1991-2000*
- *4%- 2001-2010.*

As for the energy consumption:

- *the panel buildings have 200 kWh/m^2 yearly*
- *buildings with external brick walls 38 cm thick built before 1965 - 170 kWh/m^2 yearly*
- *buildings with exterior brick walls 25 cm thick built between 1965-1999 - 180 kWh/m^2 yearly.*

There're programs for increasing the energy efficiency of the buildings at municipal level.

Electricity

Electricity consumption of households	380	GWh
Average electricity consumption per household	3317	kWh/hh

Cooking

Gas consumption for cooking appliances of households	5	GWh

Gas is rarely used for cooking in the region, most of the households are using electricity.

[8] NATIONAL LONG-TERM PROGRAMME for the promotion of investments in measures aimed at improving the energy performance of the national stock of public and private residential and commercial buildings 2016–2020, pages 26 and 27

General information

Household electricity price	0,11	EUR/kWh (incl. taxes)
Household natural gas price	0,044	EUR/kWh (incl. taxes)
Household district heating price	0,04	EUR/kWh (incl. taxes)
Household price: other energy sources – specify:		EUR/kWh (incl. taxes)
Energy expenditure by household	19,46	% of income

In Bulgaria the price of the electricity has two rates, one for the day(6:00-22:00) and one for the night(22:00-6:00). Currently the night rate is more than twice cheaper, it costs 2.79 euro cents per kWh.

Is energy poverty an issue in the region? If yes, please describe how many people are affected, in what extent?
There is no regional data on this topic.

Give an estimate of the trend in final energy consumption in the household sector using values from -5- to +5 where (-5 is a strong reduction, 0 means neither growth nor reduction, +5 strong growth).
No regional data available.

7.2. *Service Sector*

Regional final energy consumption of service sector	218	GWh

Data for energy consumption per sub-sector is not available.
As stated before the service sector is very important to the regional economy as it represents 62,5% of the GDP there.

Give an estimate of the trend in final energy consumption in the service sector using values from -5- to +5 where (-5 is a strong reduction, 0 means neither growth nor reduction, +5 strong growth).
+1 (2010-2015)

7.3. *Industry*

Total energy consumption of the industrial sector	622	GWh
Industry electricity price	0,12	EUR/kWh (incl. taxes)
Industry natural gas price	0,04	EUR/kWh (incl. taxes)
Household district heating price	0,04	EUR/kWh (incl. taxes)
Household price: other energy sources – specify:		EUR/kWh (incl. taxes)

Data for energy consumption per sub-sector is not available.
Industry is the second biggest sector in the region with 26,56% of the GDP. However its growth has stagnated in the last couple of years.

7.4. *Transport*

Regional final energy consumption of transport sector	1218	GWh

The density of the road network in the area is slightly lower than the average for the country of 17.8 km per 100km^2 and that of the railway lines is 4.4 km per 100km^2 with an average level of 3.6 km per 100 km^2. Although the share of motorways and first-class roads is relatively low, the quality of road pavements in the area is close to that of the country - as of 2015 in good condition are 39.0% of the roads. Highway E-83 "Sofia-Pleven-Byala-Ruse" also passes thru the region's territory, which is of great importance for the integration of the region in the national and European road network.

Passenger transport

Motorisation rate - number of passenger cars/1 000 inhabitants	117.82	
Regional energy consumption of passenger transport	1021	GWh

Freight transport

Regional energy consumption of road freight transport	181	GWh

The total length of railway lines in the area is 206 km. The density of the railway network in the area is 44.28% and is among the highest in the country.

Use of alternative fuels
The market for alternative fuel vehicles is still in its beginning on national level and is basically non existent in the region.
As for support mechanisms, there is a long-term program that promotes consumption of biofuels on national level.
There're are a lot of challenges and barriers right now. Except for two or three big cities in the country an infrastructure for electric cars is not available yet. The price of these vehicles is also alot higher

Give an estimate of the trend in final energy consumption in the transport sector using values from -5- to +5 where (-5 is a strong reduction, 0 means neither growth nor reduction, +5 strong growth).
+1(2010-2015)

7.5. *Summary*

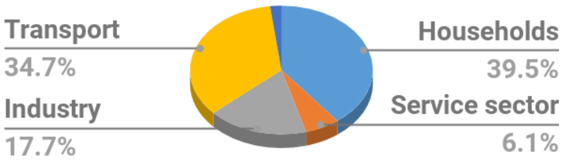
7.5.1. Final energy indicators

General indicators for the region

Total final energy consumption	3445	GWh
Final energy consumption per capita	13,949	kWh/cap
Electricity consumption per capita	3,990	kWh/cap
Heat consumption per capita	4,422	kWh/cap
% of total country consumption	1.9	%

Final energy consumption per sector

Year: 2015			%
Households	1390	GWh	39,5%
Service sector	215	GWh	6,1%
Industry	622	GWh	17,7%
Transport	1218	GWh	34,7%
Agriculture, Fishing and Other	70	GWh	2%
Sum	3515	GWh	100,0%

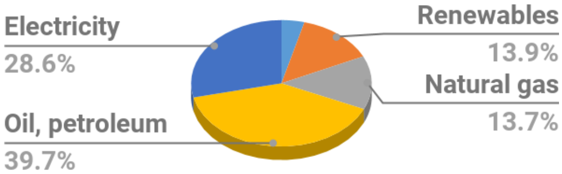


Give an estimate of the trend in final energy consumption using values from -5- to +5 (where -5 is a strong reduction, 0 means neither growth nor reduction, +5 strong growth).
0 (2010-2015)

7.5.2. Final energy consumption by fuel

Total final energy consumption by fuel

Year: 2015			%
Coal and lignite	144,11	GWh	4,1%
Renewables and waste*	488,58	GWh	13,9%
Natural gas	481,56	GWh	13,7%
Oil, petroleum and products	1395,45	GWh	39,7%
Electricity	1005,3	GWh	28.6%
Other fuels	0,00	GWh	0%
Sum	3515,00	GWh	100,0%



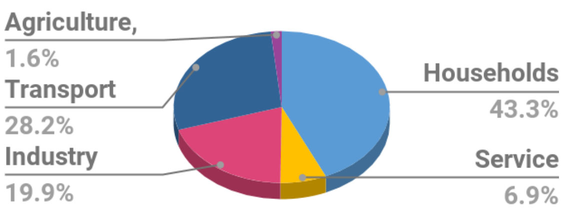
*Hydro, wind, solar, tide/wave, biomass and waste, geothermal

7.5.3. Primary energy equivalent

Total Primary Energy Consumption	3639.04	GWh
Primary energy consumption per capita	14441.4	kWh/cap
Primary energy factor of electricity	2.5	-
Energy intensity	5.35	kWh/1000 EUR

Primary energy equivalent by sector

Year: 2015			%
Households	2054.40	GWh	43.3%
Service sector	326.80	GWh	6.9%
Industry	945.44	GWh	19.9%
Transport	1339.80	GWh	28.2%
Agriculture, Fishing and Other	77.00	GWh	
Sum	4743.44	GWh	100,0%



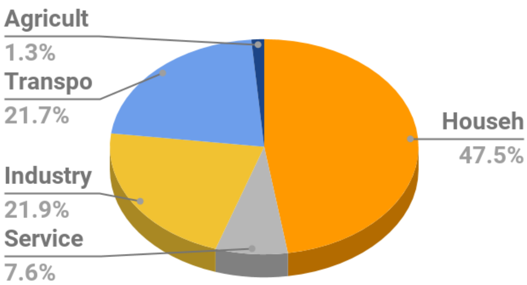
What is the level of primary energy supply dependencies: Which fuels need to be imported form the rest of the country and internationally.
Dependency on fuel supply: high
The region depends on import for all of its conventional fuels.

7.5.4. Regional CO_2-emissions associated with energy consumption

Total CO_2-emission associated with energy sector	1.10	Mio t
CO_2-emissions per capita	4.36	t/cap
CO_2-emissions per GDP	0.0015	t/€ GDP

Energy-related CO_2-emissions by sector

Year: 2015			%
Households	666,516	t CO_2	47.5%
Service sector	106,084	t CO_2	7.6%
Industry	306,905	t CO_2	21.9%
Transport	303,867	t CO_2	21.7%
Agriculture, Fishing and Other	18,673	t CO_2	1.3%
Sum	**1,402,045**	t CO_2	100,0%



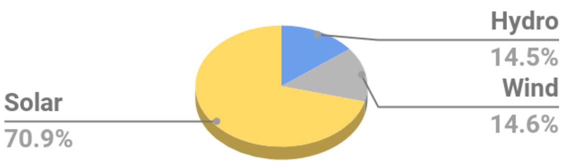
8. Renewable energy sources – status and potential

8.1. *General information*

Renewable Energy Targets:		
2020 RES share in gross final energy consumption	16	%
2030 RES share in gross final energy consumption	16	%
Current RES share (2015)	18.2	%
thereof RES out of the region	18.2	%

Share of final energy consumption produced by renewable fuels

Year: 2015			%
Hydro	70.89	GWh	14.5
Wind	71.25	GWh	14.6
Biomass, biofuels and renewable wastes	0.0008	GWh	0
Solar	346.43	GWh	70.9
Geothermal	0	GWh	0
Tide, Wave, Ocean	0	GWh	0
Sum	488.58	GWh	100,0%



Share of total electric demand covered by renewable fuels

The only available information is for the overall share of electric demand covered by such fuels, which is 19.1%. There is no information of the distribution between the different RES.

Describe if and how renewable energy sources are integrated in the transport sector, e.g. biofuels, electric vehicles.

They are not.

Describe the status of REN production in the region. % of total energy and electricity demand covered by REN. If available give a historic overview of the REN production capacities for the last 5 to 10 years.

When it comes electricity production, hydropower plants are historically the most used facilities. However in the last ten to fifteen years wind and specially solar energy production began to grow rapidly. The main reason for this growth are the subsidies from EU programs.

And now solar energy is around five times more than the rest RES and wind turbines have barely overtaken hydropower plants.

Describe if there are incentive programmes/schemes (financial and non-financial) in place to support REN-development. Are these programmes on national, regional or local level?

So far in Bulgaria we only have FIT schemes for the small scale roof PV under 150 KW and biogas installations. The other types of RES dont have FIT or loan interest rate from the banks at the moment.

Describe the top 5 regulatory barriers slowing down current and future REN-development. Should these barriers be addressed at national, regional or local level?

There is a lack of REN support and development at national and regional level
No clear rules how to join to the electricity network new RES installations
Long term energy limits for stop the planning of new RES projects and investments
Cheaper fossil fuels
lack of different possibilities for public-private schemes of planning new project development
Weak financial incentives for the final energy consumers

Give an estimate of the trend in renewable energy production using values from -5- to +5 (where -5 is a strong reduction, 0 means neither growth nor reduction, +5 strong growth). Describe supporting factor as well as barriers.

+2

8.2. *Available natural resources in the region*

8.2.1. Biomass

How are forest areas used? For what purpose? What is the regional energy potential using existing forest areas? Please state whether it is a theoretical or technical potential and describe regulatory support systems as well as barriers.

The total forest area of Pleven region is 47, 677 ha from which 96.5% are deciduous and 3.5% are coniferous. By type of ownership, the forest territories are divided into :

- *state forest areas - 24%*
- *municipal forests -23%*
- *forests in private properties -53%*

Most of the forest areas are scattered among farmland properties.

What are main agricultural products at the moment? What is the regional energy potential from agricultural products? Please state whether it is a theoretical or technical potential and describe regulatory support systems as well as barriers.

Main products: cereals 59%, oilseeds 38%, vegetables and flowers 1%.

There're no biogas plants at the moment and the potential is unknown at the moment.

8.2.2. Hydro power (incl. tide and wave power)

Give an overview of hydropower sources used at the moment and describe the energy potential for the different technologies: run-of-river hydropower plants, reservoir hydropower plants, use of tide and wave power, if applicable. Differentiate between small and large hydro power. Describe the energy potential based on geographical and political frameworks.

As stated above there are five relatively small hydropower plants in the region with total installed capacity of 6MW. One of them has 3.15MW installed output and the rest have below 1 MW. However the region is rich on water sources and there is potential for growth which is unknown at the moment.

8.2.3. Solar power

Solar irradiation (on optimally inclined plane) per year[9]	from 1600 to 1800	kWh/m²

Give an overview of both solar thermal and PV usage at the moment and describe the energy potential based on geographical and political frameworks.

The total number of solar facilities is 55 with installed output of 56.8MW and it is expected to grow. The region is also very suitable for PV installation according to the solar irradiation.

8.2.4. Wind power

Average wind speed	from 1.38 to 5.27	m/s
Full load hours		h/a

Give an overview of wind power use at the moment and describe the energy potential based on geographical and political frameworks. Differentiate between offshore and onshore potential

There're only 4 wind turbines at the moment with total installed power of 10MW. They were all built in recent years. The region is suitable for further development, but the higher price compared to the solar facilities is certainly a barrier.

Use regional/national studies but if not available, you can refer to the EEA study for approximation of wind speed or full load hours: http://www.eea.europa.eu/publications/europes-onshore-and-offshore-wind-energy-potential/at_download/file

Provide a wind map for the region, if available

https://www.windy.com/43.409/24.618?42.952,24.620,8,m:eRvagQc

[9] Joint Research Centre, Institute for Energy and Transport, Global Irradiation and Solar Electricity Potential, Optimally-inclined photovoltaic modules

8.2.5. Geothermal energy

Give an overview of use of geothermal energy at the moment and describe the energy potential based on geographical and political frameworks.

Geothermal energy is not used for energy production at the moment. There is potential for development, but no in depth study has been made yet.

You can use e.g. this study as staring point: A prospective study on the geothermal potential in the EU
http://www.geoelec.eu/wp-content/uploads/2011/09/D-2.5-GEOELEC-prospective-study.pdf

Provide a geothermal map for the region, if available

N/A

8.2.6. Waste

Describes overlaps between waste management and energy sector. Is municipal solid waste used for energy production? How is the energy from waste incineration plants used, e.g. electricity generation, district heating (cogeneration)?

Bulgaria is still in the first level of waste management and we are building the regional landfills. At local level many civil society groups are against waste burning and the building of incinerators with electricity production. This sector is less likely to be developed.

8.2.7. Other natural resources

Provide information about any other natural/renewable resources usable for energy production.

8.2.8. Restriction through protected areas

Are there environmentally protected areas, which are not available for REN facilities or restrict the overall potential?

The network of protected natural areas in the area includes one nature park, two nature reserves, one managed reserve, 28 protected areas and 19 nature landmarks. The relative share of these areas amounts to 22.32% of the territory of Pleven region.

9. Energy efficiency – status and potential

What is the status of the implementation of the Energy Efficiency Directive?

In the National Energy Efficiency Action plan from 2014, Bulgaria set 2020 goals for savings towards final energy consumption at 29.97 PJ(716 ktoe) and at 66.57 PJ(1590 ktoe) for savings from primary energy consumption. The goal for primary energy consumption is set at 706.3 PJ(16 870 ktoe) and at 361.69 PJ(8 639 ktoe) for final energy consumption.[10]

An Energy Efficiency Act was also adopted in 2015.

What is the status of the implementation of the Energy Performance of Buildings Directive (e.g. data on low/zero energy buildings)?

The National Energy Efficiency Action plan for 2014-2020 also covers energy efficiency in buldings. A priority of the National Renovation Programme for Residential Buildings in Bulgaria are multi-family residential buildings. The average energy savings expected from the implementation of the energy-efficiency measures included in the Programme are between 25-35 kWh/m2[11]

Analyse the sectors:

Households: Are energy efficiency measures implemented in this sector? Are there awareness campaigns to highlight the potential? Is there support for the implementation (financial and non-financial)?

There are numerous energy efficiency programs running mostly on municipal level and most of them provide financial support.

Energy renovation of Bulgarian homes was launched in July 2012 with the financial support of Operational Programme 'Regional Development 2007–2013', which is co-financed by the European Union through the European Regional Development Fund.

Service sector: Are energy efficiency measures implemented in this sector? Are there awareness campaigns to highlight the potential? Is there support for the implementation (financial and non-financial)?

Yes. With the potential of the different operational EU programs many SME could apply for new EE measures about their business. We can say that the service and industry sectors are equal in this regard.

Industry: Are energy efficiency measures implemented in this sector? Are there awareness campaigns to highlight the potential? Is there support for the implementation (financial and non-financial)?[12]

Few programs that support the industry have been launched so far. First of them Investments in green industry. Its main objective is to provide investment support to large enterprises in Bulgaria, directly related to the reduction of their energy and resource intensity.

Energy efficiency and green economy is also being implemented. Its main objective is to provide investment support and advice to Bulgarian micro, small and medium-sized enterprises in their transition to a green economy. The procedure combines a grant component (non-repayable aid) and a loan component – additional funding provided by the European Bank.

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[10] National Energy Efficiency Action Plan, pages 13-19

[11] National Energy Efficiency Action Plan, pages 63 and 64

[12] National Energy Efficiency Action Plan, pages 49 and 50

Transportation: Are energy efficiency measures implemented in this sector? Are there awareness campaigns to highlight the potential? Is there support for the implementation (financial and non-financial)?[13]

There are legislative measures that include:

- *suppliers of liquid transport fuels to reduce GHG emissions per energy unit of liquid fuels delivered against a fixed baseline level and reach an overall reduction of 6 % by 31 December 2020*
- *suppliers of petroleum-derived liquid transport fuels to supply fuels for diesel and petrol engines blended with biofuels in certain proportions.*

Some of the strategic measures include:

- *rehabilitation and modernisation of the road infrastructure -*
- *implementation of intelligent transport systems on national roads and in urban environments*
- *increased share of biofuels*
- *develop and promote the use of bicycles*

Give an estimate of the trend in energy efficiency development using values from -5- to +5 where (-5 is a strong reduction, 0 means neither growth nor reduction, +5 strong growth).

+2

Demand side management, smart metering, storage

[13] National Long-term Programme to Encourage the Use of Biofuels in the Transport Sector 2008-2020

10.SWOT analysis

Please make a SWOT-analysis for the development of your region towards a low-carbon economy in 2050. Include stakeholders in the process.

Strengths	**Weaknesses**
● High RES potential ● The environment is in a good shape ● Good results and examples are already existing	● The economic is lagging behind ● Lack of researches and energy data ● Lack of energy planning on regional level ● Not all available RES are used ● Aging population ● Since 80s province of Pleven has only nuclear development focus
Opportunities	**Threats**
● Studying the potential use of geothermal energy ● Using waste and biomass as energy sources ● Further development and strengthening of the RES that are already in use ● Developing an infrastructure for electric cars	● Lack of investments due to political and economic instability ● Slowing down the growth of RES usage due to lack of stimulating regulations ● Underestimating the capabilities of projects funded by EU funds from national operational programs

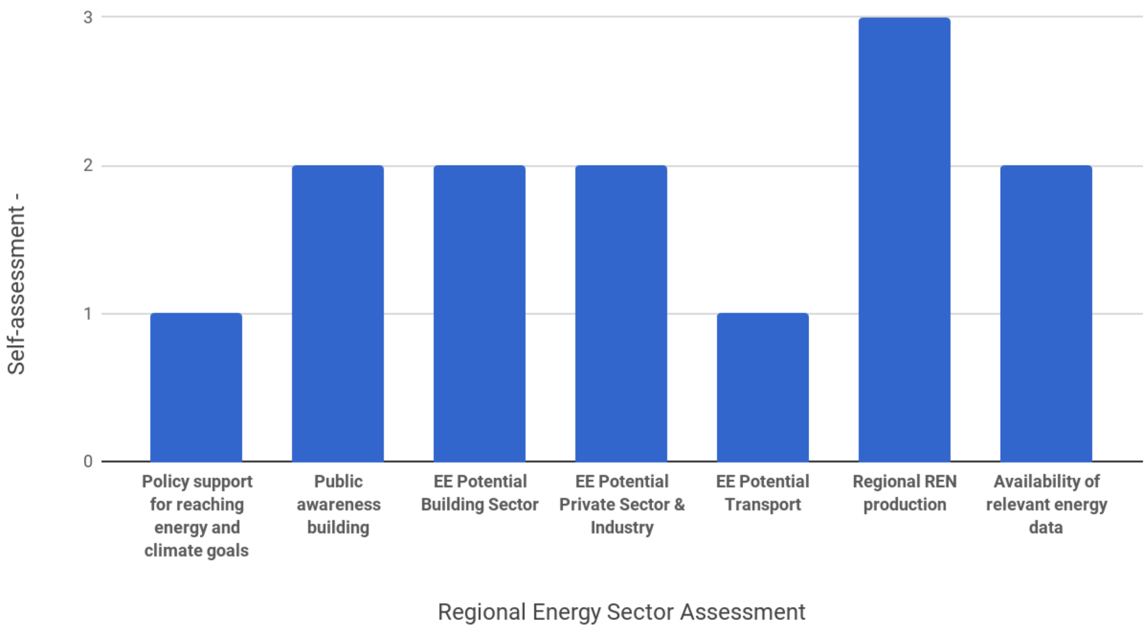
Assess the following trends:

- Policy Support for reaching energy and climate goals
- Public awareness building
- EE Potential Households
- EE Potential Private Sector & Industry

- EE Potential Transport
- Regional REN production
- Availability of relevant energy data

Self-assessment:
See Excel template or modify the graph provided here (right-click).

Points:
1 … no measures set/ potential unused
to
5 … fully developed/ potential fully used



11. Annex: List of sources /bibliography /List of relevant stakeholders/institutions in the region

Please include your sources/bibliography, a list of identified stakeholders, etc

1. http://www.nsi.bg/en/content/11460/district-pleven - Statistics
2. http://www.regionalprofiles.bg/var/docs/Profiles-2016-EN/12-Pleven-District-ENG.pdf - Socio-Economic Development
3. ttps://infostat.nsi.bg/infostat/pages/reports/result.jsf?x_2=1083 -Population
4. https://infostat.nsi.bg/infostat/pages/reports/result.jsf?x_2=1262 -GDP
5. http://www.regionalprofiles.bg/var/docs/Profiles-2012-EN/Pleven_2012_EN.pdf - Investments
6. http://www.nsi.bg/en/content/5493/gdp-regions - Leading economic sectors
7. http://www.nsi.bg/en/content/5528/employed-persons-regions -Sector Employment
8. https://ec.europa.eu/energy/sites/ener/files/documents/bg_building_renov_2017_annex_6_of_neeap_en.pdf - NATIONAL LONG-TERM PROGRAMME for the promotion of investments in measures aimed at improving the energy performance of the national stock of public and private residential and commercial buildings 2016–2020
9. http://www.regionalprofiles.bg/var/docs/Profiles-2016/15_Pleven.pdf - Transport infrastructure
10. http://re.jrc.ec.europa.eu/pvgis/cmaps/eu_cmsaf_opt/G_opt_BG.png - Solar irradiation
11. http://www.seea.government.bg/documents/2014_neeap_en_bulgaria.pdf - National Energy Efficiency Action Plan
12. file:///C:/Users/user/Downloads/Biofuels_Program_EN.pdf - Biofuels

REGIONAL ENERGY PROFILE

Region: South Bohemian Region

PANEL 2050 – Partnership for New Energy Leadership 2050
Deliverable 3.1

By: AgEnDa z.s.

Date: June 2017

Horizon 2020
European Union funding
for Research & Innovation

Table of Content

1. Methodology

The PANEL 2050 project has the aim to create durable and replicable sustainable energy networks at local (municipality/community) level, where relevant local stakeholders collaborate for the creation of a local energy visions, strategies and action plans. The aim of these networks is to contribute to and actively work for the transition towards low carbon communities in 2050.

The PANEL 2050 partnership will provide support for the creation of first successful local energy networks in the CEE countries. In the course of the project, organisations from 10 CEE countries will collaborate on creating regional energy strategies and action plans.

The present Regional Energy Profile was prepared in order to get a better understanding of the energy-related status quo in the South Bohemian Region, analysing strengths and challenges with regard to the transition towards a low carbon community.
This energy profile constitutes the groundwork for the preparation of a Regional Energy Roadmap and related Action Plans and will be essential for the communication with regional stakeholders.

For completing this Regional Energy Profile the following sources were used:

Majority of information used in this document come from regular statistics and publication by Czech Statistical Bureau, furthermore from publications of Ministry of trade, Ministry of spatial development or Energy Regulatory Bureau. Some of the data origins from thesis (e.g. J. Pojar – Energy poverty measures in the Czech Republic, etc). Also some of valuable data related to RES potential of the region comes from findings of project RESTEP (and developed tools) implemented by the group of main stakeholders.

2. General introduction of the region

Name of the region and NUTS identification

South Bohemian Region CZ031

Geography and policy:

Describe the location of the region + provide also a political map showing location of the region in your country

A substantial part of the region's border is formed by the state frontier with Austria and the Federal Republic of Germany (with the total length of 323km). The South-Bohemian Region also neighbours with the Region of Plzeň, Middle Bohemia, Vysočina and South Moravia. The border position of the region provides it with effective possibilities for cross-border cooperation in the field of production and services as well as for the development of tourism as visitors to the region can make use of the overall attractiveness of the region with pristine landscapes and plenty of historic landmarks.

Image 1 Location of South Bohemian region

Geography of the region, including morphology, geology, climate, hydrology, flora and fauna related to energy (text description)

South Bohemia makes, from a geographical point of view, quite a closed whole whose core consists of the South Bohemian Basin and the Českobudějovická and Třeboňská Basins. In the south-west it is surrounded by Šumava (the Bohemian Forest), and then it is also surrounded by the promontory of Brdy, the Středočeská (Central-Bohemian) Granite Highlands, the Českomoravská (Czech-Moravian) Highlands and the Novohradské Mountains.

The climate in South Bohemia is of a transitional Central European type. It is affected alternatively by an oceanic influence from the west, and a continental influence from the east. Therefore, the weather can be variable. Most of the South Bohemian region belongs to the mild, warm and wet zone and at altitudes above 750 m this passes to mild and cool. The warmest month is usually July, with temperatures averaging between 17 and 18 °C in valley areas. In higher localities (over 900 m) the temperatures can drop below 14 °C. Days with temperatures above 25 °C are most frequently in valley-basins, and the area around the confluence of the rivers Lužnice and Vltava (Moldau): on average there are 40-50 such days a year.

The Region of South Bohemia lies in the area which is not very rich in raw materials; there are almost no energy resources. However, there are large forests that represent a notable natural wealth especially in the Šumava and Novohradské Mountains. These forests contain mainly coniferous trees, spruces and pines. The biggest natural resources of the region are formed by the deposits of sand and gravel, brick clay, aggregate and glass sand. From other resources, peat is the most significant one as well as, in some localities, limestone, bergmeal and graphite.

The industrial production is concentrated particularly in, and around, the town of České Budějovice and in the districts of Tábor and Strakonice. The processing industry plays a significant role here, especially food and drink processing. Other important industries are production of vehicles, machinery and appliances, and also the textile and clothing industries.

The agricultural sector focuses on plant production, mostly on growing cereals, oil plants and potatoes. In animal husbandry, the breeding of cattle and pigs prevails. Fishpond cultivation has a long tradition in South Bohemia. Fish husbandry in the total area of 25 000 ha, makes up about 50% of the total production in the Czech Republic.

Brief history overview of the region – state the most important milestones related to the industrial / regional development (e.g. significant energy projects, powerplants, etc.), ideally related to energy

The region's territory has always had more of a recreational character rather than the character of a developed industrial area.

The Region of South Bohemia has been long been perceived as mainly an agricultural area with a developed system of fish farming and forestry and only in the course of the last century the processing industry developed here.

Installed capacity of South bohemian Region in the Czech electricity grid (MW) is 2 929 MW (45,4 MW as and combustion plants, 2250 MW nuclear plants and 241,8 MW photovoltaic plants). The anually Gross electricity production in the region is 15 498 GWh. The anually Gross electricity consumption is 3 104,1 GWh.

The duty of a new source of energy has been undertaken by the Temelín Nuclear Power Plant. In spring 2003, the Temelín Nuclear Power Plant, with its 2,000 MW of installed capacity, became the largest power resource in the Czech Republic. Planning began in the late 1970s and the final project was submitted in 1985. Construction of four operating units began in 1987. The project was expected to be completed in 1991 with estimated building costs of 35 billion Kčs. Six villages were demolished by the then-Communist government to make way for the power station. After the Velvet revolution in 1990 the Czechoslovakian government decided to cease construction of the third and fourth reactors. Work continued on the first two reactors; in the 1990s alterations to the original design were made by Westinghouse in conjunction with SUJB and the IAEA to bring reliability and safety levels into conformance with Western European standards. Each of two blocks has net capacity of 1055 MW. It produces around 14% of all electricity production in the country, which makes around 11% installed power share on all plants.

Photovoltaic plant in Ševětín (district of Budweis) is with 29,9 MW installed power the third largest photovoltaic plant in the Czech Republic. It has been get into operation in December 2010 and covers area of 60 ha.

In 1922 power plant built on lignite deposit was built and supplied city of Budweis with 22kV powerline and reached a historical maximum of 100 MW. It was turned in to a heating plant some years later and in 2001 rebuilt as a gas heat power plant. Between 2009 – 2011 (after rejection of massive incineration unit) plant was reconstructed and used as heating plant with gas engines, biomass boiler and two generators with 3,5 MW installed power.

There are another 9 power plants with installed power of 101 – 1960 kW (4 hydroelectric 340 – 1960 kW and 5 photovoltaic plants (101 – 506 kW) in the city of Budweis.

Small hydroelectric power plant is located on water pond Hněvkovice as a part of Vltava's cascade. Two Kaplan's turbines with 2x 4,8 MW have been installed between 1986 – 1992. Another small hydroelectric power plant Kořensko was built also between 1986 – 1992 with two Kaplan's turbines 1,9 MW.

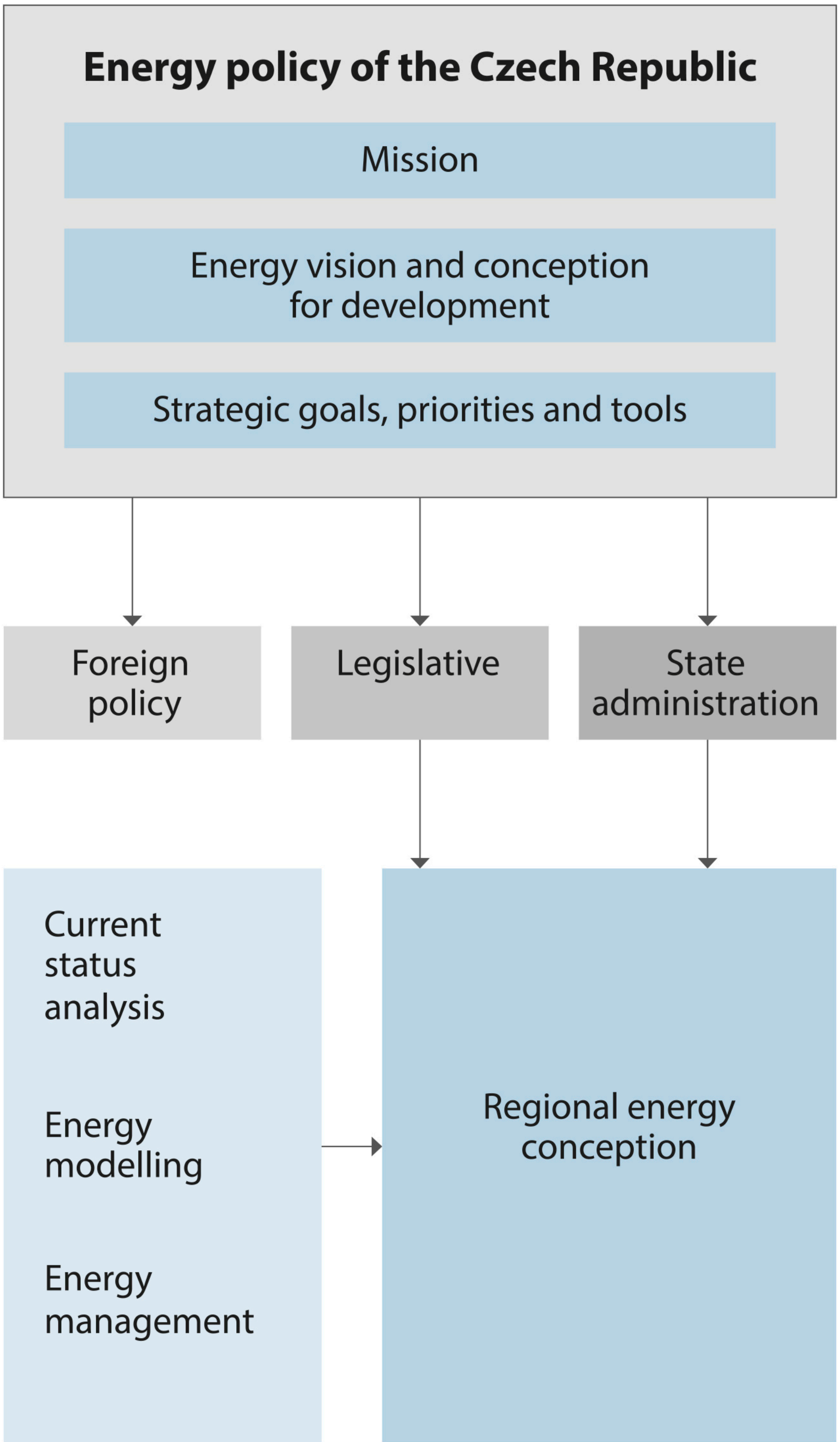
The Lipno I Hydroelectric Power Station is a part of the Vltava Cascade. Its water reservoir, covering an area of almost 50 km2, forms the largest artificial lake in the Czech Republic. The reservoir's volume is 306 million m3 of water, and it is used in a long-term runoff regulation to increase the minimum flow, limit flood peaks, and increase the generation at the other power plants along the Vltava Cascade. Its ability to quickly increase its output to the maximum, reaching 120 MW in 226 seconds, and its remote control from the Hydroelectric Power Station Control Centre at Štěchovice allows it to influence the output balance of the country's power system at any given time. The fluctuation in the runoff is balanced by the Lipno II small run-off-river hydroelectric power station with the capacity of 1.5 MW, built downstream from Lipno I.

There is also one more small hydroelectric power plant in Soběnov operating since 1924 with 2x 615kW installed power.

Public administration procedure – brief profile of current energy planning process in your region starting from the national level down to the region (see also your desk research within WP3.1)

State energy policy (last update 2015) is a basic document setting up targets in energy management in accordance with the needs of economic and social development, including environmental protection. In 2015 National Action Plan form Smart Grids (NAP SG) was approved as well. Regional Energy Conception of South Bohemian Region (2003) is a fundamental document on regional level.

Image 2 Energy policy of the Czech Republic



Highlight significant characteristics differentiating region from others and give short (!) introduction of energy targets and challenges in the region

Energetics in the region is mostly influenced by presence of Nuclear Power Plant Temelín and its future extension (doubling the installed power) that is planned.

RES potential

Biomass – South Bohemia has big potential for energy utilization of biomass thanks to the high share of wooded area, as well as for phytoenergetics deployment and growing crop on uncultivated land.

Wind energy – Only few locations in the south are being above the level of profitability and on top of that construction of wind power plants is very difficult due to the nature preservation.

Solar energy – Solar conditions for photovoltaics are pretty good, intensity of solar radiation reaches almost 3800 MJ/m2/year. Region is also known for high share of households and farms with great potential for installment of solar panels.

Hydro energy – increase of current installed power is depended on construction of new elements such as weirs and reservoirs. Rivers in the South Bohemia are not much steep which limits the power of current water power plants.

Geothermal – Geothermal energy can be utilized by heat pumps. Especially suitable locations can be found in the west part of Jindřichův Hradec districts, south of Písek city, southeast of Strakonice city and part of Budweis district.

From above stated overview it's clear that South Bohemian region has sufficient potential of biomass, solar, hydro and geothermal energy with marginal significance of wind energy potential. Optimal regional strategy would be based in utilization of biomass and solar energy. The use of hydro power is depended on number of other aspects. Geothermal energy utilization is limited by relatively high investment costs.

3. Basic demographic data and figures

Regional demographic indicators:

Population of region	637 834	cap
Area of region	10 056	km²
Population density	63	cap/km²
Number of individual municipalities	623	mun.

Data from 2015

Basic demographic data

Population growth, age distribution in last 20 year – text description

The region´s population is characterised by a rather younger average age (it is 39.0 years) compared to the rest of the republic. Also the death rate has been lower in the long term (10.0 deaths per 1000 inhabitants) and, on the contrary, the natality has been higher (9.2 newborns per 1 000 inhabitants). The two districts bordering with Austria - i.e. the districts of Český Krumlov and Prachatice - are significantly distinct from the demografic structure of the region owing to their varied national groups. The average age is younger here, the birth rates are the highest and the death rates are the lowest in comparison with other town districts. The population of Strakonice and Písek Districts has been constantly decreasing recently. On the contrary, the Districts of České Budějovice and Český Krumlov have an increase in the number of their inhabitants.

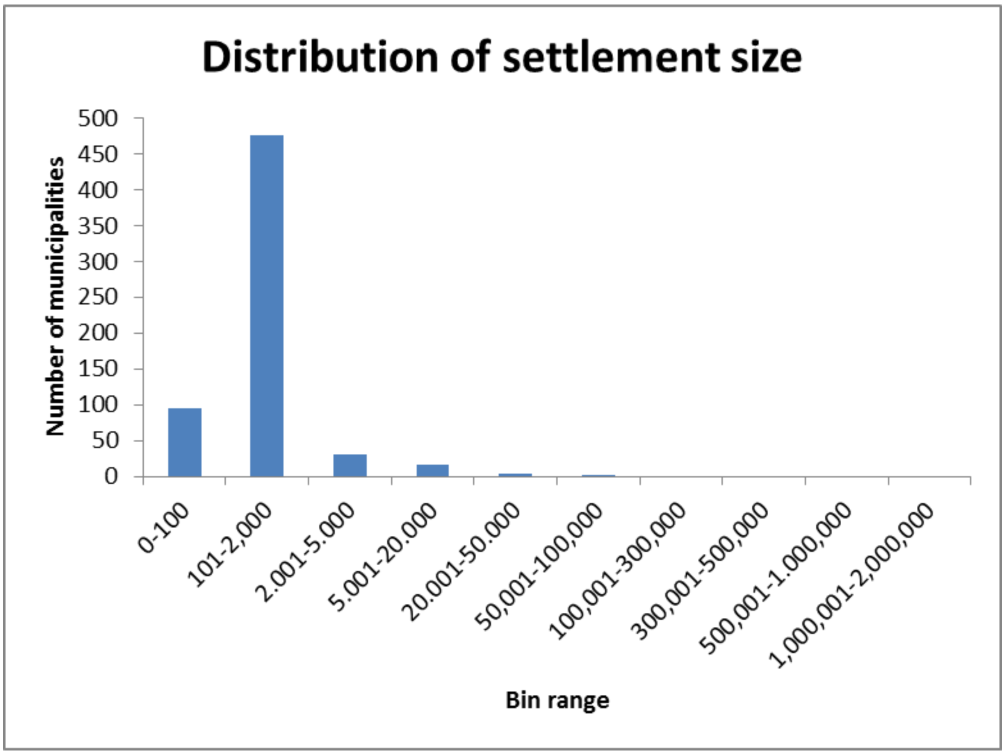
Socio-economic development of past 3-5 years

Unemployment rate	5,07	%
Average annual income per capita (gross)	12 379	EUR
difference from the EU average (34.500 EUR gross annual earning)	-64	%
Share of employees in		
agriculture	2,7	%
industry	38	%
services	59,3	%
Share of population with tertiary education	11	%

Text description for figures above

The region participates in creating only 5.4% of the gross domestic product which, however, amounts to 87.8% of the national average when recalculated per 1 inhabitant. This puts the region in the 4th place of the whole of the Czech Republic (after the capital of Prague, the Region of Plzeň, and the Region of South Moravia).

Image 3 The spatial distribution of the population, level of urbanisation



4. Regional economy and economic trends

Regional economic indicators:

GDP, total	8 450	million EUR
GDP per capita	13 259	EUR/cap
HDI	0,861	

Data from 2015

GDP per economic sectors:		
Agriculture	5,3	% of total GDP
Industry	41,4	%
Services	53,3	%

Data from 2015

Regional economy

Please provide information about the regional economy, past development and trends using GDP and other indicators. If available, include graphs about GDP / HDI development of last 10-20 years.

Image 4 Progress of GDP per capita in CZK (1 EUR = 28 CZK)

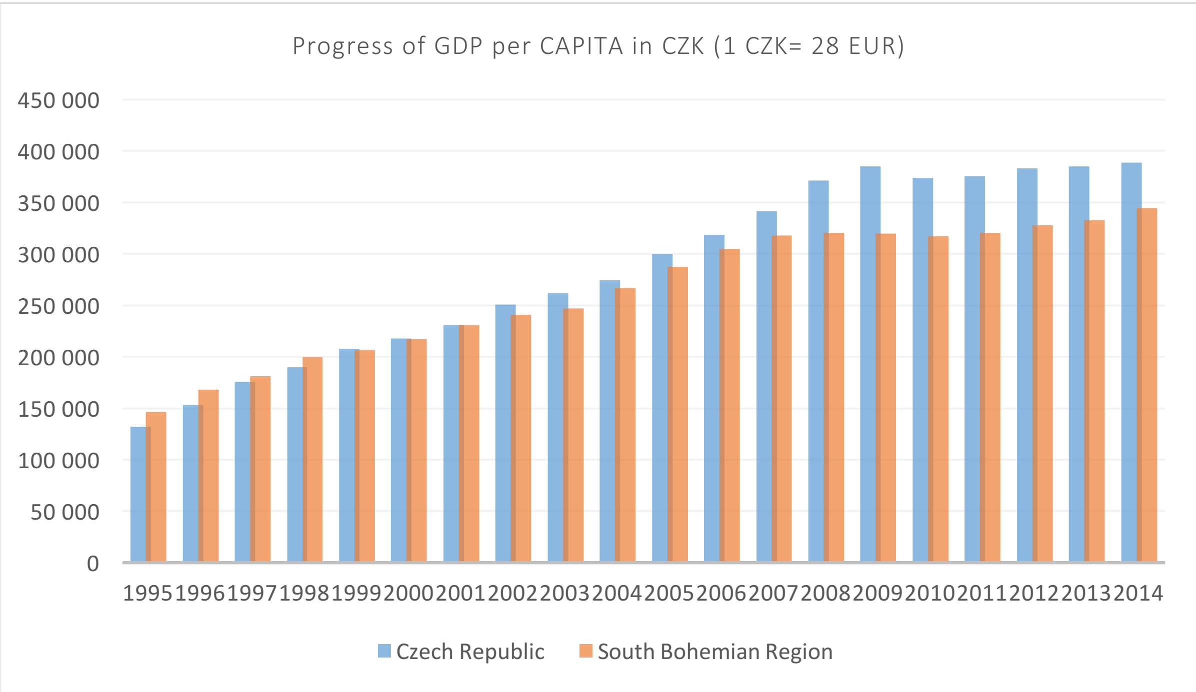
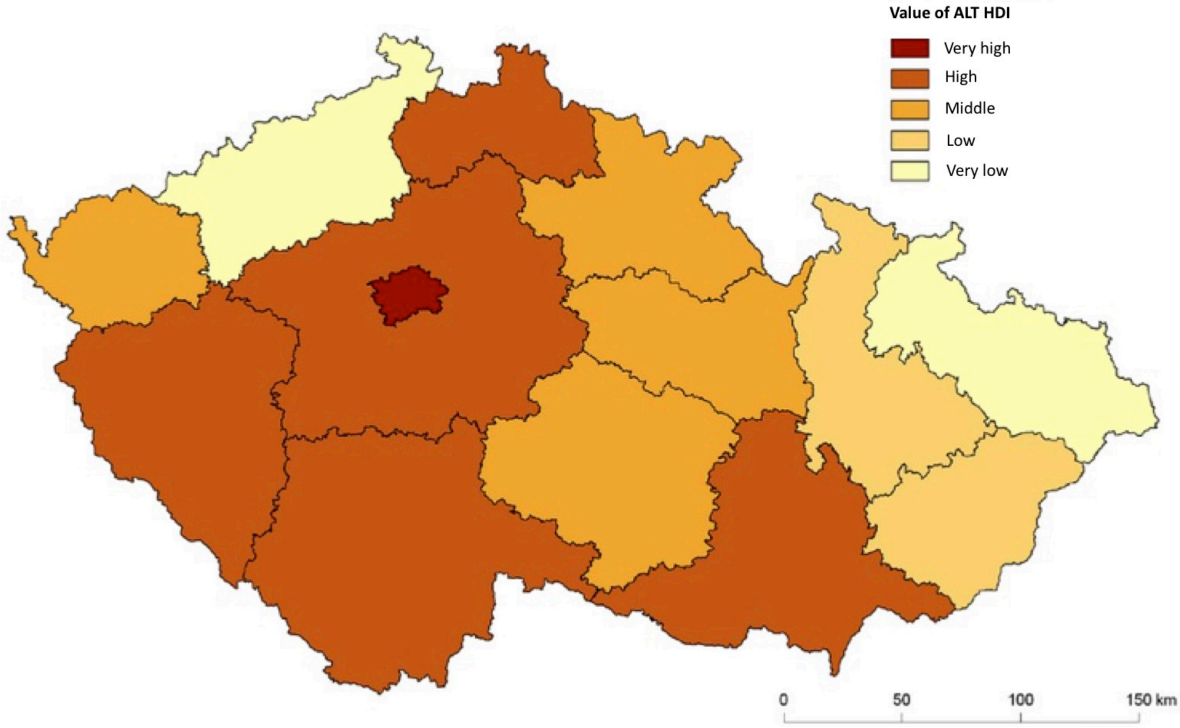


Image 5 Value of ALT HDI



number of operating entrepreneurs (SMEs, large and individual)	**162 106**	
→ share of SMEs	99,93	% of total number of operating businesses
number of operating nonprofit organisations	6 269	
Amount of EU funds (2007-13)	745 474 363*	EUR (*ROP Southwest – for South Bohemian and Pilsener Region)

What are the main contributors/contributing sectors to the regional GDP? How stable are these sectors (qualitative assessment)?

Industrial production is concentrated mainly in the České Budějovice urban agglomeration; rather significant share of industry is also reported for the Tábor and Strakonice Districts. However, the Region does not rank among key industrial areas - its 2001 share in sales of industrial enterprises accounted for 5.1% of the CR's total. Manufacturing (mainly manufacture of food products and beverages, means of transport, machinery and equipment, and of textile and textile products) prevails over the other industries. Activities in construction are focusing on new construction, modernisation and reconstruction in the Region, accounting for 4.4% of the CR's total construction output.

Describe the regional job market, employment/unemployment rates per sectors – agriculture and forestry, industry, services

The unemployment rate in the region is about 5–6 % for the last 5 years. In the I. sector (agriculture and forestry) 2,7 % of total employees were employed, in the II. sector (industry) 38 % and in III. sector (services) 59,3 %, in 2014.

Importance of trade; Import/ export balance, if available

From the point of view of the international transport, the South Bohemian Region has a strategic position on the north-south axis. Important international roads lead through the region as well as the north-south railway corridor. However, to connect these roads and the railway to the European network is a big problem of the region.

Total export to region (2010): 3 650 mil. EUR. Later and complete data are not available.
Total Czech export in 2015: 142 369 mil. EUR; total Czech import: 127 486 mil. EUR, Balance: 14 883 mil. EUR.

5. National and local energy strategies

List of relevant and most influencing strategies / roadmaps / measures to local energy situation or development

Region	Brief description of current ...	legal requirement OR voluntary initiative	National/ regional/ local level	Original title + link (if possible)	English title + brief description	Organisation in charge	Type (EE,EPB,RES, etc. or combination...)
Czech Republic	On 18th of May 2015 the government of the Czech Republic approved the updated version of the State Energy Policy for the following 25 years. The main reason for the update of the State Energy Policy and its subsequent approval is a need for clearly formulated priorities and strategic objectives in the energy sector.	legal	national	Státní energetická koncepce 2015	State Energy Policy (SEC)	Ministry of Industry and Trade	all
Czech Republic	This task is associated with one of the priorities of SEC — the concept of development of network infrastructure to ensure reliable and safe operation with respect to the required development of distributed generation (especially Renewable Energy Sources — RES), including the involvement of small combined heat and power (CHP) generation plants, production management, accumulation and consumption and taking into account the requirement of	Legal	National	Národní akční plán pro chytré sítě	National Action Plan form Smart Grids	Ministry of Industry and Trade	distribution

	increasing of energy efficiency.						
Czech Republic	National Action Plan for Energy from Renewable sources sets national goals of member states for share of renewable in transport, electricity production, heating and cooling by 2020.	legal	national	Národní akční plán České republiky pro energii z obnovitelných zdrojů	National Action Plan for Energy from Renewable sources	Ministry of Industry and Trade	RES
Czech Republic	The first Action Plan on Energy Efficiency for the Czech Republic was prepared in compliance with directive 2006/32/ES, concerning energy efficiency and the end user and concerning energy services.	legal	national	Akční plán energetické účinnosti ČR	Czech Republic Action Plan on Energy Efficiency	Ministry of Industry and Trade	EE
South Bohemian Region		legal	regional	Územní energetická koncepce Jihočeského kraje	Regional Energy Conception of South Bohemian Region	South Bohemian Region	all

6. Energy Production

6.1. *Conventional energy production capacities (fossil fuels and nuclear power)*

Give an overview of energy production by fossil fuels and nuclear power plants – concentrate on the most significant 3 to 5 power plants.

Name & Location (city, town)	Owner	Year of commis-sioning (refur-bishment)	Type of plant & fuel	Capacity in MW	Annual energy production in MWh	Annual CO_2-emissions in t	Utilization rate (qualitative assessment)
Nuclear plant Temelín *(source: ČEZ)*	ČEZ - Public 69,78 %, private 30,22 %	2002	Nuclear (fuel UO_2)	2 110 MWe / 6 000 MWt	13 914 000 MWh electricity[1]	0	Constantly used
Heat plan Budweis *(source: annual report of the plant)*	Stock company of Budweis	1994	Thermal PS - Lignite / natural gas	456 MWt (heat) / 66 MWe	1 486 TJ heat/ 76 722 MWh electricity (2015)	451 663 t	Constantly used
Heat Plant Strakonice *(source: annual report of the plant)*	Stock company of Strakonice	1954	Thermal PS – lignite / biomass	214 MWt / 30 MWe	508 TJ heat / 104 135 MWh electricity	242 629 t	Constantly used

Add additional details to describe the conventional energy production capacities in the region. What are current trends? What influence have age, regional economy, fuel imports, and fuel prices on the on the current status?

There is one dominant source of electricity production in the region of South Bohemia – nuclear power plant Temelín (one of two nuclear power plants in the Czech Republic). There are no coal power heat plants only municipal heat plants with cogeneration heat and electricity production. Besides plants in Budweis and Strakonice (see table above) larger heat plants are located in city of Tábor and Písek. Refurbishment of current facilities in order switch to biomass combustion is actually trending in the region since the biomass is available. All fossil fuels are being imported from other regions. Doubling of the nuclear power plant Temelín capacity is still under preparation unlike the other intentions for fossils utilization. The region is unique in terms of lowest rate of gas utilization compared to the national average. Use of renewables is above the average in South Bohemia.

[1] No data on heat production available, 170TJ of heat energy is supplied by pipelines to the city of Týn nad Vltavou

6.2. *Renewable energy production*

Energy production capacities

Give an overview of energy production by renewable energy capacities (e.g. small/large hydro, solar PV, solarthermal, biomass, geothermal & other production capacities – concentrate on the most significant 3 to 5 power plants or aggregation of production facilities.

Name & Location (city, town)	Owner	Year of commis-sioning (refur-bishment)	Type of plant & fuel	Capacity in MW	Annual energy production in MWh	Annual CO_2-emissions in t	Utilization rate (qualitative assessment)
Hydropower Lipno I	ČEZ - Public 69,78 %, private 30,22 %	1959	Hydropower	120 MWe	145 450	0	Constantly used
Solar PV Ševětín *(source: ČEZ)*	ČEZ - Public 69,78 %, private 30,22 %	2010	PV solar	29,9 MWe	32 500	0	Constantly used
Hydropower Lipno II	ČEZ - Public 69,78 %, private 30,22 %	1957	Hydropower	1,5 MWe	4 850	0	Constantly used
Hydropower Soběnov	E.ON - private large enterprise	1924	Hydropower	1,23 MWe	3 981	0	Constantly used

Add additional details to describe the renewable energy production capacities in the region. What are current trends? What influence have age, regional economy, fuel availability or renewable energy potential, and subsidy systems on the current status?

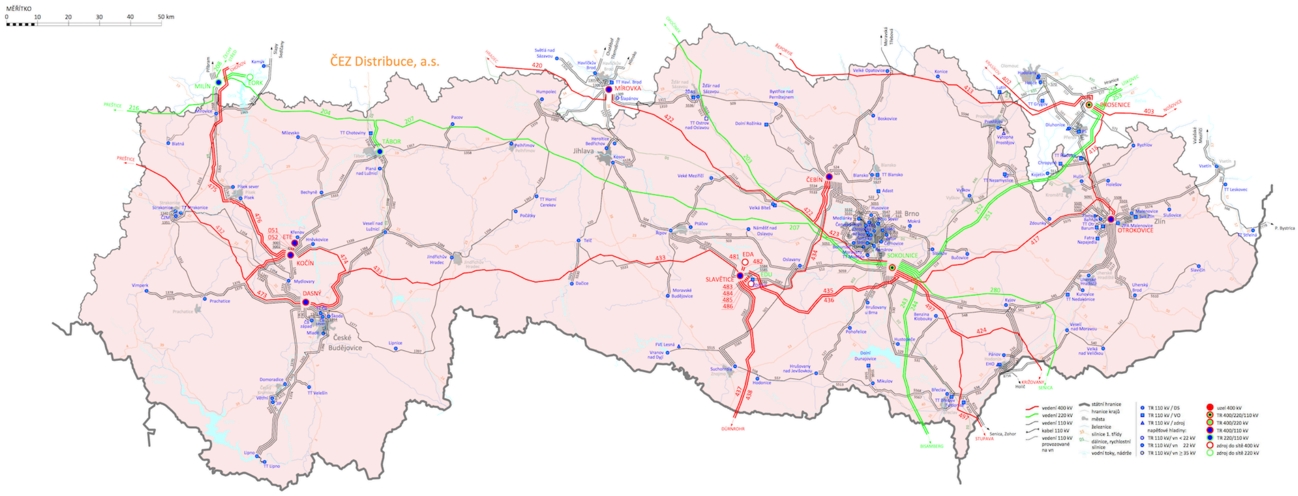
The potential of South Bohemia comes from quite dense network of water streams and reservoirs, locally also from sunlight exposure. Currently hydropower potential has been used up and photovoltaic development ended with the termination of national subsidy scheme. Only small private sources can be expected in the future.

6.3. *Transmission and distributions*

What kind of facilities constitute the electric transmission and distribution system? Who are the owners? Who are the operators? Please add relevant map if available.

Distribution system is being operated by E.ON Distribuce, a.s.. Distribution network is operated in three voltage levels: 1) 110kV, 2) 22 kV and 3) 0,4 kV and supplied by electric transmission by ČEPS via superior transformations 400/220/110 kV. Distribution network is powered further (partially) from E.ON production plants and other local sources. In the Western sector the majority of the network is powered via transformers 400/110 kV connected in parallel bridge operation with 4 transformers 400/110 kV (TR Dasný – TR Kočín) with connection to 2x110 kV transmission.[2]

Image 6 Map of distribution system of electricity in South Bohemia

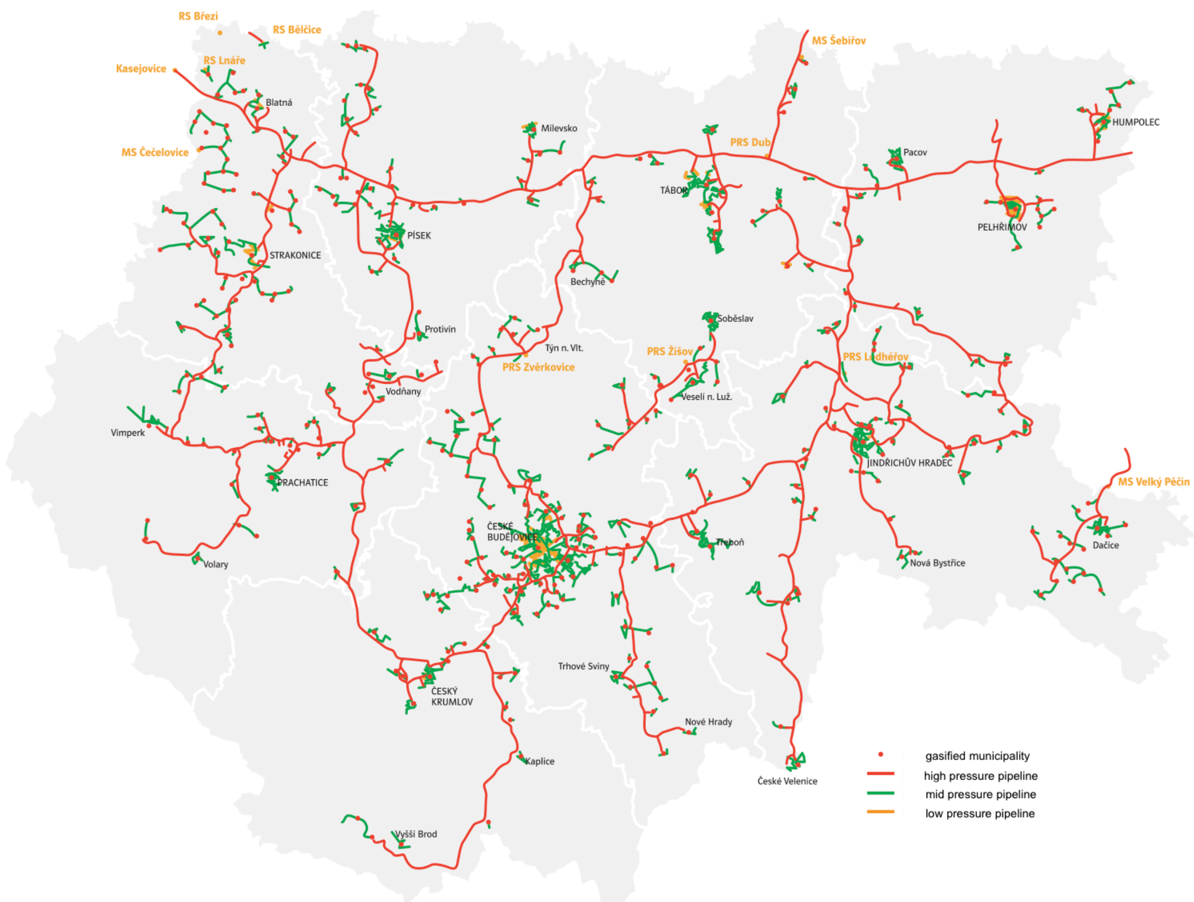


[2] Description of distribution system of electricity, E.ON Distribuce, a.s., 2016

Give an overview of other centralised or decentralised energy distribution systems (e.g. natural gas pipelines, heat grids, etc.).

South Bohemia region belongs to the distribution system of E.ON Distribuce (operator of electric transmission and gas supply). There are few exceptions on the regional borders (Jindřichův Hradec) using other competitor's network from GasNet (Innogy). Heat grids are located locally related to the municipal heat plants operation. Rural areas includes mainly domestic utilities and gas.[3]

Image 7 Map of distribution system of natural gas in South Bohemia



Give an overview on interconnections of regional energy production with the rest of the country. Are there large production facilities in the region on which the rest of the country's energy supply might depend?

The only source of energy with interregional / international importance is nuclear power plant Temelín, other sources are not so significant (local / regional). Apart from biomass South Bohemia has no other energy sources.

[3] Description of distribution system of natural gas, E.ON Distribuce, a.s., 2016

6.4. *Jobs in the energy sector*

Give an overview about the status of the energy sector in the regional economy. How many jobs are there at the moment in the energy sector. How important are new "green job" for regional economy development. If possible, quantify investments in the energy sector.

Energy sector employment fluctuates between 3,3 – 6,6 % in 2005 – 2016[4]. Data on actual job opportunities in energy sector, importance and share of Green Jobs are not available. Significant growth of investments and job offers is expected if extension of nuclear power plant Temelín is launched.

Are coal and lignite mining undertaken in the region? What role does fossil fuel mining play for the regional economy and for regional energy security?

There are no coal or lignite mines in the South Bohemia. All energy raw materials are being imported (including nuclear fuel from Russia).

4 Czech Statistical Bureau, Employed by sectors 2005 – 2016 (source: https://vdb.czso.cz/vdbvo2/faces/cs/index.jsf?page=vystup-objekt&pvo=ZAM03&z=T&f=TABULKA&filtr=G~F_M~F_Z~F_R~F_P~_S~_U~301-501-401-202-411_null_&katalog=30853&str=v221&u=v228__VUZEMI__100__3034&c=v265~8__RP2016)

7. Final energy consumption

7.1. *Households*

Regional final energy consumption of household sector	5 439	GWh

Heat consumption

Total heat energy consumption of households sector (heating and hot water consumption)	4392	GWh
Average heat energy consumption per household	15902	kWh/hh [5]

Describe the average building standard. What is their average age of existing building stock? Are energy efficient renovations in progress?

Average annual heat consumption per m^2 in residential spaces is 0,4 GJ which responds to national average. Average age of existing building stock is 46,5 years. In comparsion with other EU states Czech Republic has rather older housing fund. In the Czech Republic number of subsidy schemes focuse on insulation and fossil heat source replacements. In the South Bohemian region 41% of buildings have insulated walls, 34% insulated roofs and 75% thermal insulating windows. 19% of the buildings have not been insulated yet.

Electricity

Electricity consumption of households	1 047	GWh
Average electricity consumption per household	3792	kWh/hh

Describe if there are any national or regional programmes for reducing household electricity consumption (e.g. washing machine or refrigerator replacement programme). If yes, please elaborate it briefly.

No such schemes on the regional level. South Bohemian Regional Authority only helps with promotion of national schemes.

Cooking

Gas consumption for cooking appliances of households	30,61	GWh

Describe if gas is a significant energy source for cooking in the household sector.

Gas is being used from 38% for cooking. More significant is the use of electricity (57%).

[5] Czech Statistical Bureau, Domestic fuel and heat consumption, 23.2 2017
https://www.czso.cz/documents/10180/50619982/ENERGO_2015.pdf/86331734-a917-438a-b3c2-43a5414083fc?version=1.4

General information

Household electricity price	0,1122	EUR/kWh (incl. taxes)
Household natural gas price	0,0688	EUR/kWh (incl. taxes)
Household district heating price	0,0804	EUR/kWh (incl. taxes)
Household price: other energy sources – wooden pellets	0,0421	EUR/kWh (incl. taxes)
Energy expenditure by household [6]	10,14	% of income

(source: E.ON, exchange rate 26,13 CZK/EUR)

Is there any element of Demand Side Management of electricity on household level in place? If yes, please describe it (e.g. peak price, smart metering)

There is only HDO system used in the Czech Republic (low and high tariff).

Is energy poverty an issue in the region? If yes, please describe how many people are affected, in what extent?

There are no energy poverty regions or communities in the region of South Bohemia.

Give an estimate of the trend in final energy consumption in the household sector using values from -5- to +5 where (-5 is a strong reduction, 0 means neither growth nor reduction, +5 strong growth).

0 – households *stands* for the most significant group of consumers with share of 37,8%. The consumption is quite stable without greater fluctuations[7] (2001 – 2014).

7.2. *Service Sector*

Regional final energy consumption of service sector	5248	GWh[8]

What are the main sub-sectors driving energy consumption in the in the service sector (building standard, number of businesses, …)? How important is service sector for the regional economy?

Service sector represents 53,2% of regional GDP (2013) followed by industry with 34,4% share.

The most significant branches within services sector is business, transport, tourism and then public administration, defense, education, health and social care.

Give an estimate of the trend in final energy consumption in the service sector using values from -5- to +5 where (-5 is a strong reduction, 0 means neither growth nor reduction, +5 strong growth).

-1 (2010 – 2015)[9]

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6 Czech Statistical Bureau, Households money expenditures by activity status of the head of household, 2015 https://vdb.czso.cz/vdbvo2/faces/en/index.jsf?page=vystup-objekt&pvo=ZUR06&z=T&f=TABULKA&katalog=30847&c=v3~8__RP2015

7 Report on environment in South Bohemia, 2014, CENIA, http://www1.cenia.cz/www/sites/default/files/Jihocesky.pdf

8 Calculated from total regional energy balance – on the basis of GDP per service sector.

9 Consumption of fuels and energy – 2013, Czech Statistical Bureau (https://www.czso.cz/csu/czso/spotreba-paliv-a-energie-2013-j4s3kzewuv)

7.3. *Industry*

Total energy consumption of the industrial sector	3921	GWh[10]
Industry electricity price	0,0720	EUR/kWh (incl. taxes)[11]
Industry natural gas price (2015) zdroj:	0,0310	EUR/kWh (incl. taxes)[12]
Industry district heating price	0,0626	EUR/kWh (incl. taxes)[13]
Industry price: other energy sources – specify:	-	EUR/kWh (incl. taxes)

What are the main sub-sectors driving energy consumption in the in the industrial sector? How important is industry for the regional economy?

Industry represents 34,4% of GDP in the South Bohemia (2013) and therefore it is the second most significant sector after services.[14]

7.4. *Transport*

Regional final energy consumption of transport sector	2276	GWh[15]

Describe the main characteristics of the transport sector: transport infrastructure, motorisation rate, availability of public transport and differences between urban and rural environments.

The region of South Bohemia belongs to the spatials with the lowest density compared to the national average. Rural areas affected by limitation or termination of economic activities are being depopulated or restored to new functions.

Highway D3 and related motor roads R3, R4 belongs among the most important infrastructural investments in the region. In order to provide good transport accessibility public transport is preferred before individual transport, integrated transport systems are developing. [16]

[10] Calculated from total regional energy balance – on the basis of GDP per industry sector.

[11] Source: http://oenergetice.cz/elektrina/trh-s-elektrinou/cr-ma-jednu-nejlevnejsich-cen-elektriny-domacnosti-i-prumysl-eu/

[12] Source: http://ec.europa.eu/transparency/regdoc/rep/1/2016/CS/COM-2016-769-F1-CS-MAIN.PDF

[13] Source: Price list - http://www.teplarna-cb.cz/files/teplarna-cb/uploads/files/ceniky/cenik-2017.pdf (if contracted 50 – 90.000 GJ/y)

[14] Source: Czech Statistical Bureau, 2013 (https://www.czso.cz/csu/xc/vyvoj_makroekonomiky_v_jihoceskem_kraji_v_letech_2010_az_2013)

[15] Source: Calculated from https://www.mdcr.cz/Statistiky/Souhrnne-ukazatele/Spotreba-energie-v-doprave/Spotreba-energie-v-doprave-(NACE-49-51-bez-49-5, (businesses above 20 employees) on the basis of regional GDP and national + household consumption https://www.czso.cz/documents/10180/50619982/ENERGO_2015.pdf/86331734-a917-438a-b3c2-43a5414083fc?version=1.4

[16] Source: http://invest.kraj-jihocesky.cz/cz/page/dopravni-dostupnost-jihoceskeho-kraje

Passenger transport

Motorisation rate - number of passenger cars/1 000 inhabitants [17]	346	
Regional energy consumption of passenger transport in the region [18]	1455	GWh

Freight transport

Regional energy consumption of road freight transport [19]	821	GWh

If the rail, or transport by pipeline is a significant way of the freight transport, please describe their main characteristics.

Freight transport within the region of South Bohemia reached 60.700 tons in 2015. Doubled since 2010.[20] Pipeline transport is marginal.

Use of alternative fuels

Describe the market development for alternative fuel vehicles (natural gas, biogas, electric cars). What supporting mechanisms for alternative fuel are available on national and regional level? Describe challenges and barriers, e.g. infrastructure, technological, supply, financial barriers, etc..

In 2015 there were 0,14% of cars on bioethanol and 1,27% on LPG/CNG/LNG in possesion of households in South Bohemia region.[21] Annual sales of electric cars represents 0,27% of all purchased vehicles.[22] There is supportive mechanism for CNG in form of zero excise duty. On the national level there are two major resolutions: 1) Programme for public administration fleet replacement for ecology friendly cards. [23] 2) Programme for support to alternative fuels in transport – natural gas.[24]

Czech Republic has its own National Action Plan for Clean Mobility and made number of measures for support to natural gas utilization inlcuding LNG. The update of is due 2018. Currently implementation of suggested measures from NAPCM and CNG support. There are several Operational programmes that includes different supportive schemes.

Give an estimate of the trend in final energy consumption in the transport sector using values from -5- to +5 where (-5 is a strong reduction, 0 means neither growth nor reduction, +5 strong growth).

17 Czech Statistical Bureau, https://www.czso.cz/documents/10180/50619982/ENERGO_2015.pdf/86331734-a917-438a-b3c2-43a5414083fc?version=1.4

18 Czech Statistical Bureau, https://www.czso.cz/documents/10180/50619982/ENERGO_2015.pdf/86331734-a917-438a-b3c2-43a5414083fc?version=1.4

19 Calculated from https://www.mdcr.cz/Statistiky/Souhrnne-ukazatele/Spotreba-energie-v-doprave/Spotreba-energie-v-doprave-(NACE-49-51-bez-49-5, (business above 20 employees) on the basis of regional population and the Czech Republic

20 *Source: https://www.mdcr.cz/Statistiky/Drazni-doprava/Srovnani-zakladnich-ukazatelu-mezi-regiony-CR/Preprava-veci-po-zeleznici-v-ramci-regionu-Jihoc.*

21 Source: https://www.czso.cz/documents/10180/50619982/ENERGO_2015.pdf/86331734-a917-438a-b3c2-43a5414083fc?version=1.4

22 Source: http://www.ceskenoviny.cz/zpravy/pocet-registraci-elektromobilu-v-cesku-loni-klesl-na-271-aut/1462401

23 Source: http://www.mvcr.cz/soubor/vestnik-vlady-pro-kraje-o-obce-2-2009.aspx

24 Source: http://www.ngva.cz/files/ngva/uploads/files/Usneseni%CC%81%20z%20r.%202005.pdf

-1, between 2010 – 2015[25]

Other relevant sectors (delete if not relevant)

Regional final energy consumption of other sectors	1422	GWh

Please give a summary of large energy-consumers, which were not covered in the chapters above.

Above stated figure includes: Construction with 825 GWh Agriculture, forestry and fishing with 596 GWh

[25] Source: https://www.mdcr.cz/Statistiky/Souhrnne-ukazatele/Spotreba-energie-v-doprave/Spotreba-energie-v-doprave-(NACE-49-51-bez-49-5

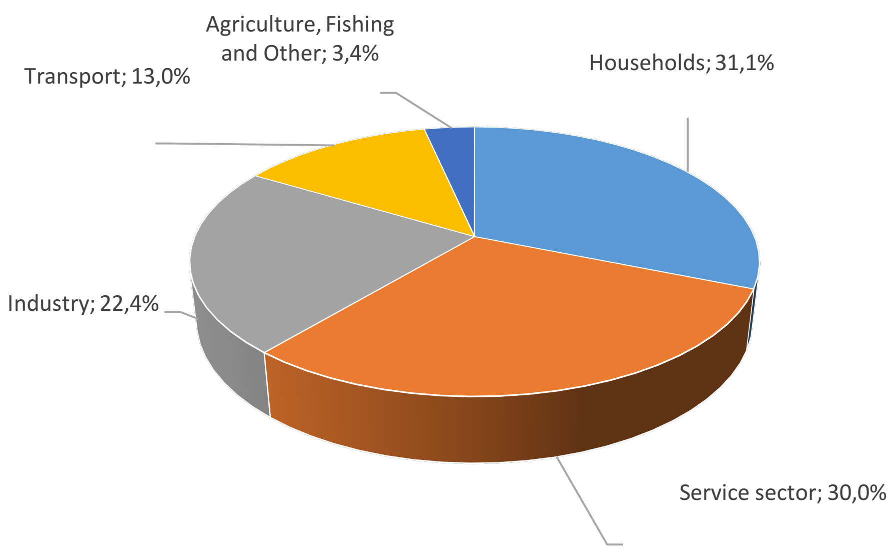
7.4.1. *Final energy indicators*

General indicators for the region

Total final energy consumption	17480,00	GWh
Final energy consumption per capita	27364,58	kWh/cap
Electricity consumption per capita	3481,15	kWh/cap
Heat consumption per capita	18375,08	kWh/cap
% of total country consumption	1,92	%

Final energy consumption per sector

Year: 2015			%
Households	5439	GWh	31,1%
Service sector	5248	GWh	30,0%
Industry	3921	GWh	22,4%
Transport	2276	GWh	13,0%
Agriculture, Fishing and Other	596	GWh	3,4%
Sum	17480	**GWh**	**100,0%**



Give an estimate of the trend in final energy consumption using values from -5- to +5 (where -5 is a strong reduction, 0 means neither growth nor reduction, +5 strong growth).

-1

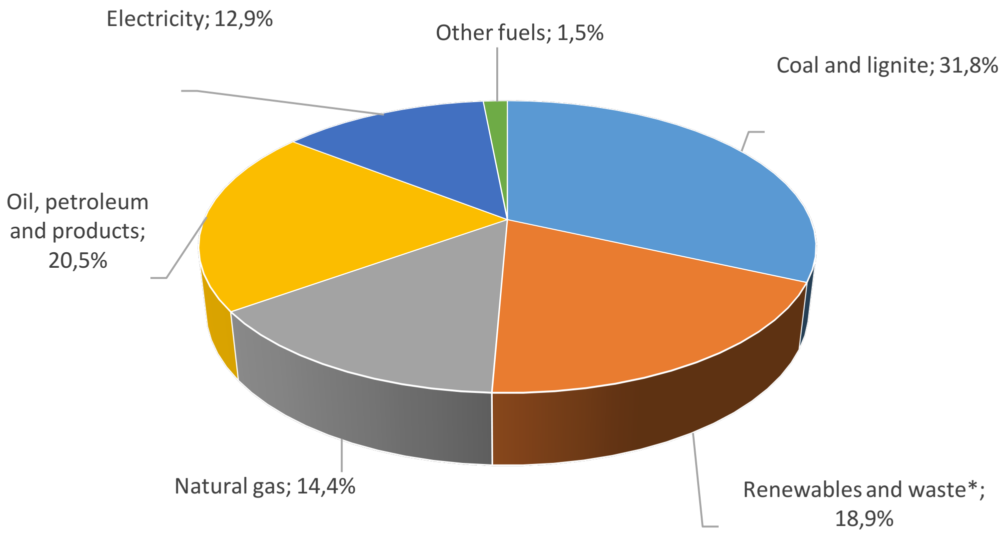
7.4.2. Final energy consumption by fuel

Use the Excel tool to fill the following tables and generate graphs.
If regional data is available, use this information and quote your sources.

Total final energy consumption by fuel

Year: 2015			%
Coal and lignite	5551	GWh	31,8%
Renewables and waste*	3305	GWh	18,9%
Natural gas	2522	GWh	14,4%
Oil, petroleum and products	3578	GWh	20,5%
Electricity	2261	GWh	12,9%
Other fuels	263	GWh	1,5%
Sum	17480	**GWh**	**100,0%**

*Hydro, wind, solar, tide/wave, biomass and waste, geothermal

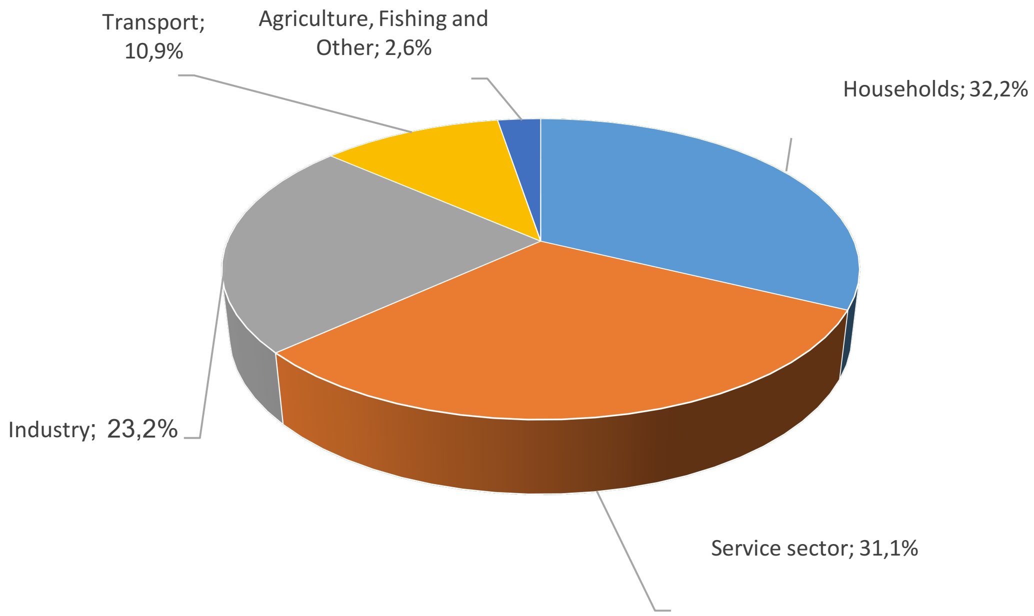


7.4.3. Primary energy equivalent

Total Primary Energy Consumption	22881,076	GWh
Primary energy consumption per capita	35819,8509	kWh/cap
Primary energy factor of electricity	2,5	-
Energy intensity	0,002820187	TPES/GDP

Primary energy equivalent by sector

Year: 2015			%
Households	7365	GWh	32,2%
Service sector	7106	GWh	31,1%
Industry	5310	GWh	23,2%
Transport	2504	GWh	10,9%
Agriculture, Fishing and Other	596	GWh	2,6%
Sum	**22881,08**	**GWh**	**100,0%**



What is the level of primary energy supply dependencies: Which fuels need to be imported form the rest of the country and internationally.

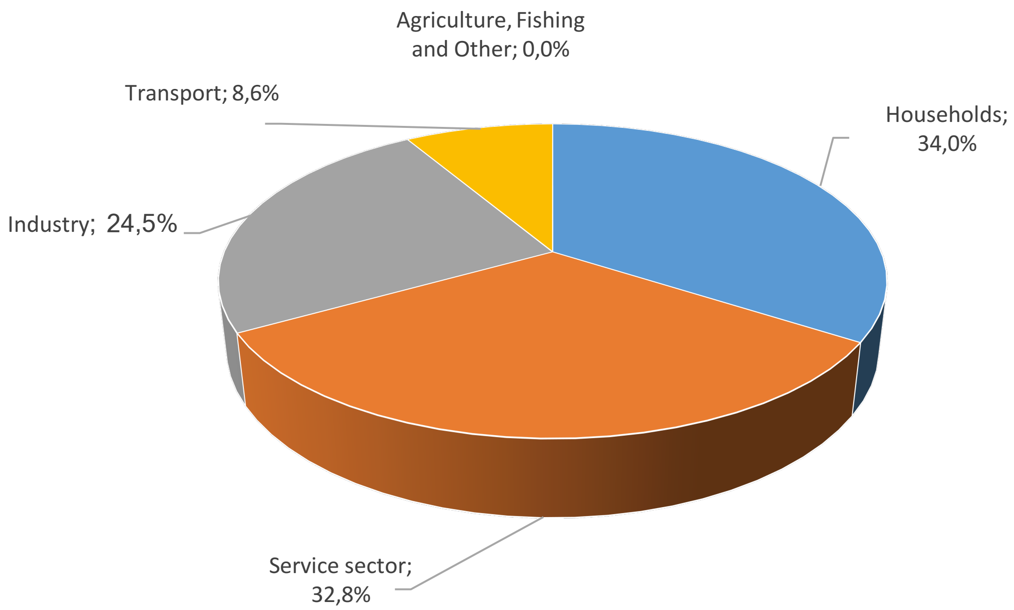
Dependency on fuel imports: very high / high / average / low / very low average

7.4.4. Regional CO_2-emissions associated with energy consumption

Total CO_2-emission associated with energy sector	0,01	Mio t
CO_2-emissions per capita	0,010744782	t/cap
CO_2-emissions per GDP	0,000845964	t/€ GDP

Energy-related CO_2-emissions by sector

Year: 2015			**%**
Households	2337	t CO_2	34%
Service sector	2255	t CO2	32,8%
Industry	1685	t CO2	24,5%
Transport	587	t CO2	8,6%
Agriculture, Fishing and Other	0	t CO2	0%
Sum	**6864**	**t CO2**	**100,0%**



8. Renewable energy sources – status and potential

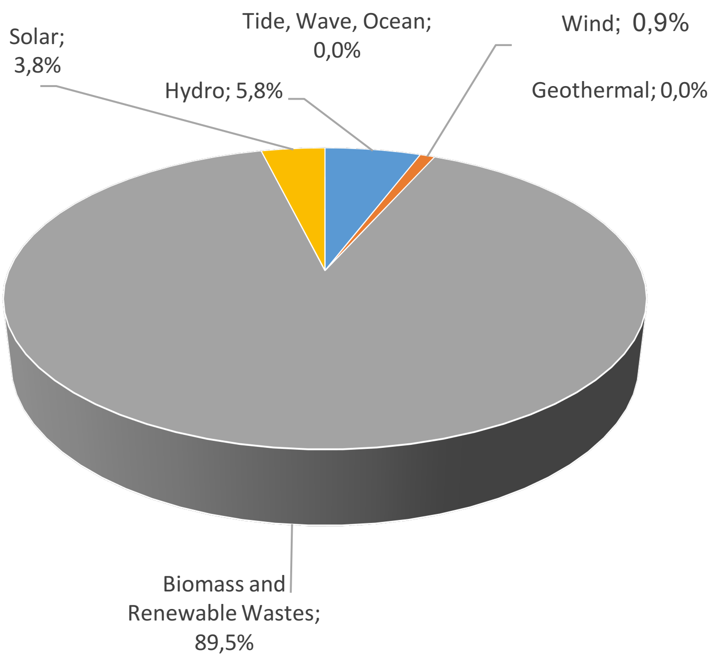
8.1. *General information*

Use the Excel tool to fill the following tables and generate graphs.
If regional data is available, use this information and quote your sources.

Renewable Energy Targets:		
2020 RES share in gross final energy consumption	15,3	%
2030 RES share in gross final energy consumption	n.a.	%
Current RES share (2015)	13,27	%
thereof RES out of the region	7,61[26]	%

Share of final energy consumption produced by renewable fuels

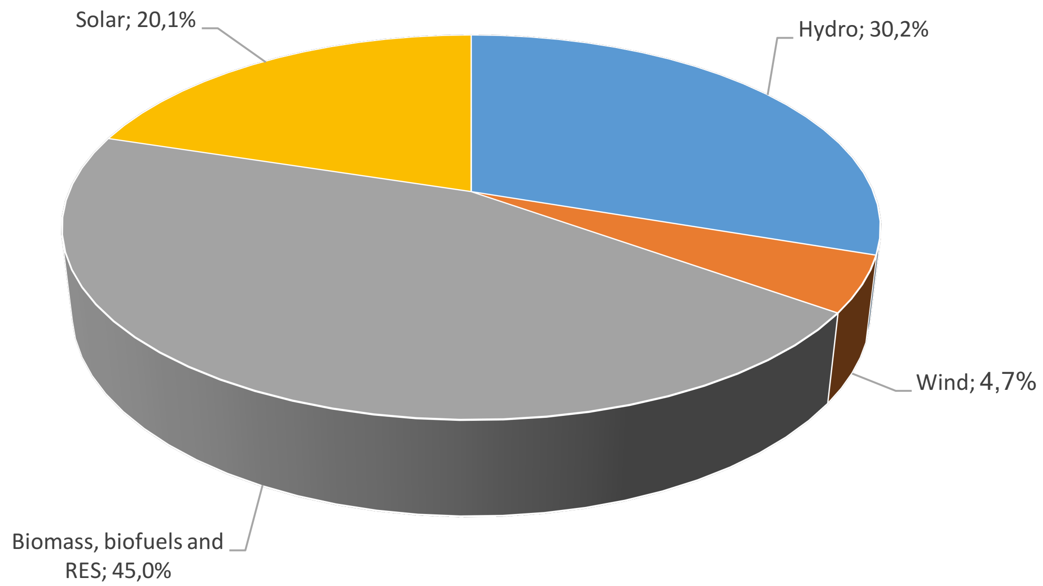
Year: 2015			**%**
Hydro	190	GWh	5,8%
Wind	30	GWh	0,9%
Biomass, biofuels and renewable wastes	2958	GWh	89,5%
Solar	127	GWh	3,8%
Geothermal	0	GWh	0,0%
Tide, Wave, Ocean	0	GWh	0,0%
Sum	3305	**GWh**	**100,0%**



[26] Source: Annual report on energy systems in the Czech Republic, Energy Regulatory Bureau, 2015

Share of total electric demand covered by renewable fuels

Year: 2015			%
Hydro	104	GWh	30,2%
Wind	16	GWh	4,7%
Biomass, biofuels and renewable wastes	154	GWh	45,0%
Solar	69	GWh	20,1%
Geothermal	0	GWh	0,0%
Tide, Wave, Ocean	0	GWh	0,0%
Sum	343	**GWh**	**100,0%**



Describe if and how renewable energy sources are integrated in the transport sector, e.g. biofuels, electric vehicles.

According to the Ministry of trade's statistics renewables used in fuels represents 6,45% in form of bioethanol and biological components of diesel. According to the Association of e-mobillity industry there were 2400 e-vehicles in the Czech Republic in 2016 (out of 5 110 450 all registered vehicles).

Describe the status of REN production in the region. % of total energy and electricity demand covered by REN. If available give a historic overview of the REN production capacities for the last 5 to 10 years.

RES cover roughly 18,9% of total consumption of energy and fuels and 15% of electricity consumption in the region. Within total sum of consumption biomass plays the key role (firewood). Within electricity production hydropower plants are historically the most applied source and for the last 7 years production of photovoltaic plants has increased rapidly which is related to the massive subsidies back in that period.

Describe if there are incentive programmes/schemes (financial and non-financial) in place to support REN-development. Are these programmes on national, regional or local level?

There are no major national or regional subsidy schemes running for RES development. Only few marginal measures supporting follow-up technologies (e.g. biogas heat utilization).

Describe the top 5 regulatory barriers slowing down current and future REN-development. Should these barriers be addressed at national, regional or local level?

Used up potential of hydropower

Low feed in tariffs for RES.

Low fossil fuel costs, enduring support to the mining industry (jobs)

Unpreparedness of distribution system.

Public distrust to RES thanks to recent political development.

Give an estimate of the trend in renewable energy production using values from -5- to +5 (where -5 is a strong reduction, 0 means neither growth nor reduction, +5 strong growth). Describe supporting factor as well as barriers.

0

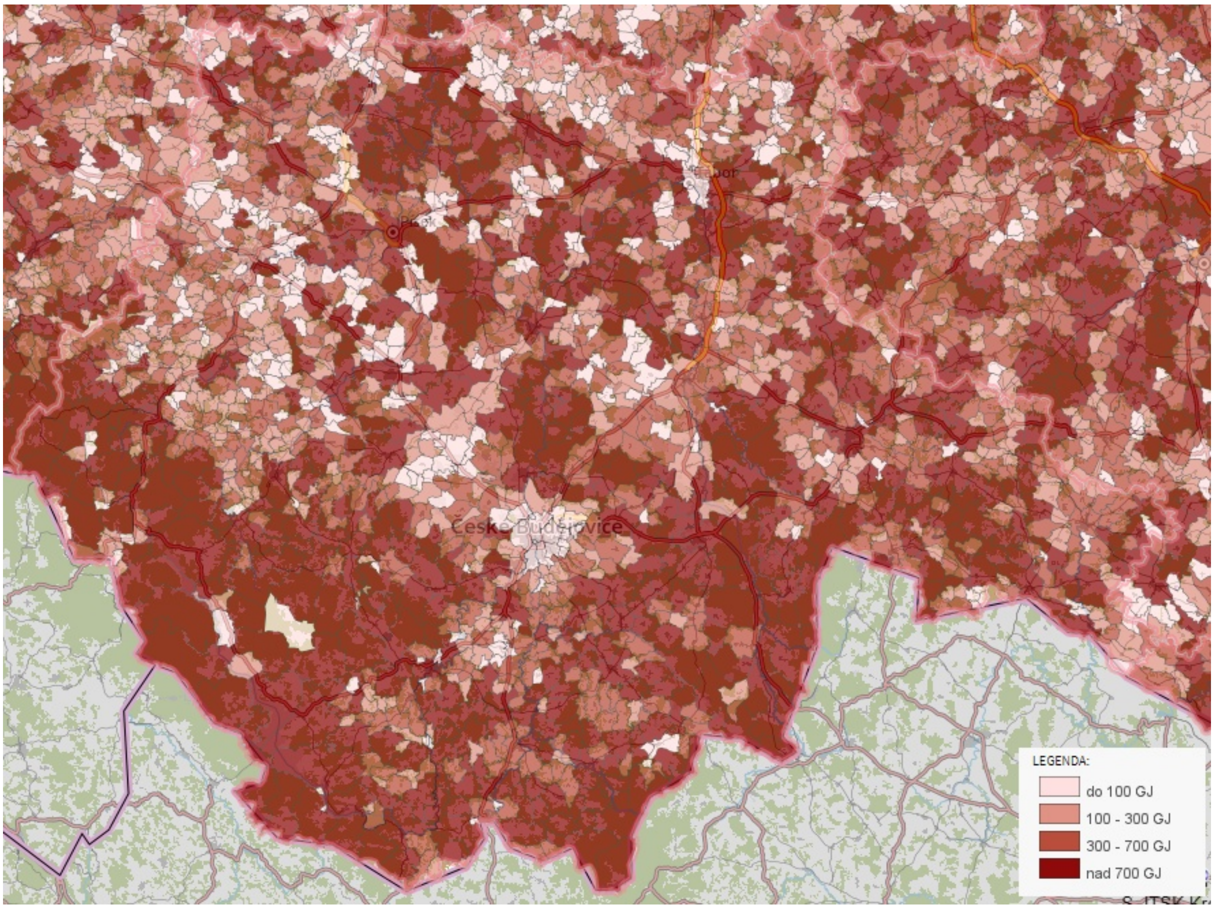
8.2. *Available natural resources in the region*

8.2.1. Biomass

How are forest areas used? For what purpose? What is the regional energy potential using existing forest areas? Please state whether it is a theoretical or technical potential and describe regulatory support systems as well as barriers.

South Bohemia region has 378.000 ha of forest land, the most among the regions in the Czech Republic. 14% of all forests are located here. Logging in 2013 reached around 2 mil. m^3 (firewood and construction). Conifers are predominant with 86% share. Acreage of fast growing trees reaches 117 ha. There is a 0,1% annual increase of forest land in the region. From the beginning of millenium forest lands extended for more than 4.5000 ha.[27] This more or less defines the current potential. Subsidy scheme for afforestation is running.[28] Maximum amount of accessible residues left from logging reaches annualy 142.000 t.[29] Main barriers consist in loss of other areas (meadows, fertile grounds), predisposition of mono cultures for calamities. Lack of rainfalls belongs among the future threads causing dryness of spruce cultures.

Image 8 Annual calorific value potential of forest biomass waste



What are main agricultural products at the moment? What is the regional energy potential from agricultural products? Please state whether it is a theoretical or technical potential and describe regulatory support systems as well as barriers.

Main representation: winter wheat 34%, winter rape 16%, spring barley 12%, maize for silage 8%. Number of biogas plants in the region: 64 with installed output of 33 MWel., 32 MW heat. Number of biomass combustion plants: 23, installed output of 39 MWel, 260 MW heat.[30]

27 Source: Czech Statistical Bureau, 2013 https://www.czso.cz/csu/xc/les_jhc_2013

28 http://eagri.cz/public/web/mze/lesy/lesnictvi/dotace-a-programy/dotace-na-zalesnovani-zemedelske-pudy.html

29 Application RESTEP – www.restep.eu

30 Application RESTEP – www.restep.eu

8.2.2. Hydro power (incl. tide and wave power)

Give an overview of hydro power sources used at the moment and describe the energy potential for the different technologies: run-of-river hydropower plants, reservoir hydropower plants, use of tide and wave power, if applicable. Differentiate between small and large hydro power. Describe the energy potential based on geographical and political frameworks.

Number of hydropower plants: 314, installed output 19,4 MW. Theoretical potential of hydropower can't be calculated precisely, in general it is all used up in the Czech Republic with respect to flowability and preservation of minimal flow.

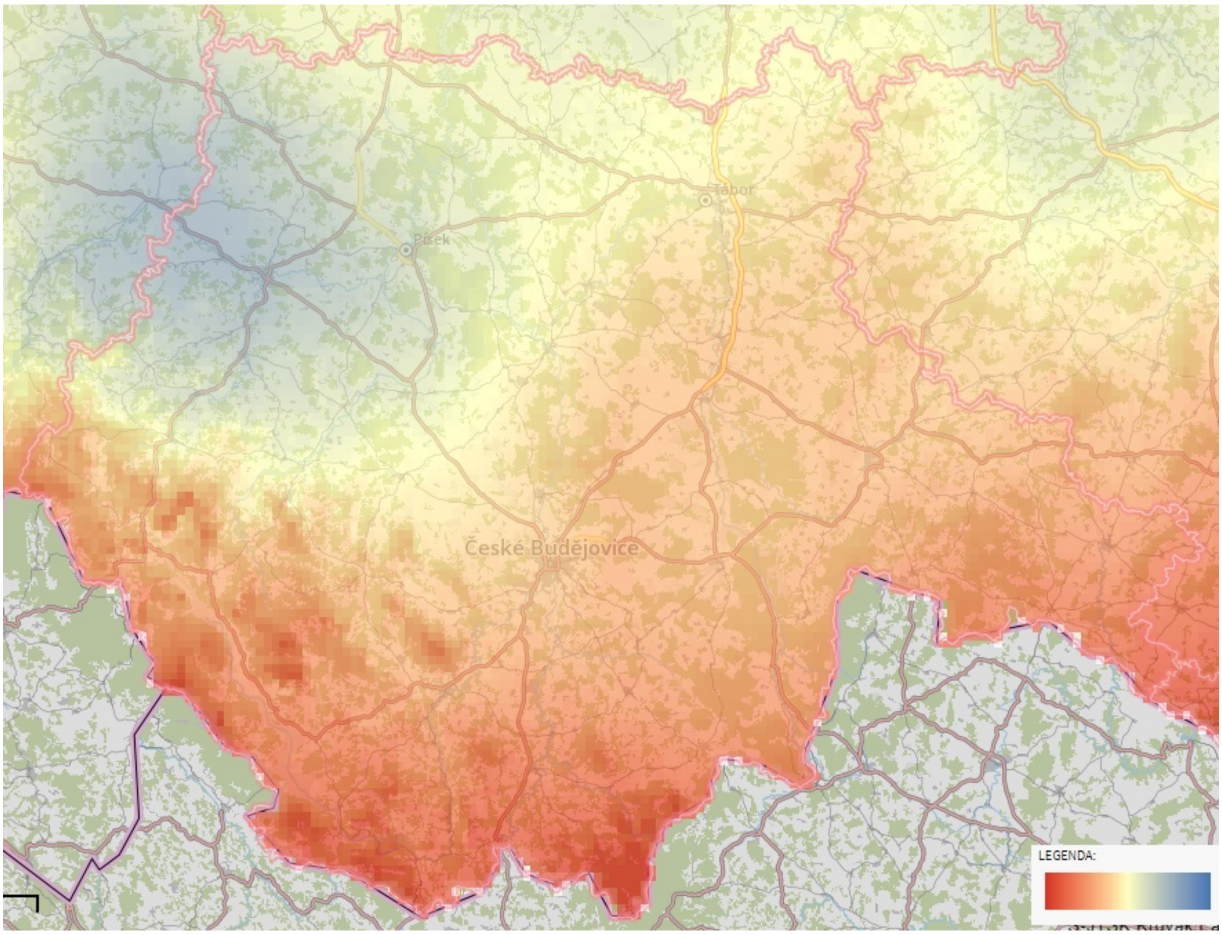
8.2.3. Solar power

Solar irradiation (on optimally inclined plane) per year	from 1000 to 1100	kWh/m²

Give an overview of both solar thermal and PV usage hydro power sources at the moment and describe the energy potential based on geographical and political frameworks.

Number of PV plants: 2328, installed output of 156 MW.
Ultimate space for collectors (usable buildings' roofs only): 20 345 913 m^2

Image 9 Solar irradiation of the the region



8.2.4. Wind power

Average wind velocity	From 2,5 to 8,5	m/s
Full load hours	n.a.	h/a

Give an overview of wind power use at the moment and describe the energy potential based on geographical and political frameworks. Differentiate between offshore and onshore potential

Use regional/national studies but if not available, you can refer to the EEA study for approximation of wind speed or full load hours: http://www.eea.europa.eu/publications/europes-onshore-and-offshore-wind-energy-potential/at_download/file
Number of wind power plant: 3 with installed output 0,002 MW
Number of potential installations according to UFA: 982

Image 10 Speed of wind in 100 m altitude

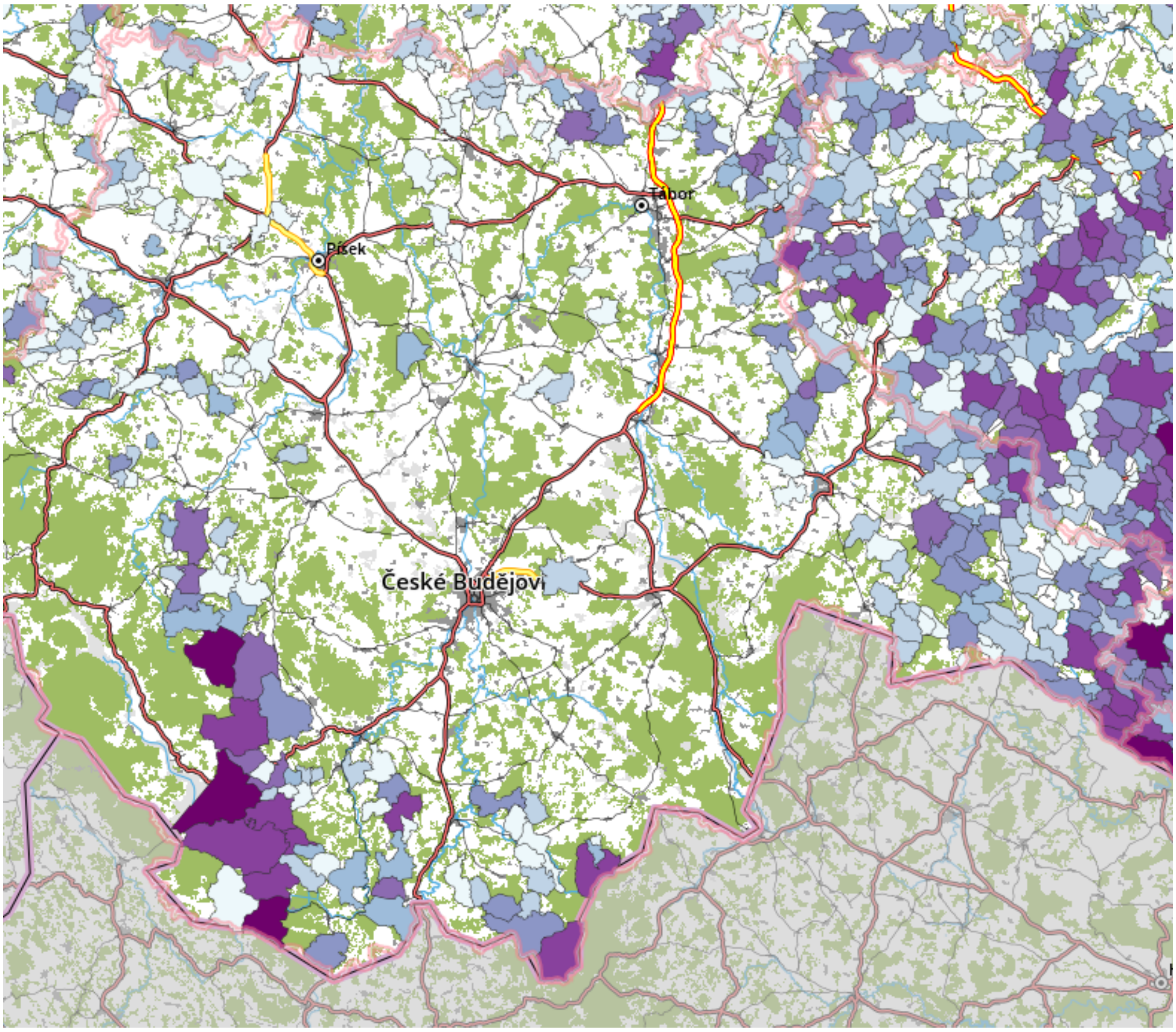
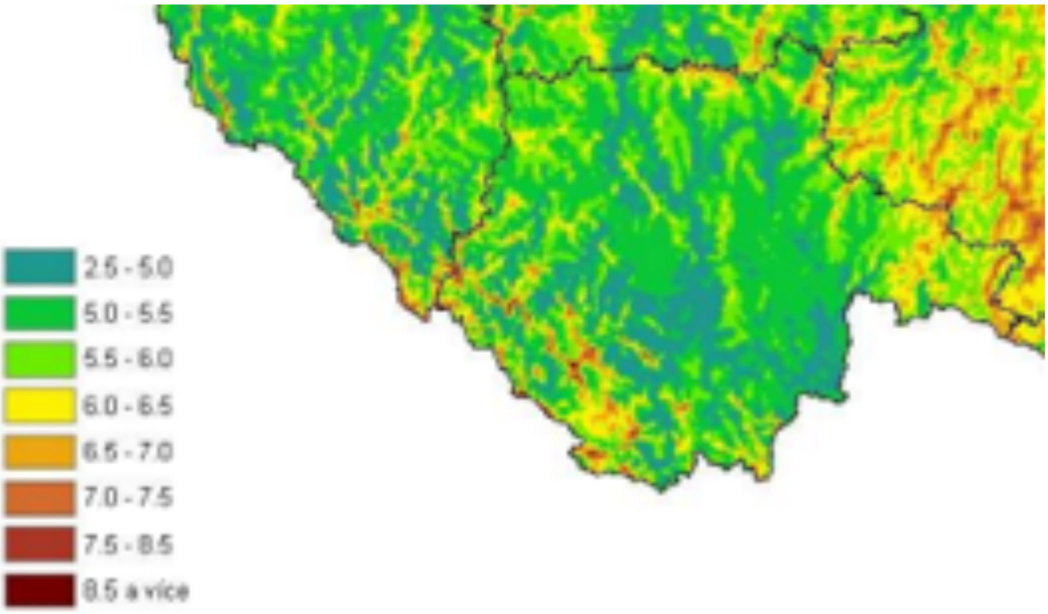


Image 11 Potential of wind energy



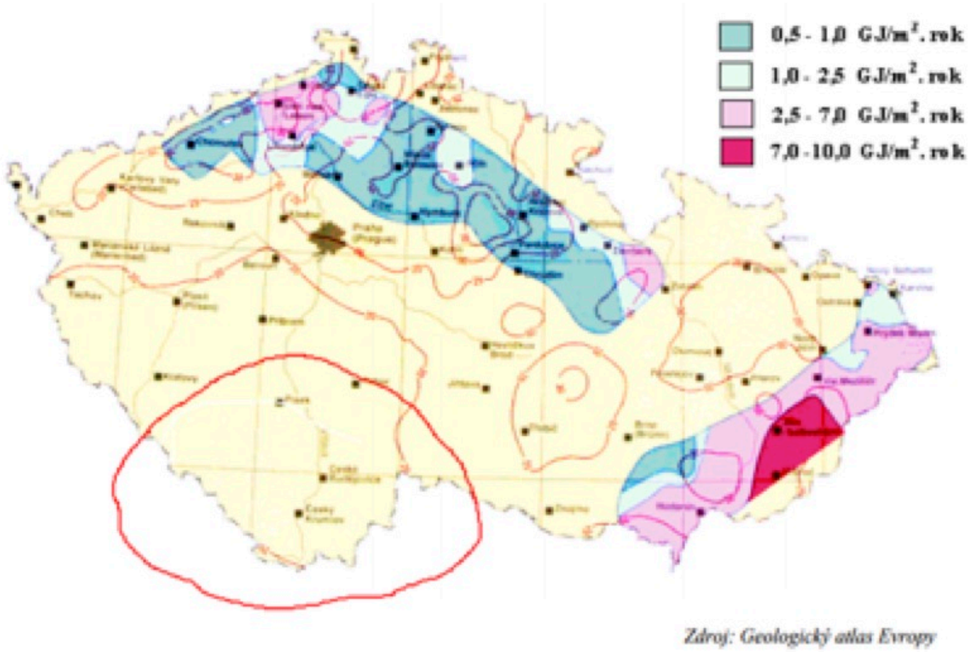
8.2.5. Geothermal energy

Give an overview of use of geothermal energy at the moment and describe the energy potential based on geographical and political frameworks.

You can use e.g. this study as staring point: A prospective study on the geothermal potential in the EU http://www.geoelec.eu/wp-content/uploads/2011/09/D-2.5-GEOELEC-prospective-study.pdf

In South Bohemia geothermal sources don't have such potential for efficient utilization – see map below.

Image 12 Potential of geothermal energy – temperature isolines -500 m



8.2.6. Waste

Describes overlaps between waste management and energy sector. Is municipal solid waste used for energy production? How is the energy from waste incineration plants used, e.g. electricity generation, district heating (cogeneration)?

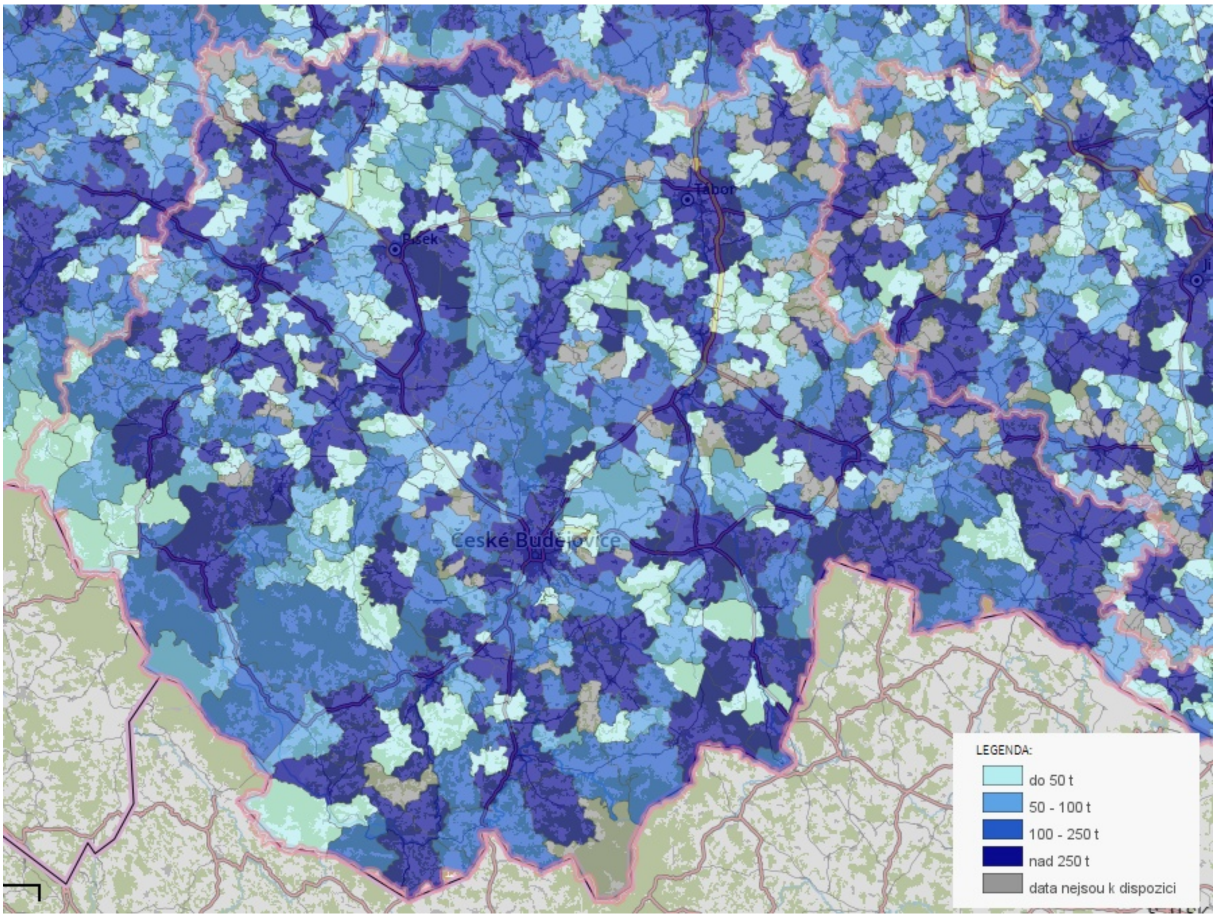
Number of waste water treatment plant: 306, theoretical potential of gas production at WWTP (m^3/year): 10 178 782
Number of municipal landfills: 22, amount of the waste 125 000 t/rok; installed output: 1 325 kW el. energie, 1 551 kW heat

Production of biodegradable waste: 378 956 t/year

Production of burnable waste: 215 279 t/year

Number of composting plants: 17, capacity 210 000 t/year

Image 13 Production of biodegradable municipal waste per basic territorial unit



8.2.7. Other natural resources

Provide information about any other natural/renewable resources usable for energy production.

n.a.

8.2.8. Restriction through protected areas

Are there environmentally protected areas, which are not available for REN facilities or restrict the overall potential?

In the region of South Bohemia there are 4 large specially protected areas. Whole two of them are located inside the region, two of them are shared with Pilsen region. Those are as follows:

Southeast part of national park Šumava - 33 620 ha; in total 68 064 ha),

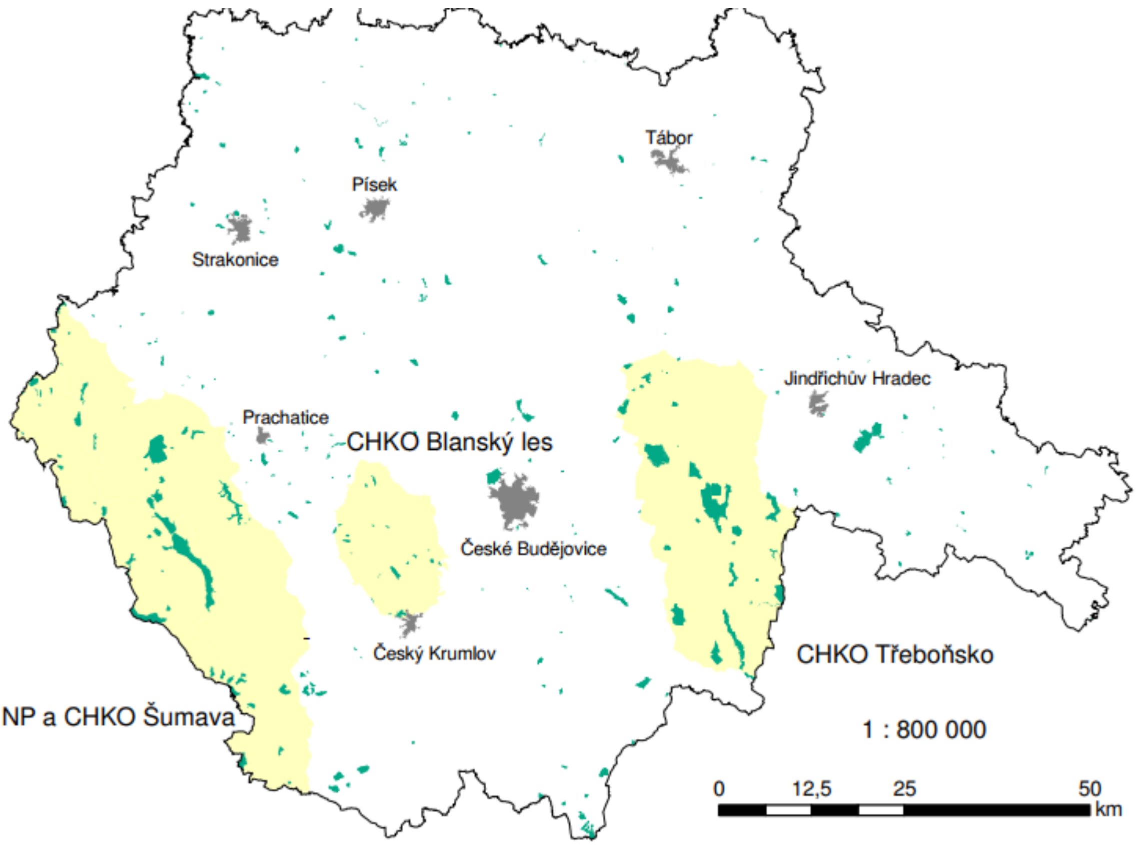
Southeast part of protected area of Šumava - 73 358 ha; in total 99 398 ha),

Protected area Třeboňsko - 70 000 ha

Protected area Blanský les - 21 235 ha

In total there are 302 smaller specially protected areas in the region.

Image 14 Map of protected areas in the South Bohemia



9. Energy efficiency – status and potential

What is the status of the implementation of the Energy Efficiency Directive?

Strategy of the Czech Republic for increasing energy efficiency is described in National Action Plan for Energy Efficiency (NAPEE). National goal got first notification by EC in April 2014 and it was set to 47,84 PJ (= 13,29 TWh = 1 142,64 ktoe) of total new savings towards final energy consumption by 2020.

The Directive on energy efficiency is very wide focused therefore the transition into Czech legislative took place within three Acts novelisations (458/2000 coll., 406/2000 coll., 165/2012 coll.).

By the end of 2015 all political measures fulfilling national commitment have been launched.[31]

What is the status of the implementation of the Energy Performance of Buildings Directive (e.g. data on low/zero energy buildings)?

In 2015 plan for refurbishment of public owned buildings have been passed. For the household sector strategy for refurbishment of buildings was created in 2014. This document analyzed potential of energy savings in the buildings in the Czech Republic focusing on so called usually inhabited houses.

Analysis concluded potential energy savings as follows:[32]

- energy savings for heating at residential buildings 77 PJ if using medium energy efficient renovation (45% former consumption) and 140 PJ if profound renovation is applied (81% of former consumption)

- energy saving for hot water heating is 12 PJ, which means ca 30% actual consumption

- energy saving for lightning is 3,4 PJ, which means ca 60% actual consumption

Main initiatives now focusing on following measures:

Economic:

- New national subsidy schemes for energy savings measures on the buildings (Zelená úsporám)

- Operational programmes 2014 - 2020

- Energy Performance Contracting

Legal and administrative:

- Requirements on minimal energy standards for renovations and newly built buildings

- Reduction of administrative load for applicants and donors

31 Source: https://www.mpo.cz/assets/dokumenty/55299/63434/653016/priloha001.pdf

32 Source: zdroj: https://www.mpo.cz/assets/dokumenty/55299/63434/653016/priloha001.pdf

Households: Are energy efficiency measures implemented in this sector? Are there awareness campaigns to highlight the potential? Is there support for the implementation (financial and non-financial)?

Longterm scheme Zelená úsporám ("Green light to savings") had been running for three calls in 2009 – 2012 / 2013 / 2013 – 2020 with over than 21 thousands applications and almost 5 billions of CZK. In household sector the biggest interest is in insulation followed up by heat source replacement and solar systems installations.

Other subsidy schemes:

1.1 Programme PANEL / NOVÝ PANEL (Ministry for Spatial Development) – insulation of prefabricated block of flats

1.4 Nová Zelená úsporám 2014 – 2020 (Ministry of Environment)

1.5 Programme JESSICA (Ministry for Spatial Development)

1.6 Integrational Regional Operational Programme (Ministry for Spatial Development)

1.7 Joint programme for boilers replacement (Ministry of Environment)

1.9 Operational programme Environment 2014 – 2020 (Ministry of Environment) (priority axe 2.)

Service sector: Are energy efficiency measures implemented in this sector? Are there awareness campaigns to highlight the potential? Is there support for the implementation (financial and non-financial)?

For the service sector there are following possibilities for subsidies:

1.9 Operational programme Environment 2014 – 2020 (Ministry of Environment)

1.10 National programme EFEKT for RES and energy savings – investments (Ministry of Trade)

1.11 OP Prague Growth Pole – buildings (city of Prague)

1.13 OP Entreprise and Innovations for Competitiveness (Ministry of Trade)

No specific campaigns to highlight the potential, only those related to above mentioned subsidy schemes.

Industry: Are energy efficiency measures implemented in this sector? Are there awareness campaigns to highlight the potential? Is there support for the implementation (financial and non-financial)?

There is one specialized programme financed by structural funds:

1.13 OP Entreprise and Innovations for Competitiveness (Ministry of Trade)

No specific campaigns to highlight the potential, only those related to above mentioned subsidy schemes.

Transportation: Are energy efficiency measures implemented in this sector? Are there awareness campaigns to highlight the potential? Is there support for the implementation (financial and non-financial)?

The most appropriate way of energy savings measures implementation seems to be the application of voluntary agreement on reducing the energy intensity of transport between Ministry of trade, other state authorities involved in the sector, private operators and fuel distributors along with

Operational programme Transport involvement. Energy savings in transport sector is being covered indirectly by mentioned OP Entreprise and Innovations for Competitiveness by supporting technologies with higher efficiency. This could be also achieved by measures aimed at better linkage of individual kinds of transport. Combined transport in freight transport (with rail transport) and preference of public transportation in areas with more intensive transport flows.[33]

Give an estimate of the trend in energy efficiency development using values from -5- to +5 where (-5 is a strong reduction, 0 means neither growth nor reduction, +5 strong growth).

-2

Demand side management, smart metering, storage

Still in the phase of considerations, no concrete measures or plans yet although it has been integrated into research agendas – e.g. programme DELTA by Technology Agency of the Czech Republic (objective 1.4.2).

33 Source: https://www.mpo.cz/assets/dokumenty/50711/63238/651838/priloha004.pdf

10. SWOT analysis

Please make a SWOT analysis for the development of your region towards a low-carbon economy in 2050. Include stakeholders in the process.

Strengths

- High production of biomass in agricultural sector and forestry
- Natural character of the region – low share of industry
- Temelín nuclear power plant
- High share of water streams and reservoirs
- Healthy environment

Weaknesses

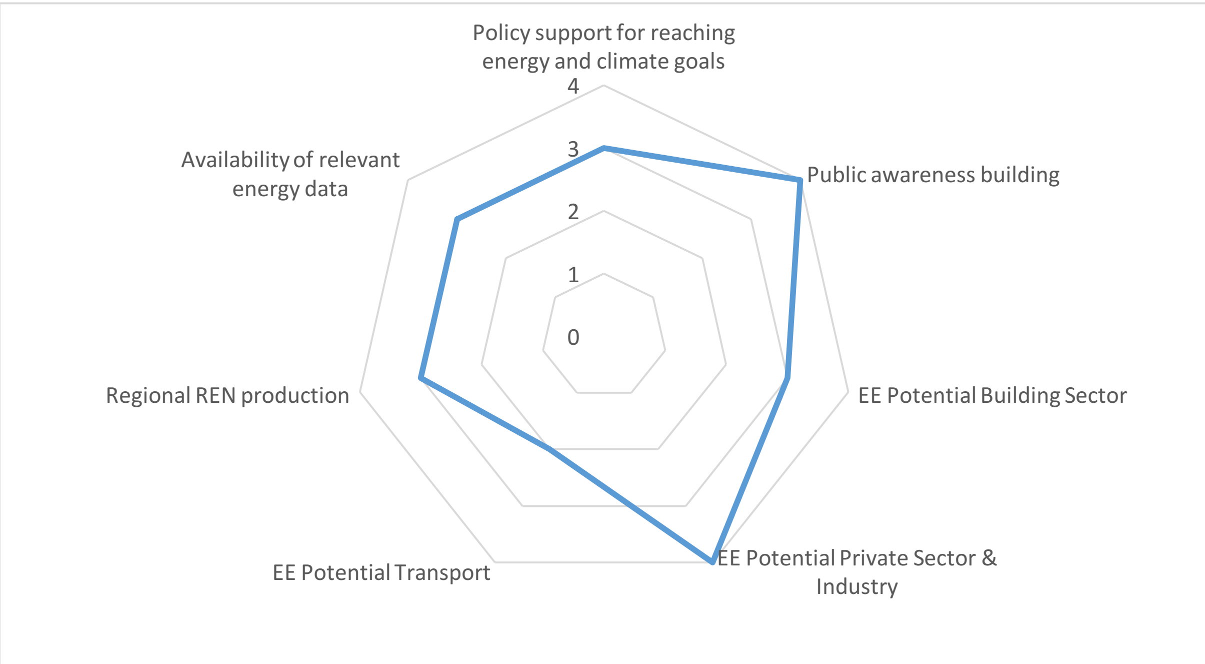
- Used up potential for hydropower
- High share of land-fill waste deposition
- None geothermal potential

Opportunities

- Potential for wind power and waste utilization
- High share of rural areas
- Mountain are of Šumavy
- Recreational potential

Threats

- Continous degradation of agricultural soil
- Climate changes – rainfall reduction, temperate increase



11. Annex: List of sources /bibliography /List of relevant stakeholders/institutions in the region

1. Czech Statistical Bureau, Employed by sectors 2005 – 2016
2. Czech Statistical Bureau, Domestic fuel and heat consumption, 23.2 2017
3. Czech Statistical Bureau, Households money expenditures by activity status of the head of household, 2015
4. Report on environment in South Bohemia, 2014, CENIA
5. Consumption of fuels and energy – 2013, Czech Statistical Bureau
6. Oenergetice.cz, article: Czech Republic has one of the lowest electricity prices for households and industry within EU, 8.1. 2017
7. Report for EU Parliament and EU Council on electricity prices and costs for energy in Europe, SWD (2016) 420 final
8. Price list of heat plant České Budějovice
9. Czech Statistical Bureau, Macroeconomy development in South Bohemia 2010 – 2013
10. Accessibility of the South Bohemia region, portal for investors, South Bohemian Authority
11. Czech Statistical Bureau, Consumption of fuel and energy by households, 2017
12. Comparsion of basic indicators on regional level, Freight transport in the region of South Bohemia, 2016, Ministry of Transport
13. Article on ceskenoviny.cz: “Number of e-mobiles dropped to 271 last year”, 17.3. 2017
14. Governmental journal for municipalities, 2009
15. Consumption of energy in transport sector, Ministry of Transport, 2016
16. Czech Statistical Bureau, Area of forestry land in South Bohemia, 2013
17. Ministry of Agricultural, Subsidy for afforestation
18. Application RESTEP – www.restep.eu
19. Report on progress of fulfillment of national goals in energy efficiency, Ministry of trade, 2015
20. National Action Plan for Energy Efficiency, Czech Republic, 2016
21. Annual report on energy systems in the Czech Republic, Energy Regulatory Bureau, 2015

REGIONAL ENERGY PROFILE

Region: Estonia

PANEL 2050 – Partnership for New Energy Leadership 2050
Deliverable 3.1

By: Estonian University of Life Sciences

Date: 27.06.2017

Table of Content

1. Methodology

The PANEL 2050 project has the aim to create durable and replicable sustainable energy networks at local (municipality/community) level, where relevant local stakeholders collaborate for the creation of a local energy visions, strategies and action plans. The aim of these networks is to contribute to and actively work for the transition towards low carbon communities in 2050.

The PANEL 2050 partnership will provide support for the creation of first successful local energy networks in the CEE countries. In the course of the project, organisations from 10 CEE countries will collaborate on creating regional energy strategies and action plans.

The present Regional Energy Profile was prepared in order to get a better understanding of the energy-related status quo in the region of Estonia, analysing strengths and challenges with regard to the transition towards a low carbon community.
This energy profile constitutes the groundwork for the preparation of a Regional Energy Roadmap and related Action Plans and will be essential for the communication with regional stakeholders.

For completing this Regional Energy Profile the following main sources were used:

a) Estonian Statistics Bureau, www.stat.ee
b) Energiatalgud.ee, website for energy statistics and future scenarios: https://energiatalgud.ee/
c) Energy Yearbook of Estonia 2015: http://www.taastuvenergeetika.ee/taastuvenergia-aastaraamat-2015/
d) Energy Yearbook of Estonia 2016: http://www.taastuvenergeetika.ee/taastuvenergia-aastaraamat-2016/

2. General introduction of the region

Name of the region and NUTS identification: **Estonia EE00**

Geography and policy:

Describe the location of the region + provide also a political map showing location of the region in your country

Estonia is located in Northern Europe and is one of three Baltic States which regained their independence in the beginning of 1990s. It is bordered to the north by the Gulf of Finland, to the west by the Baltic Sea, to the south by Latvia, and to the east by the Lake Peipsi and the Russian Federation. The territory of Estonia covers 45,227 km2. The Estonians are a Finnic people, and the sole official language, Estonian, is closely related to Finnish.

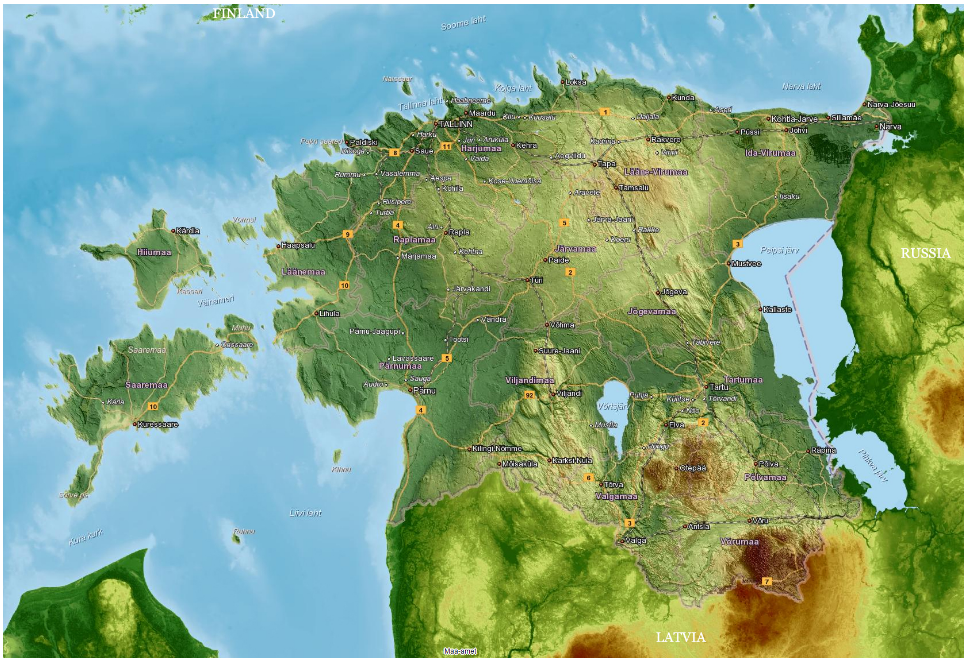


Figure 1. Map of Estonia. (Estonian Land Board, 2017)

Estonia is a democratic parliamentary republic and is divided into 15 counties. The capital and largest city is Tallinn. With a population of 1.34 million, Estonia is one of the least-populous members of the European Union, Eurozone and NATO. Today, Estonia has the highest GDP per person of any country that used to be part of the Soviet Union. Estonia is listed as a High-Income Economy by the World Bank and a High-income OECD member. The United Nations lists Estonia as a developed country with a Human Development Index of "Very High". The country is also ranked highly for press freedom, economic freedom, democracy and political freedom and education.

Geography of the region, including morphology, geology, climate, hydrology, flora and fauna related to energy (text description)

Estonia lies in the northern part of the temperate climate zone and in the transition zone between maritime and continental climate. Because Estonia (and all of Northern Europe) is continuously warmed by maritime air influenced by the heat content of the northern Atlantic Ocean, it has a milder climate despite its northern latitude. The Baltic Sea causes differences between the climate of coastal and inland areas. Estonia has four seasons of near-equal length. Average temperatures range from 16.3 °C (61.3 °F) on the Baltic islands to 18.1 °C (64.6 °F) inland in July, the warmest month, and from −3.5 °C (26 °F) on the Baltic islands to −7.6 °C (18 °F) inland in February, the coldest month. The average annual temperature in Estonia is 5.2 °C (41.4 °F). Estonia is

located in a humid zone in which the amount of precipitation is greater than total evaporation. The average precipitation in 1961–1990 ranged from 535 to 727 millimeters (21.1 to 28.6 in) per year and was heaviest in late summer. There were between 102 and 127 rainy days a year, and average precipitation was most plentiful on the western slopes of the Sakala and Haanja Uplands. (EMHI, 2005)
Snow cover, which is deepest in the south-eastern part of Estonia, usually lasts from mid-December to late March. Estonia has over 1,400 lakes. Most are very small, with the largest, Lake Peipus, (Peipsi in Estonian) being 3,555 km2 (1,373 sq mi). There are many rivers in the country. The longest of them are Võhandu (162 km/101 mi), Pärnu (144 km/89 mi), and Põltsamaa (135 km/84 mi). Estonia has numerous fens and bogs.
Phytogeographically, Estonia is shared between the Central European and Eastern European provinces of the Circumboreal Region within the Boreal Kingdom. According to the WWF, the territory of Estonia belongs to the ecoregion of Sarmatic mixed forests.
Average elevation reaches only 50 meters (164 ft) and the country's highest point is the Suur Munamägi in the southeast at 318 meters (1,043 ft). There is 3,794 kilometers (2,357 mi) of coastline marked by numerous bays, straits, and inlets. The number of islands and islets is estimated at some 1,500. Two of them are large enough to constitute separate counties: Saaremaa and Hiiumaa.

Brief history overview of the region – state the most important milestones related to the industrial / regional development (e.g. significant energy projects, powerplants, etc.), ideally related to energy

Until the early **13th century**, the territory that is now known as Estonia was independent. The economy was largely an agricultural one, but Estonia being a country with a long coastline, there were also many maritime activities. Autonomous development was brought to an end by the Northern Crusades undertaken by the King of Denmark, the German Livonian and the Teutonic military orders. The war against the invaders lasted from 1208–1227. Thereafter, through many centuries until WWI, Estonian agriculture consisted of native peasants working large feudal-type estates held by ethnic German landlords. In the decades prior to independence, centralised Czarist rule had created a rather large industrial sector dominated by the Kreenholm Manufacturing Company, then the world's largest cotton mill.
After declaring independence in **1918**, the Estonian War of Independence and the subsequent signing of the Treaty of Tartu in 1920, the new Estonian state inherited a ruined post-war economy and an inflated ruble currency. Despite considerable hardship, dislocation, and unemployment, Estonia spent the first decade of independence entirely transforming its economy. In 1918, The Czarist ruble was replaced by the Estonian mark, which was in circulation until 1927. By 1929, a stable currency, the kroon, had been established. It was issued by the Bank of Estonia, the country's central bank. Compensating the German landowners for their holdings, the government confiscated the estates and divided them into small farms, which subsequently formed the basis of Estonian prosperity. Trade focussed on the local market and the West, particularly Germany and the United Kingdom. Only 3% of all commerce was with the USSR.
The USSR's forcible annexation of Estonia in **1940** and the ensuing Nazi and Soviet destruction during World War II crippled the Estonian economy. Post-war Sovietisation of life continued with the integration of Estonia's economy and industry into the USSR's centrally planned structure. More than 56% of Estonian farms were collectivised in the month of April 1949 alone. Moscow expanded on those Estonian industries which had locally available raw materials, such as oil shale mining and phosphorites.

Estonia re-established independence in 1991 and has styled itself as the gateway between East and West and aggressively pursued economic reform and integration with the West. Estonia's market reforms put it among the economic leaders in the former COMECON area. A balanced budget, almost non-existent public debt, flat-rate income tax, free trade regime, fully convertible currency backed by currency board and a strong peg to the euro, competitive commercial banking sector, hospitable environment for foreign investment, innovative e-Services and even mobile-based services are all hallmarks of Estonia's free-market-based economy. Estonia also has made excellent progress in regard to structural adjustment.

Public administration procedure – brief profile of current energy planning process in your region starting from the national level down to the region (see also your desk research within WP3.1)

Local municipalities with a heat consumption above 50 GWh/year have to compile a district heating plan. 147 of the local municipalities have also included the topic of energy planning in their general planning documents. In 2015 there were 23 municipalities in Estonia which had no energy action plan nor had the included the topic in their overall action plans.
(Source: https://energiatalgud.ee/index.php/Energiaplaneerimine_kohalikes_omavalitsustes)

Highlight significant characteristics differentiating region from others and give short (!) introduction of energy targets and challenges in the region

The Estonian electricity market has historically been highly concentrated and oriented towards one energy source - oil shale. The significance of other sources, including renewable sources, was low, especially before the EU accession. However, Estonia's entry into the European Union influenced its emphasis on renewable energy and the share of renewable sources has been growing steadily ever since. The potential of Estonian renewable energy primarily means wind power and combined heat and power production based on biofuel; at the same time small-scale hydropower industry is developed. The main support measure for the production of energy from renewable energy sources in Estonia is the obligation of the grid operator to buy renewable energy sources at feed-in tariffs. Other support measures include investment subsidies and support for technological investments by the European Union and state budget. Largely due to these support measures, the development of renewable energy in Estonia has been much faster than expected in recent years. The share of renewable energy in gross final energy consumption was 24% in 2010, which was 104 ktoe higher than initially planned. Estonian national renewable energy target for 2020 is 25% (863 ktoe (36.1 PJ, 10.0 TWh)). In 2010, the amount of energy produced from renewable sources was already 770 ktoe (32.2 PJ, 8.96 TWh). This demonstrates that Estonia has practically reached its target for 2020 already in 2011.
The most successful support measure in Estonia has been the support scheme for producing electricity from renewable energy sources (valid from 2007 and derived from Directive 2001/77/EC). The directive set a target of 5,1% for the share of electricity produced from renewable sources in gross final energy consumption by 2010. Estonia exceeded this target by a large margin. The share of electricity produced from renewable sources was 9,7% in 2010 and already 13% in 2011. The measure has considerably contributed to the increase of electricity production from biomass, biogas and windpower in Estonia.
Increasing the share of renewable energies in transport has been rather slow in Estonia. Therefore much more emphasis in coming years (from 2012 onwards) will be put on stimulating the uptake of renewable energies in transport sector.
(data sourve: https://ec.europa.eu/europeaid/renewable-energies-estonia_en)

3. Basic demographic data and figures

Regional demographic indicators:

Population of region	1313271	cap
Area of region	45339	km²
Population density	28.97	cap/km²
Number of individual municipalities	213	mun.

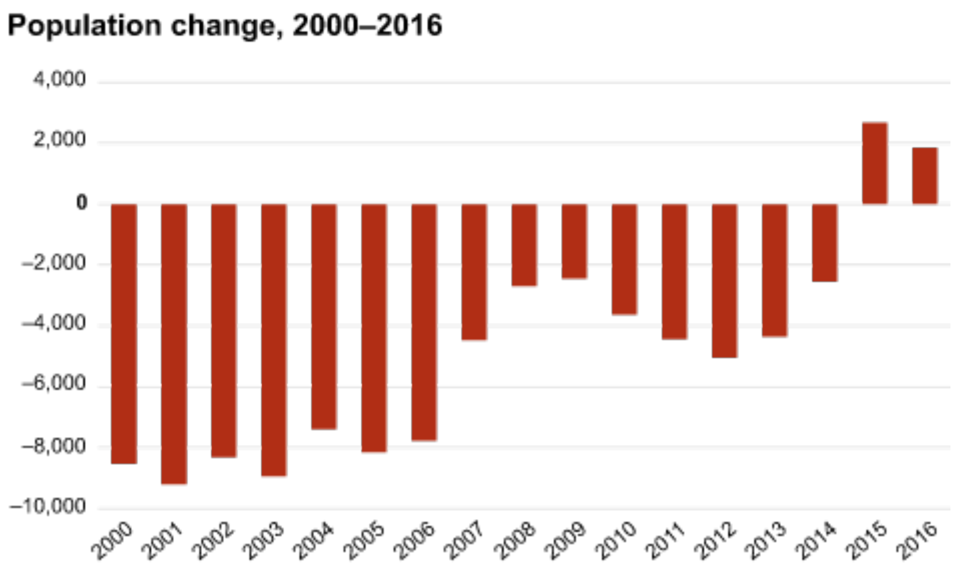
Data from 2015

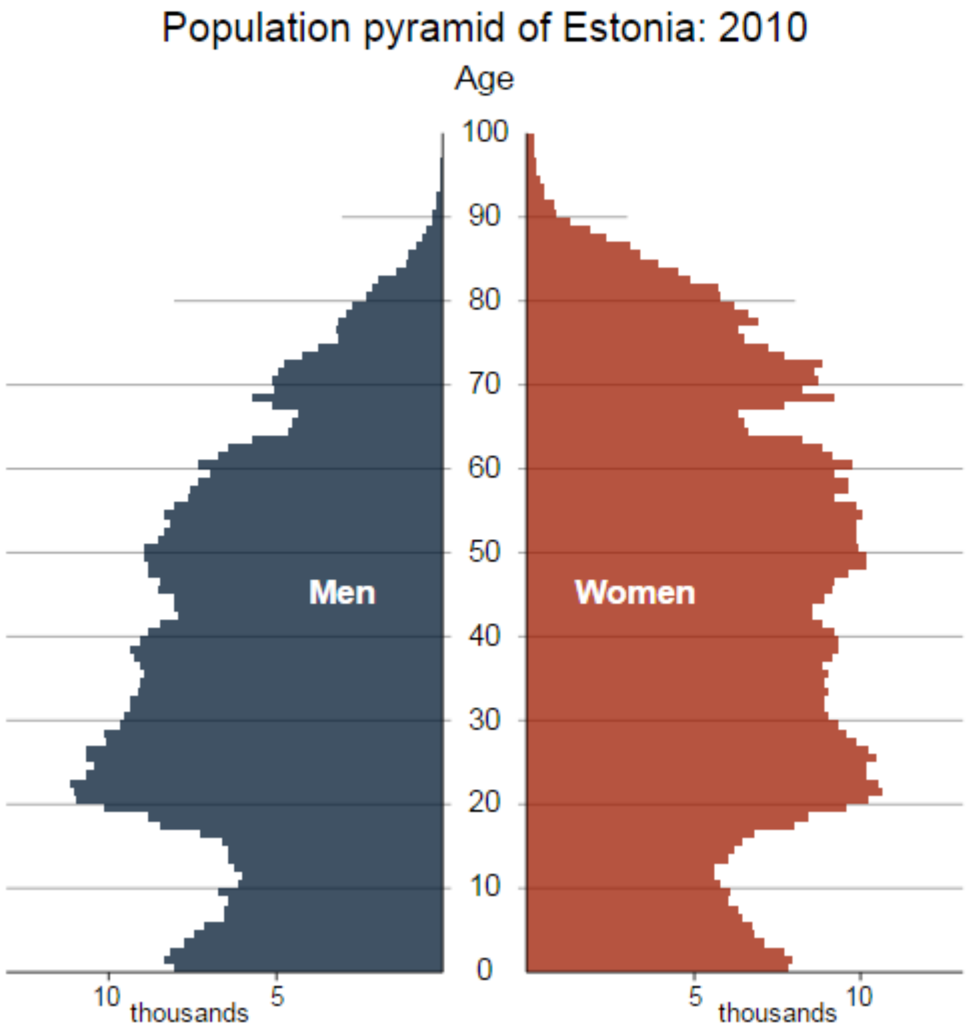
Basic demographic data

Population growth, age distribution in last 20 year – text description

The population of Estonia as at 1 January 2017 was 1,317,800, which is 1,850 persons more than at the same time in 2016. The population of Estonia has increased for two years already, because immigration has been higher than emigration and negative natural increase.

The population decreased by 1,370 due to negative natural increase (the number of deaths exceeded the number of births) and increased by 3,220 due to positive net migration (more persons immigrated to Estonia than emigrated). In total, the population of Estonia increased by 0.14% in 2016 (data source: http://www.stat.ee/news-release-2017-008).





Source: http://www.stat.ee/public/rahvastikupyramiid/

Socio-economic development of past 3-5 years (data source: https://data.oecd.org/estonia.htm , https://www.stat.ee/37205)

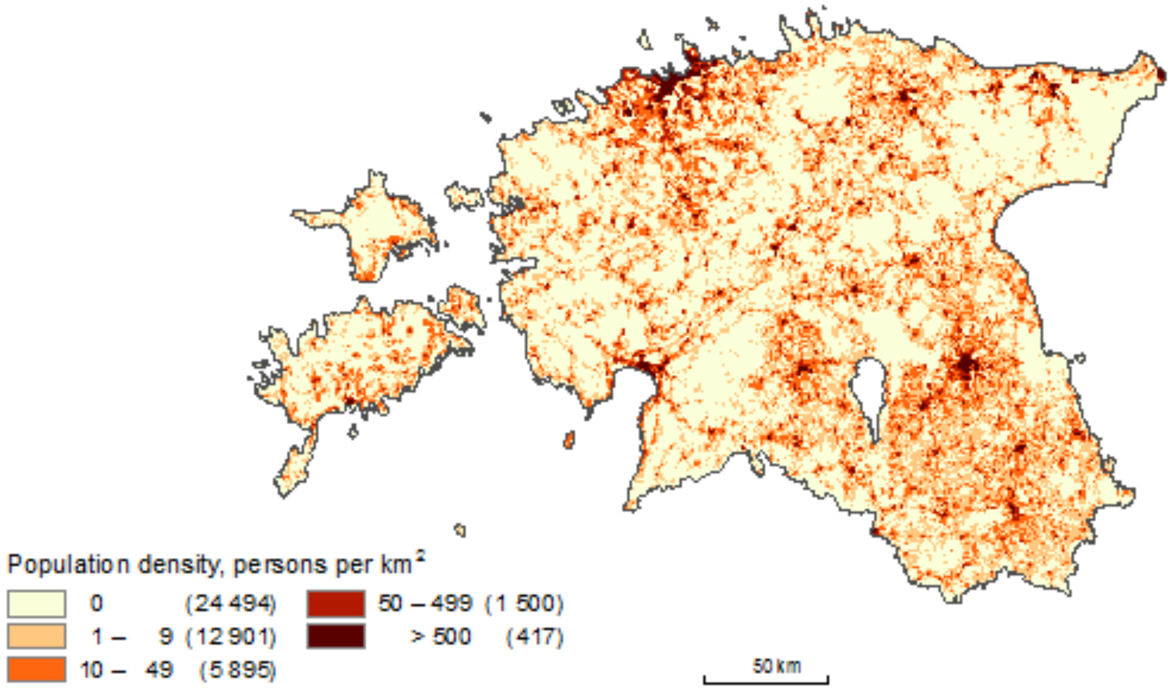
Unemployment rate	6.2	%
Average annual income per capita (gross)	27102	EUR
difference from the EU average (34 500 EUR gross annual earning)	78.56	%
Share of employees in		
agriculture	3.8	%
industry	30.1	%
services	66.1	%
Share of population with tertiary education	43.7	%

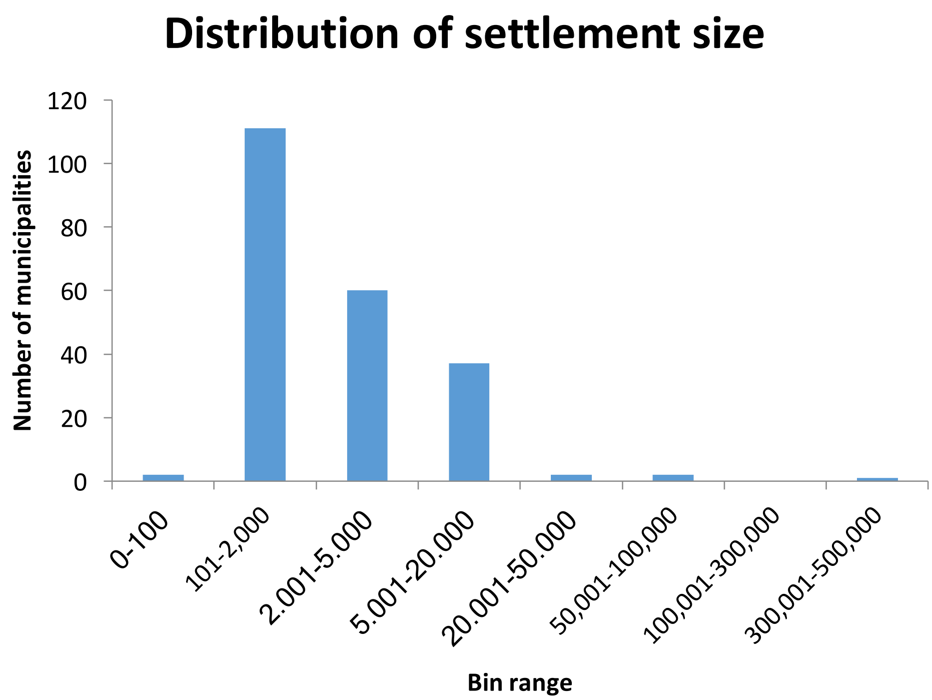
Tertiary education is more common among the female population (58.7 % of women have tertiary education and 33.1 % of men have).

The spatial distribution of the population, level of urbanisation

69.5% of the Estonian population lives in urban areas. Population density is the highest in the Lasnamäe district of Tallinn city, specifically in the Linnamäe-Kärberi streets area with 15,800 inhabitants per square kilometre, as shown by the 1 km x 1 km grid map of population density created on the basis of the 2011 Population and Housing Census, reported Statistics Estonia.

Almost 25,000 square kilometres (55%) of the total area of Estonia are uninhabited. A tenth of the Estonian territory is sparsely populated, with only 1–2 inhabitants per square kilometre.





(data source: http://www.stat.ee/pp)

4. Regional economy and economic trends

Regional economic indicators:

GDP, total	20 500	million EUR
GDP per capita	27 807	EUR/cap
HDI	0.861	

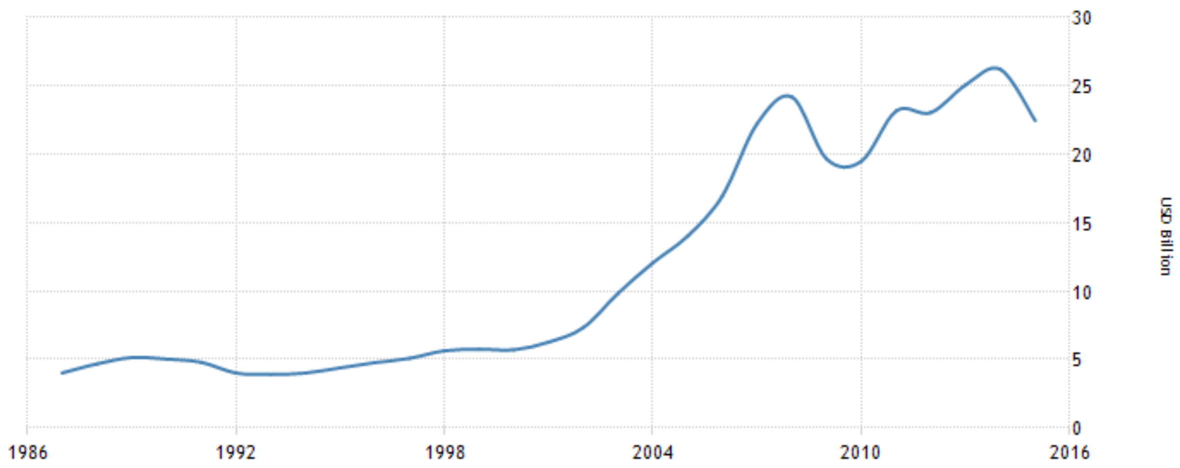
Data from 2015 (source: http://data.worldbank.org/indicator/NY.GDP.PCAP.PP.CD)

GDP per economic sectors:		
Agriculture	3.7	% of total GDP
Industry	28.4	%
Services	67.9	%

Data from 2015 (source: http://www.indexmundi.com/estonia/gdp_composition_by_sector.html)

Regional economy

Please provide information about the regional economy, past development and trends using GDP and other indicators. If available, include graphs about GDP / HDI development of last 10-20 years.



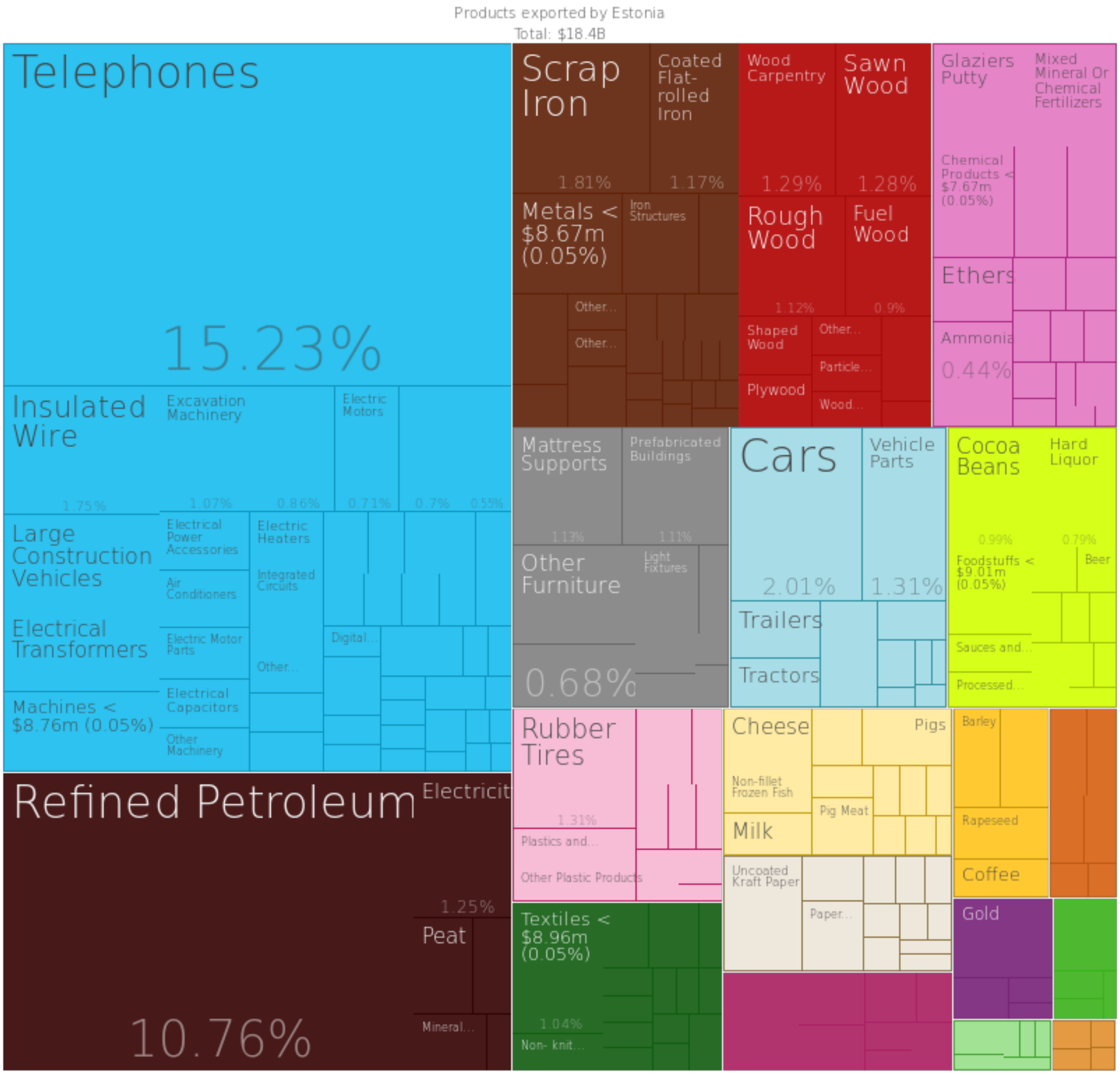
(source: http://www.tradingeconomics.com/estonia/gdp)

number of operating entrepreneurs (SMEs, large and individual)	117398	
share of SMEs	99.83	% of total number of operating businesses
number of operating nonprofit organisations	31 581	
Amount of EU funds (2007-13)	4 764 000 000	EUR

(data source: http://www.vm.ee/en/estonia-5-years-european-union)

What are the main contributors/contributing sectors to the regional GDP? How stable are these sectors (qualitative assessment)?

Estonian service sector employs over 60% of workforce. Estonia has a strong information technology (IT) sector, partly due to the Tiigrihüpe project undertaken in mid-1990s, and has been mentioned as the most "wired" and advanced country in Europe in the terms of e-government.[36]
Farming, collectivized until 20 years ago, has become privatized, more efficient, and the farming area has increased recently.[37] The share of agriculture in the gross domestic product decreased from 15% to 3.3% during 1991–2000, while employment in agriculture decreased from 15% to 5.2%.[38]
The mining industry makes up 1% of the GDP. Mined commodities include oil shale, peat, and industrial minerals, such as clays, limestone, sand and gravel.



Describe the regional job market, employment/unemployment rates per sectors – agriculture and forestry, industry, services

The unemployment rate in Estonia is *relatively low*, compared to other European Union countries. The decrease in unemployment continued at the end of last year. In the 4th quarter of 2014, the unemployment rate was 6.3%. The youth unemployment rate (i.e. the share of unemployed persons aged 15–24 among the labour force of the same age) was 15.0% in 2014. The numbers of working-age population as well as youth entering the labour market are continuously decreasing. Employment grew primarily in services, which increased the dominance of the tertiary sector compared to other sectors.
There is a **growing demand for high-skilled labour in Estonia.**
In view of the occupational forecasts, the most intensive labour demand is expected to affect the following areas: motor vehicle drivers, specialists in technical and life sciences, specialists in business and management, managers in various fields, sales personnel, metal and machinery operators and skilled personnel, education professionals, health professionals, construction workers and personal service specialists. Above average demand is forecast for ICT, electricity and electronics and personal care specialists as well as for various types of unskilled labour.
According to Statistics Estonia, in the 4th quarter of 2014. there were 7,200 job vacancies in the enterprises, institutions and organisations in Estonia. The number of job vacancies decreased by 15.9% compared to the previous quarter.
(source: http://www.eures.ee/eng/)

Importance of trade; Import/ export balance, if available

Estonia is the 73rd largest export economy in the world and the 29th most complex economy according to the Economic Complexity Index (ECI). In 2014, Estonia exported $17.8B and imported $19.8B, resulting in a negative trade balance of $2B. In 2014 the GDP of Estonia was $26.5B and its GDP per capita was $28.1k.
The top exports of Estonia are Telephones ($2.32B), Crude Petroleum ($958M), Refined Petroleum ($891M), Cars($416M) and Prefabricated Buildings ($291M), using the 1992 revision of the HS (Harmonized System) classification. Its top imports are Refined Petroleum($2.93B), Telephones ($997M), Cars ($894M), Integrated Circuits ($457M) and Packaged Medicaments ($312M).
The top export destinations of Estonia are Sweden($2.67B), Russia ($2.62B), Finland ($1.91B), Latvia ($1.17B) and Spain ($1.04B). The top import origins are Russia($2.91B), Germany ($2B), Finland ($1.92B), China ($1.51B) and Sweden ($1.16B).
(source: http://atlas.media.mit.edu/en/profile/country/est/)

5. National and local energy strategies *(task WP 3.1) max 1 pg*

List of relevant and most influencing strategies / roadmaps / measures to local energy situation or development – already provided in task WP 3.1

Region	Brief description of current …	legal requirement OR voluntary initiative	National/ regional/ local level	Original title + link (if possible)	English title + brief description	Organisation in charge	Type (EE,EPB ,RES, etc. or combination...)
Estonia	The Directive 2010/31/EU on energy performance of buildings is applied on national level by the Regulation of Energy Efficiency that is part of the Building Act	**legal requirement**	**National**	**Energiatõhususe miinimumnõuded** https://www.riigit	Minimum requirements for energy efficiency	Ministry of Economic Affairs and Communications	EE, EPB
Estonia	Enforces the EU directive 28/2009 that obliges to rise the share of renewables in Estonian energy end use to 25% until the year 2020. In the year 2013 the share of renewable energy was 25,6 %, which fulfilled the goal.	**legal requirement**	**National**	**Eesti Taastuvenergia tegevuskava aastani 2020**	Renewable Energy Action Plan for Estonia until 2020	Ministry of Economic Affairs and Communications	RES
Estonia	Enforces the EU directive 28/2009 that obliges to rise the share of renewables in Estonian energy end use to 25% until the year 2020;	**legal requirement**	**National**	**Säästva arengu seadus,** http://www.energi	Law of Sustainable Development	Ministry of Economic Affairs and Communications	RES
Estonia	Regulates the subsidies and rules for selling and buying electricity generated from renewable energy sources. Open electricity market for all consumers from the beginning of 2013	**legal requirement**	**National**	**Elektrituruseadus** https://www.riigiteataja.ee/akt/112	Electricity Market Regulation	Ministry of Economic Affairs and Communications	RES
Estonia	Defines minimum energy efficiency requirements for district heating networks	**legal requirement**	**National**	**Kaugkütteseadus** https://www.riigiteataja.ee/akt/11207	District heating law	Ministry of Economic Affairs and Communications	EE

Estonia	Sets long term goals for energy efficiency and renewable energy use	**legal requirement**	**National**	**Eesti pikaajaline energiamajanduse arengukava 2030+**	National Long Term Energy Action Plan Until 2030 and beyond	Ministry of Economic Affairs and Communications	combination of EE, EPB and RES

6. Energy Production

6.1. *Conventional energy production capacities (fossil fuels and nuclear power)*

Give an overview of energy production by fossil fuels and nuclear power plants – concentrate on the most significant 3 to 5 power plants.

Name & Location (city, town)	Owner	Year of commissioning (refurbishment)	Type of plant & fuel	Capacity in MW	Annual energy production in MWh	Annual CO_2-emissions in t	Utilization rate (qualitative assessment)
	[choose: Public / private SME / private large enterprise]			[state: electr. and/or heat]			[choose: Constantly used / sometimes / seldom / to be decommissioned]
Eesti Powerplant, Narva	Public (Eesti Energia)	1969	Condensation, Oil Shale	1615 MW_{el} / 84MW_{th}		11 Mt	Constantly used
Balti Powerplant, Narva	Public (Eesti Energia)	1959	Condensation, Oil Shale	1435 MW_{el} / MW_{th}			Constantly used
Iru Powerplant, Iru	Public (Eesti Energia)		Organic Rankine Cycle, Waste, Natural gas	190 MW_{el} / 764 MW_{th}	310 000 MWhel / 134 000 MWhth		Constantly used

Add additional details to describe the conventional energy production capacities in the region. What are current trends? What influence have age, regional economy, fuel imports, and fuel prices on the on the current status?

Estonia has set a goal to establish an open market situation on all the different energy sectors, so that the achieved price is the result of competition between different suppliers.

Estonia is among the European Union countries that are least dependent on energy imports. Thanks to the use of oil shale and increasingly also renewable fuels, we can largely meet the energy requirements of our country.

We also work to maintain and even enhance Estonia's energy independence in the conditions of stricter energy and climatic policies. The goal of Estonia's market based energy policy is to secure our energy independence, secure supply and competitive energy prices, which are all among the main prerequisites for economic development.

6.2. *Renewable energy production*

Energy production capacities

Give an overview of energy production by renewable energy capacities (e.g. small/large hydro, solar PV, solarthermal, biomass, geothermal & other production capacities – concentrate on the most significant 3 to 5 power plants or aggregation of production facilities.

Name & Location (city, town)	Owner	Year of commissioning (refurbishment)	Type of plant & fuel	Capacity in MW	Annual energy production in MWh	Annual CO_2-emissions in t	Utilization rate (qualitative assessment)
	[choose: Public / private SME / private large enterprise]			[state: electr. and/or heat]			[choose: Constantly used / sometimes / seldom / to be decommissioned]
Tartu Powerplant, Tartu	Private large enterprise	2009	Organic Rankine Cycle, Biomass	$25MW_{el}$ / $60MW_{th}$		0	Constantly used
Wind farms, distributed	Private	2002-2017	Wind turbines	309,96 MW	589 000 MWh	0	1900 full load hours. Cf=21,69 % (2016)
Solar panel installations, distributed	Private	2012-2017	Solar panels	10 MW	8760 MWh	0	876 full load hours. Cf=10 %

Add additional details to describe the renewable energy production capacities in the region. What are current trends? What influence have age, regional economy, fuel availability or renewable energy potential, and subsidy systems on the current status?

The main share of renewable energy is generated from wind and biomass.

6.3. *Transmission and distributions*

What kind of facilities constitute the electric transmission and distribution system? Who are the owners? Who are the operators? Please add relevant map if available.

The transmission grid consists of:
1702 km of 330 kV lines
158 km of 220 kV lines;
3479 km of 110 kV lines;
61 km of 35 kV lines;
146 transformation and distribution stations.

The distribution system consists of 60 000 km of lines with voltages ranging from 0.4 to 35 kV that supply the vast majority of consumers.

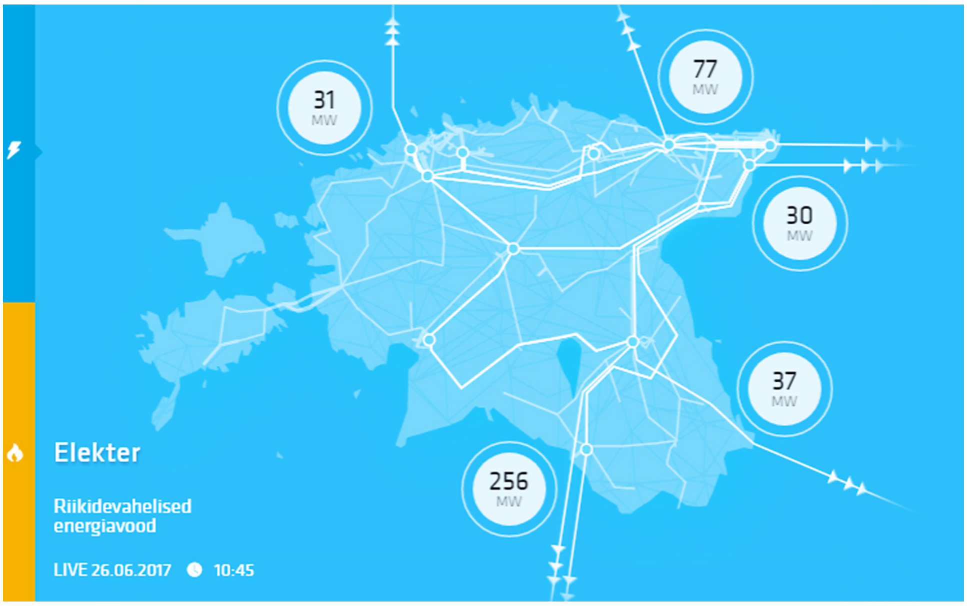
Give an overview of other centralised or decentralised energy distribution systems (e.g. natural gas pipelines, heat grids, etc.).

Approximately 60 % of the population live in homes that are connected to one of the 239 central heating networks in the country. These networks have altogether 1430 km of heat pipelines and deliver 4,6 TWh/a heat to the consumers. The remaining 40% of the population uses local heating applications like wood stoves or heat pumps.

Give an overview on interconnections of regional energy production with the rest of the country. Are there large production facilities in the region on which the rest of the country's energy supply might depend?

The project region is the whole country of Estonia. Estonia is connected to neighbouring countries and has active electricity market with Russia, Finland and Latvia.

Following image shows the main connections with our neighbouring countries and the energy flow in the grid. The live map can be seen here: https://dashboard.elering.ee/et



6.4. *Jobs in the energy sector*

Give an overview about the status of the energy sector in the regional economy. How many jobs are there at the moment in the energy sector. How important are new "green job" for regional economy development. If possible, quantify investments in the energy sector.

There are 6300 jobs in the energy sector (Electricity and head production and distribution), which is 1 % of the total workforce in Estonia. There are also 3300 jobs in the mining industry (0.5 %), which almost entirely serves energy production.
The biggest employer is Eesti Energia with 5840 employees (https://www.energia.ee/-/doc/8457332/ettevottest/investorile/pdf/annual_report_2016_est.pdf).

Are coal and lignite mining undertaken in the region? What role does fossil fuel mining play for the regional economy and for regional energy security?

Estonian energy production relays heavily of one region in north-east Estonia, Ida-Virumaa. The workforce of this region is to a large extent employed in jobs that are in the oil shale based energy sector or in sectors that support it. Furthermore a major portion of the population in the region is Russian speaking and there are concerns of instability if those jobs would cease to exist.

7. Final energy consumption

Final energy *is a form, which might already been subject to conversion from the raw fuel. It is the energy made available to the user.*

For the sectoral analysis please use regional statistics as far as they are available to you and quote your sources.
If no regional data is available please use the Excel tool, which will give you a suggestion to estimate the needed indictors using national statistics.

Please always use kWh, MWh, GWh, etc. You can find a good conversion tool here: [*https://www.iea.org/statistics/resources/unitconverter/*](https://www.iea.org/statistics/resources/unitconverter/)

7.1. *Households*

Regional final energy consumption of household sector	10320	GWh/a

Heat consumption

Total heat energy consumption of households sector (heating and hot water consumption)	3470	GWh/a
Average heat energy consumption per household	5785	kWh/a/hh

Describe the average building standard. What is their average age of existing building stock? Are energy efficient renovations in progress?

The average age of residential building stock is 44. Renovations to improve the energy efficiency are made constantly. The state offers subsidies to renovate residential building stock.

Electricity

Electricity consumption of households	1738	GWh/a
Average electricity consumption per household	2897	kWh/a/hh

Describe if there are any national or regional programmes for reducing household electricity consumption (e.g. washing machine or refrigerator replacement programme). If yes, please elaborate it briefly.

There are no incentives, but there are few awareness raising campaigns.

Cooking

Gas consumption for cooking appliances of households	N/A	GWh

Describe if gas is a significant energy source for cooking in the household sector.

The majority of gas is used for space heating and to a lesser extent warm water preparation. A distinction of how much of it is used for cooking cannot be made.

Households consumed 64 000 000 m^3 of natural gas and 4 000 t of liquefied natural gas in 2014.

General information

Household electricity price	0.104	EUR/kWh (incl. taxes)
Household natural gas price	0.049	EUR/kWh (incl. taxes)
Household district heating price	0.054	EUR/kWh (incl. taxes)
Household price for energy from firewood	0.037	EUR/kWh (incl. taxes)
Energy expenditure by household	5.5	% of income

Is there any element of Demand Side Management of electricity on household level in place? If yes, please describe it (e.g. peak price, smart metering)

All electricity consumers have smart metering and pay for electricity on the basis of hourly changing prices. This gives a basis to motivate consumers to implement demand side management.

Is energy poverty an issue in the region? If yes, please describe how many people are affected, in what extent?

Energy poverty is not widespread, but it is an issue to some residents of smaller settlements where district heating prices tend to be higher and wages are lower.

Give an estimate of the trend in final energy consumption in the household sector using values from -5- to +5 where (-5 is a strong reduction, 0 means neither growth nor reduction, +5 strong growth).

Estimate: 0, because there is a slight growth trend for the electricity consumption in the household sector and a downward trend for the heat consumption. According to Estonia's long-term energy development plan until 2030: https://energiatalgud.ee/index.php/Energiatarbimine_teenindussektoris

7.2. *Service Sector*

Regional final energy consumption of service sector	4880	GWh

What are the main sub-sectors driving energy consumption in the in the service sector (building standard, number of businesses, …)? How important is service sector for the regional economy?

The regional economy is service based, but the service sector does not constitute a majority of the energy consumption.

Give an estimate of the trend in final energy consumption in the service sector using values from -5- to +5 where (-5 is a strong reduction, 0 means neither growth nor reduction, +5 strong growth).

Estimate: 0, because there is a slight growth trend for the electricity consumption in the service sector and a downward trend for the heat consumption. (According to Estonia's long-term energy development plan until 2030: https://energiatalgud.ee/index.php/Energiatarbimine_teenindussektoris)

7.3. *Industry*

Total energy consumption of the industrial sector	8040	GWh
Industry electricity price	0.09	EUR/kWh (incl. taxes)
Industry natural gas price	0.0433	EUR/kWh (incl. taxes)
Household district heating price	0.054	EUR/kWh (incl. taxes)
Household price for energy from firewood	0.037	EUR/kWh (incl. taxes)

What are the main sub-sectors driving energy consumption in the in the industrial sector? How important is industry for the regional economy?

The biggest electricity consumer is a paper pulp industry. Also big consumers are wood processing industry and metalworking sectors.

7.4. *Transport*

Regional final energy consumption of transport sector	8850	GWh

Describe the main characteristics of the transport sector: transport infrastructure, motorisation rate, availability of public transport and differences between urban and rural environments.

Estonian private car stock is one of the least energy efficient in the European Union.
There is no direct data how much of the final energy consumption attributes to the transport of passengers and how much to freight.

Passenger transport

Motorisation rate - number of passenger cars/1 000 inhabitants	497	
Regional energy consumption of passenger transport in the region	N/A	GWh

Freight transport

Regional energy consumption of road freight transport	N/A	GWh

If the rail, or transport by pipeline is a significant way of the freight transport, please describe their main characteristics.

Freight transport by rail has been in comparable quantities (6.27 million freight tonne-kilometers in 2011) than road transport (5,91 freight tonne-kilometers). Pipeline transport is insignificant.

Use of alternative fuels

Describe the market development for alternative fuel vehicles (natural gas, biogas, electric cars). What supporting mechanisms for alternative fuel are available on national and regional level? Describe challenges and barriers, e.g. infrastructure, technological, supply, financial barriers, etc..

There was a support scheme in 2014 for purchasing electric cars. The support was up to 50% of the cars price, but not more than 18000 €. There are no more

Give an estimate of the trend in final energy consumption in the transport sector using values from -5- to +5 where (-5 is a strong reduction, 0 means neither growth nor reduction, +5 strong growth).

The energy consumption of the transport sector will grow in the coming decades. Estimate: +2.

7.5. *Summary*
7.5.1. Final energy indicators

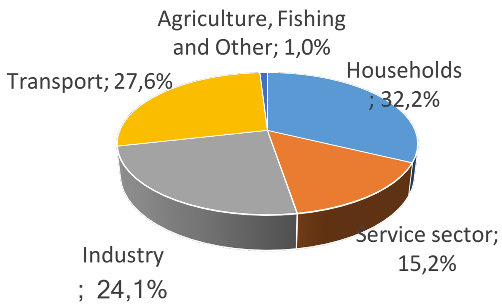
General indicators for the region

Use the Excel tool to fill the following tables and generate graphs.
If regional data is available, use this information and quote your sources.

Total final energy consumption	32090	GWh
Final energy consumption per capita	24410	kWh/cap
Electricity consumption per capita	5644	kWh/cap
Heat consumption per capita	12072	kWh/cap
% of total country consumption	100	%

Final energy consumption per sector

Year: 2014			%
Households	10320	GWh	32.2%
Service sector	4880	GWh	15.2%
Industry	7727	GWh	24.1%
Transport	8850	GWh	27.6%
Agriculture, Fishing and Other	313	GWh	1.0%
Sum	**32090**	**GWh**	**100.0%**



Give an estimate of the trend in final energy consumption using values from -5- to +5 (where -5 is a strong reduction, 0 means neither growth nor reduction, +5 strong growth).

Estimate: -1. There will be a slight reduction, mainly because of the decreasing heat consumption due to energy efficiency measures for buildings. This estimate is based on the actions that are already done. If the state would be more active in this matter, then the estimate could be even better.

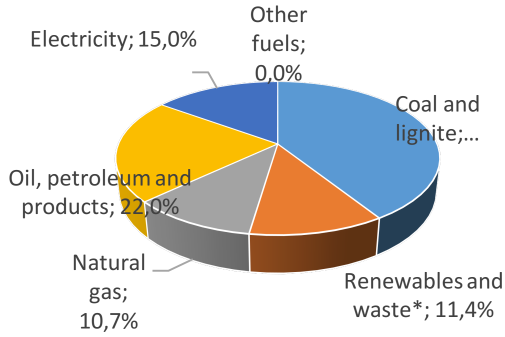
7.5.2. Final energy consumption by fuel

Use the Excel tool to fill the following tables and generate graphs.
If regional data is available, use this information and quote your sources.

Total final energy consumption by fuel

Year: 2014			%
Coal and lignite	20260	GWh	41.0%
Renewables and waste*	5629	GWh	11.4%
Natural gas	5272	GWh	10.7%
Oil, petroleum and products	10873	GWh	22.0%
Electricity	7420	GWh	15.0%
Other fuels	0	GWh	0.0%
Sum	**49454**	**GWh**	

*Hydro, wind, solar, tide/wave, biomass and waste, geothermal



7.5.3. Primary energy equivalent

Primary energy *is an energy form found in nature that has not been subjected to any conversion or transformation process. It is energy contained in raw fuels.*

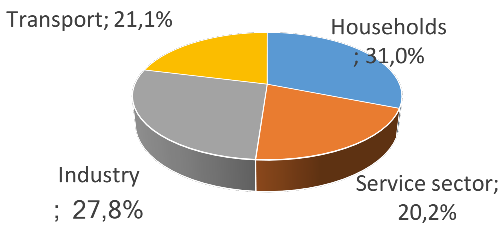
If regional data is not available for these indicators, use specific national indicators to break energy supply down to regional level. Refer to Excel tool for suggestions on calculation methodologies. Quote your sources and assumptions

Total Primary Energy Consumption	76758	GWh
Primary energy consumption per capita	58389	kWh/cap
Primary energy factor of electricity	2.78	-
Energy intensity	5814710	TPES/GDP

Give an overview of the regional primary energy supply by fuel.
Use the Excel conversion tool using primary energy coefficients suitable for your region.

Primary energy equivalent by sector
Use the Excel tool to fill the following tables and generate graphs.
If regional data is available, use this information and quote your sources.

Year: 2014			%
Households	14298	GWh	31.0%
Service sector	9299	GWh	20.2%
Industry	12806	GWh	27.8%
Transport	9735	GWh	21.1%
Sum	46138	**GWh**	100.0%



What is the level of primary energy supply dependencies: Which fuels need to be imported form the rest of the country and internationally.

Dependency on fuel imports: very high / high / average / low / very low

The dependency is in some categories very low, for example the country produces 1.5 times more electrical energy than it consumes, but it needs to import all transport fuels. On average the dependency is average.

7.5.4. Regional CO_2-emissions associated with energy consumption

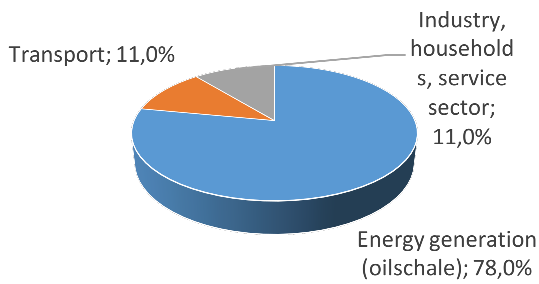
Use the Excel tool to fill the following tables and generate graphs.
If regional data is available, use this information and quote your sources.

Total CO_2-emission associated with energy sector	14.36	Mio t
CO_2-emissions per capita	14.01	t/cap
CO_2-emissions per GDP	0.807	t/€ GDP

Give an overview of the regional primary energy supply by fuel.
Use the Excel conversion tool using CO_2-emission coefficients suitable for your region.

Energy-related CO_2-emissions by sector

Year: 2014			%
Energy generation (oilshale)	14.36	10^6 t CO_{2ekv}	78%
Transport	2.02	10^6 t CO_{2ekv}	11%
Industry, households, service sector	2.02	10^6 t CO_{2ekv}	11%
Sum	18.40	**GWh**	100%



8. Renewable energy sources – status and potential

8.1. *General information*

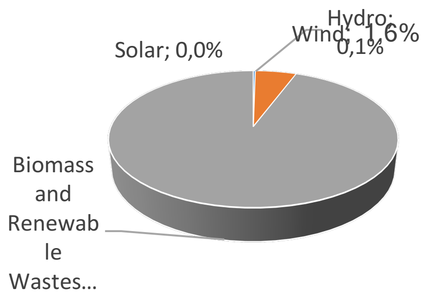
Use the Excel tool to fill the following tables and generate graphs.
If regional data is available, use this information and quote your sources.

Renewable Energy Targets:		
2020 RES share in gross final energy consumption	25	%
2030 RES share in gross final energy consumption	30	%

Current RES share (2016)	25	%
thereof RES out of the region	25	%

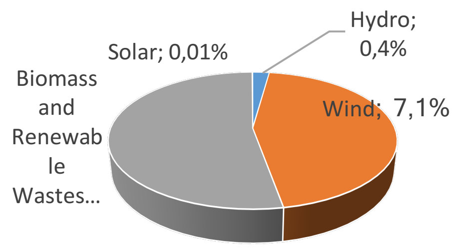
Share of final energy consumption produced by renewable fuels

Year: 2014			**%**
Hydro	26	GWh	0.1%
Wind	529	GWh	1.6%
Biomass, biofuels and renewable wastes	621	GWh	1.9%
Solar	1	GWh	0.0%
Geothermal	0	GWh	0.0%
Tide, Wave, Ocean	0	GWh	0.0%
Sum	**1177**	**GWh**	**3.7%**



Share of total electric demand covered by renewable fuels

Year: 2014			**%**
Hydro	26	GWh	0.4%
Wind	529	GWh	7.1%
Biomass, biofuels and renewable wastes	621	GWh	8.4%
Solar	1	GWh	0.01%
Geothermal	0	GWh	0.0%
Tide, Wave, Ocean	0	GWh	0.0%
Sum	**1177**	**GWh**	**15.9%**



Describe if and how renewable energy sources are integrated in the transport sector, e.g. biofuels, electric vehicles.

Electric vehicles that where bought with state subsidy have a commitment to use electricity from renewable sources. Biofuels are currently not used in the transport sector

Describe the status of REN production in the region. % of total energy and electricity demand covered by REN. If available give a historic overview of the REN production capacities for the last 5 to 10 years.

Biomass that is used in CHP-s generates 6% of the electricity production.
Wind energy is the energy source with the second highest share of the renewable sources in electricity production, with 5%.

Describe if there are incentive programmes/schemes (financial and non-financial) in place to support REN-development. Are these programmes on national, regional or local level?

There is a feed-in subsidy for RE for the first 12 years of operation of a RE generation device. The subsidy is 0.053 EUR/kWh. There have been also subsidy campaigns for the installation of small scale RE devices, but no longer term subsidy programmes.

Describe the top 5 regulatory barriers slowing down current and future REN-development. Should these barriers be addressed at national, regional or local level?

Legislation does not favour energy unions. If somebody wants to sell electricity to another entity then they have to register as a grid operator, which is a significant barrier.
There is an annual limit for wind energy subsidies, no subsidies will be paid for all the wind energy produced above this limit.
A simplified grid connection procedure is possible for micro power plants with a capacity of up to 11 kW, but this limit could be higher to enable more installations.
There is an ongoing debate, if forestry regulations are too strict and restrain biomass use for energy.
Renewable energy is not clearly set as a priority by the state.

Give an estimate of the trend in renewable energy production using values from -5- to +5 (where -5 is a strong reduction, 0 means neither growth nor reduction, +5 strong growth). Describe supporting factor as well as barriers.

Estimate: +3. In the long run there is no alternative, but it will take time. A supporting factor is the sentiment of the population to adapt new technologies and also a desire to be an energy producer themselves.

8.2. *Available natural resources in the region*

8.2.1. Biomass

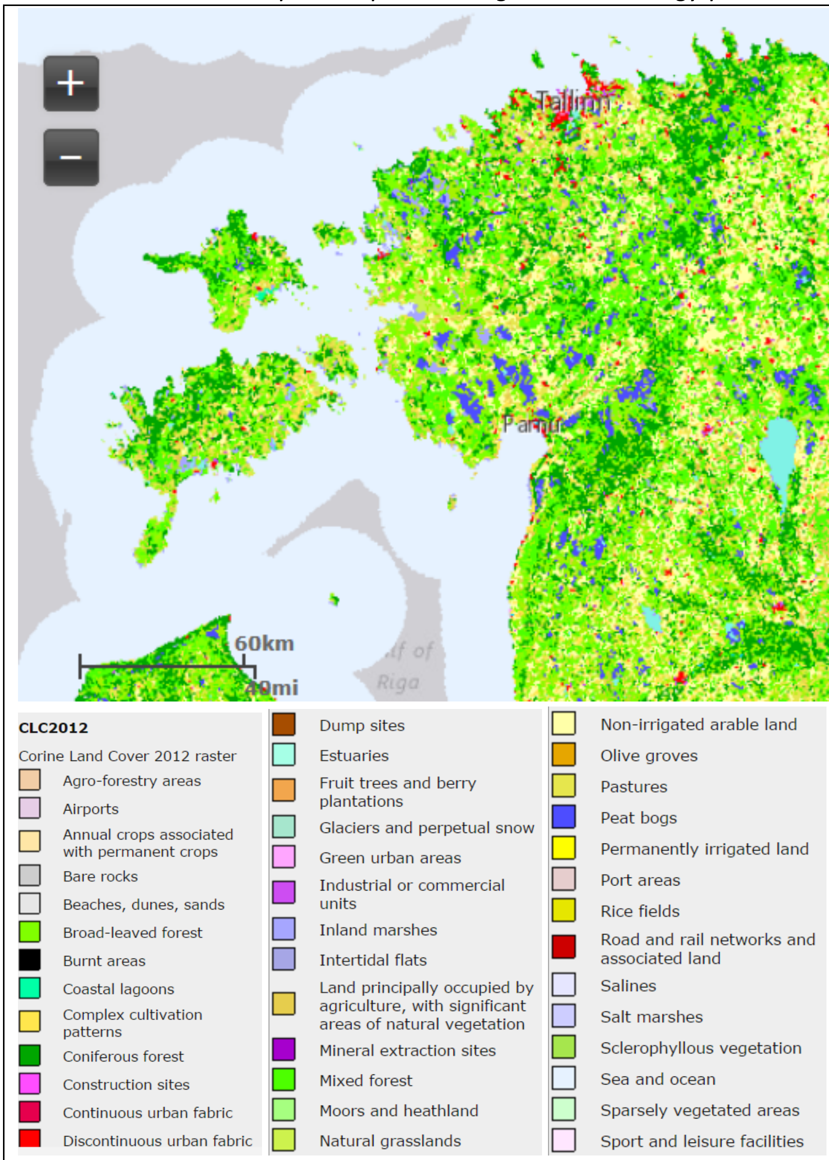
How are forest areas used? For what purpose? What is the regional energy potential using existing forest areas? Please state whether it is a theoretical or technical potential and describe regulatory support systems as well as barriers.

53% of Estonia is covered with forest. The theoretical growth is 15 mil m^3 of wood per year. 442 mil m^3 is the total forest stock. 8 mil m^3 is cut every year for various purposes like building material and energy.

What are main agricultural products at the moment? What is the regional energy potential from agricultural products? Please state whether it is a theoretical or technical potential and describe regulatory support systems as well as barriers.

The main agricultural products are: dairy products, meat, grain.
Biogas, straw, reed and wood resources are quite evenly distributed over Estonian counties. The largest total resources are located in Pärnu, Lääne-Viru, Viljandi, Harju and Tartu counties, which coincide with the location of Estonia's larger cities. The use of biogas, straw, reed and wood is dependent on the potential of combined heat and power. Such a potential in Estonia is estimated to be 397 MW and the electricity generation of these plants could be 2,095 GWh. This evaluation is based on the assumption that 45% of the heat demand is covered with CHP plants and that the heat to power ratio is 3 (TTU, 2008).

Provide a land use map or map indicating biomass energy potential of the region, if available.



Source: the Corine Land Cover 2012 database: http://land.copernicus.eu/pan-european/corine-land-cover/clc-2012/view

8.2.2. Hydro power (incl. tide and wave power)

Give an overview of hydro power sources used at the moment and describe the energy potential for the different technologies: run-of-river hydropower plants, reservoir hydropower plants, use of tide and wave *power, if applicable. Differentiate between small and large hydro power. Describe the energy potential based on geographical and political frameworks.*

There are 47 small hydropower stations with a total capacity of 8,09 MW in Estonia. No significant additions are foreseeable in the future, because Estonian rivers have generally a low water flow capacity and small height difference. No tide and wave power installations exist nor are planned in Estonia in the near future. In 2016 there was 35 GW produced from hydropower.

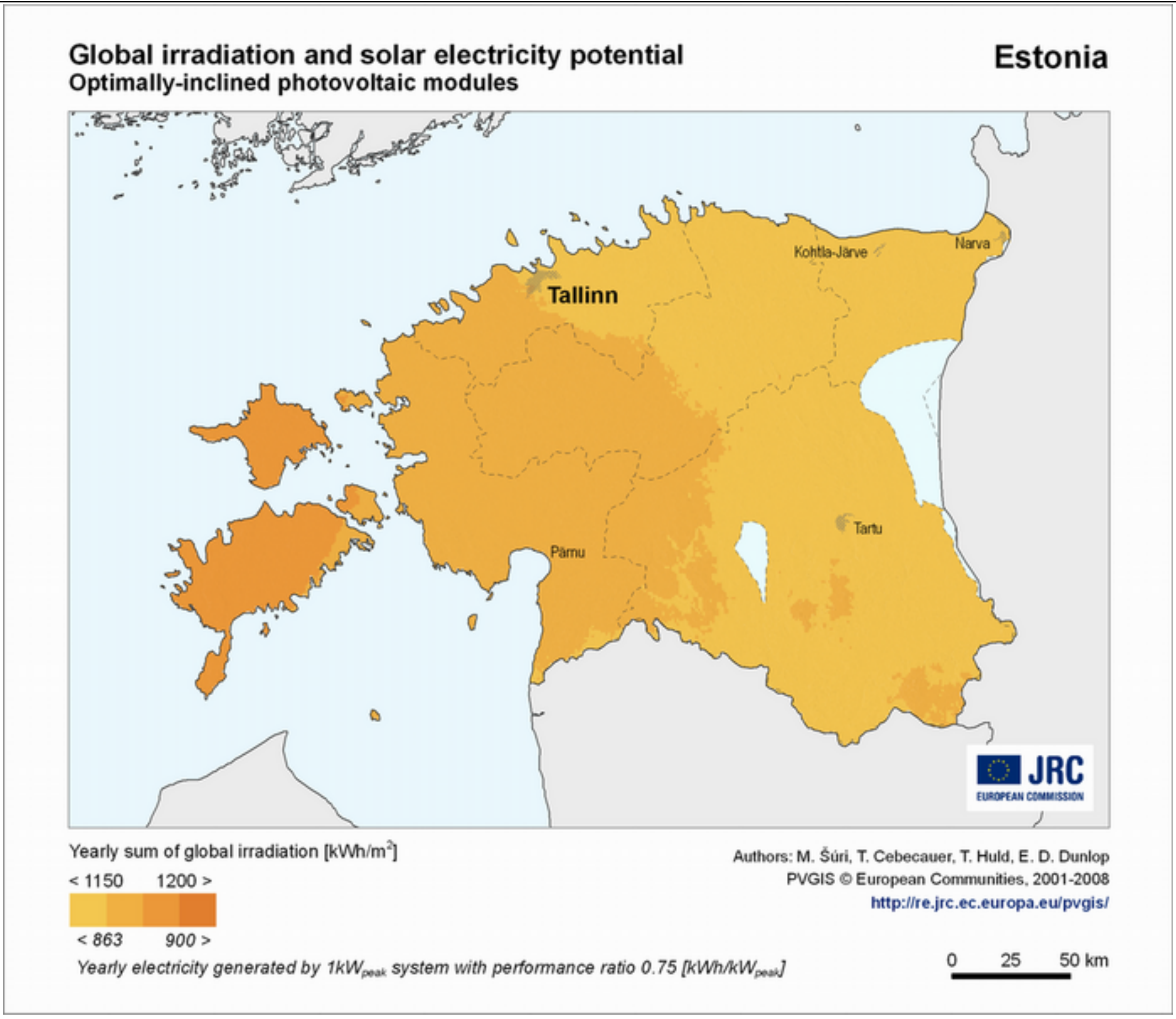
8.2.3. Solar power

Solar irradiation (on optimally inclined plane) per year	from 1050 to 1150	kWh/m²

Give an overview of both solar thermal and PV usage at the moment and describe the energy potential based on geographical and political frameworks.

There are around 600 PV installations in Estonia at the moment. The majority of them has a peak power of up to 11 kW and they are installed mainly on private houses. Solar thermal is less common, but there are no accurate statistics of how many of these systems are installed. There are 11MW of solar panels connected to the Estonian main grid. In 2016 there was 3 GWh of electricity produced by solar energy, according to the operators of the main grid. However the exact number is unknown as a lot of small producers are not connected to the main grid.

Map indicating solar irradiation in the region.



8.2.4. Wind power

Average wind velocity	from 2.5 to 7	m/s
Full load hours	1900	h/a

Give an overview of wind power use at the moment and describe the energy potential based on geographical and political frameworks. Differentiate between offshore and onshore potential

Use regional/national studies but if not available, you can refer to the EEA study for approximation of wind speed or full load hours: http://www.eea.europa.eu/publications/europes-onshore-and-offshore-wind-energy-potential/at_download/file

As of 31.12.2016 there were 139 wind turbines installed in Estonia with a total capacity of 309,96 MW. 282,2 MW of them have been connected to the main grid of Estonia operated by Elering. The only wind farm commissioned in 2016 was Tooma II wind park with three turbines and total capacity of 7,05MW in the West of Estonia.

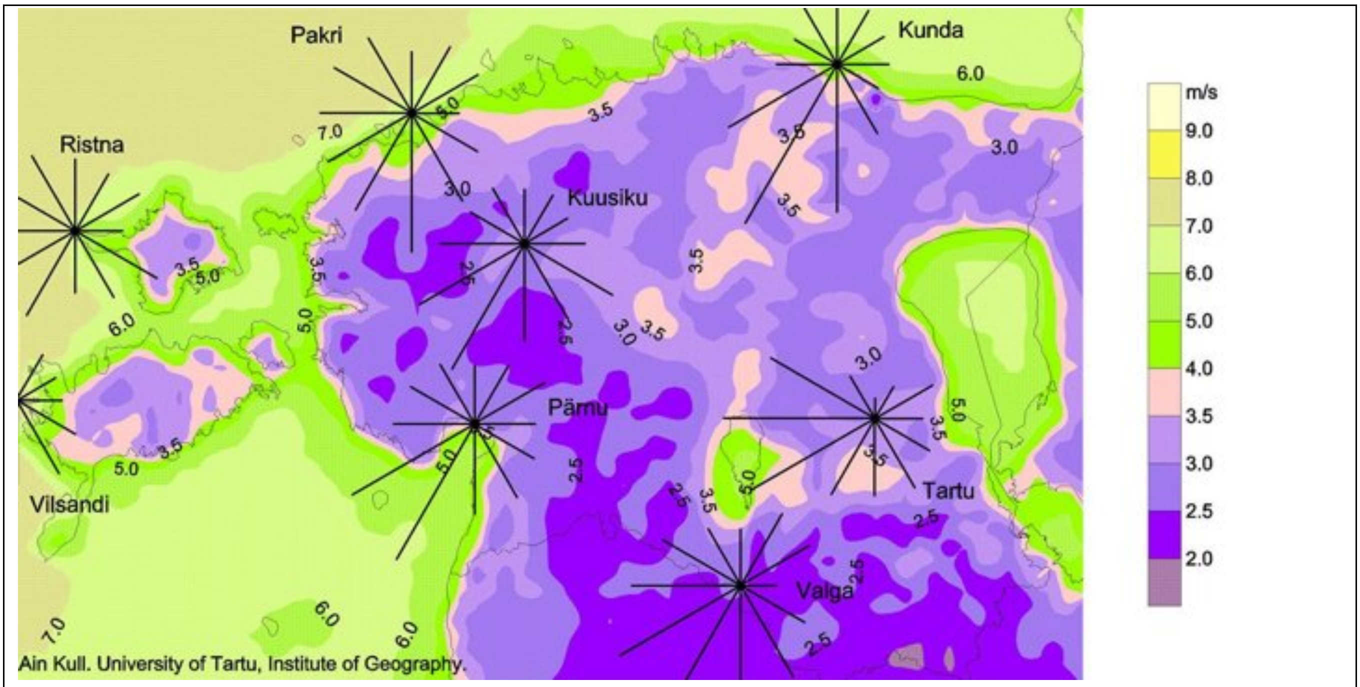
Wind energy accounted for 41.7 percent of total renewable energy production and wind farms produced 589 GWh of electric energy in Estonia during 2016, 15 percent less than in 2015. Unlike in 2015, the 600 GWh cap set for the amount of wind energy eligible for subsidization per year was not achieved last year.

The record wind energy was produced on December 10, 2014 when 279 MW was generated between 14.45-14.50.

Besides industrial wind farms there are also 20 small scale wind turbines (less than 15kw), with a total output of 190kw. In addition 3 micro producers have joined the distribution grid that combine wind and solar to produce their energy (total 30kw).

Currently there are plans to develop two off-shore wind parks. There will be a wind farm of 100 to 160 wind turbines with an aggregate capacity of 700 to 1,100 megawatts built in the sea to the north of Hiiumaa island. The turbines having a nominal capacity of 4-7 megawatts would stand at a distance of about one kilometer from each other, have masts 100-105 meters tall and rotors with a diameter of 130-164 meters. Another off-shore park is planned to be built in south-east of Estonia, in Pärnu bay. However the size of it is still under negotiation.

Wind map for the region



8.2.5. Geothermal energy

Give an overview of use of geothermal energy at the moment and describe the energy potential based on geographical and political frameworks.

The groundwater temperatures are inadequate for geothermal electricity generation. Geothermal energy is used with the help of heat pumps for space heating. According to studies, Estonia has a geothermal energy potential of 0.04 TWh in the year 2030 (http://www.geoelec.eu/wp-content/uploads/2011/09/D-2.5-GEOELEC-prospective-study.pdf).

Provide a geothermal map for the region, if available

Not available for Estonia.

8.2.6. Waste

Describes overlaps between waste management and energy sector. Is municipal solid waste used for energy production? How is the energy from waste incineration plants used, e.g. electricity generation, district heating (cogeneration)?

Yes, there is a waste incineration plant in Iru, near the capital. It uses almost all the household waste of the country (250 000t of 300 000t) and produces electricity and heat for the nearby district heating network.

8.2.7. Other natural resources

Provide information about any other natural/renewable resources usable for energy production.

There is uranium ore in the ground, but it is found that it is not environmentally nor economically feasible to mine it.

8.2.8. Restriction through protected areas

Are there environmentally protected areas, which are not available for REN facilities or restrict the overall potential?

15% of the Estonian land mass is to some extent environmentally protected. Many of those areas are located on the coast, which would be in theory also a potential location for example for wind turbines.

9. Energy efficiency – status and potential

What is the status of the implementation of the Energy Efficiency Directive?

The estimated amount of energy savings to be achieved over the obligation period in Estonia is 7140 GWh (2014-2020). Currently this plan is implemented on schedule.

What is the status of the implementation of the Energy Performance of Buildings Directive (e.g. data on low/zero energy buildings)?

It is implemented in Estonia. Newly built buildings have to meet minimum energy efficiency criteria to get accepted. These criteria get more demanding every year until 2020.

Analyse the sectors:
Households: Are energy efficiency measures implemented in this sector? Are there awareness campaigns to highlight the potential? Is there support for the implementation (financial and non-financial)?

There are some frequent awareness raising campaigns to motivate households to save energy. The household sector is directly influenced by subsidies for the renovation of residential buildings.

Service sector: Are energy efficiency measures implemented in this sector? Are there awareness campaigns to highlight the potential? Is there support for the implementation (financial and non-financial)?

There are currently no energy efficiency measures specifically targeted for the service sector.

Industry: Are energy efficiency measures implemented in this sector? Are there awareness campaigns to highlight the potential? Is there support for the implementation (financial and non-financial)?

The industry implements energy efficiency measures largely by themselves to be competitive. There are innovation grants by the NGO Enterprise Estonia for enterprises to improve efficiency. These grants support enterprises in cooperation with universities to develop plans to innovate production.

Transportation: Are energy efficiency measures implemented in this sector? Are there awareness campaigns to highlight the potential? Is there support for the implementation (financial and non-financial)?

The efficiency of the transport sector is supported with an electro-mobility programme that established a countrywide loading network for electric cars.

Give an estimate of the trend in energy efficiency development using values from -5- to +5 where (-5 is a strong reduction, 0 means neither growth nor reduction, +5 strong growth).

There are subsidies to renovate and improve the energy efficiency of the building stock. For both, individual dwellings as well as for apartment buildings.

Demand side management, smart metering and storage

All electricity consumers in Estonia have automated remote metering. Demand side management gets more widespread as home automation systems are implemented.

10. SWOT analysis

Please make a SWOT-analysis for the development of your region towards a low-carbon economy in 2050. Include stakeholders in the process.

Strengths

- Good statistical monitoring
- Desire to have a progressive image
- High environmental awareness
- Secured domestic energy supply
- High level of technological education and practical know-how
- Good connection with neighbouring countries
- Open mind to innovation and implementing new technologies
- E-Estonia.

Weaknesses

- Heavy dependence on one fossil resource (oil-shale)
- No significant alternative resource (i.e. hydro) for balancing
- Legally binding development plans in energy sector are not followed consistently
- Weak political and public support
- No clear vision on low-carbon economy in Estonia
- Low domestic investment capacity of public and private sector
- Objective technological know-how is insufficient, private sector holds lot of the know-how
- Limited human capacity in sectorial development participation (both national and EU level)

Opportunities

- High potential for wind energy
- Good biomass (forestry, agriculture) resource
- Using the existing smart metering system
- Well-developed infrastructure
- Increasing energy efficiency in public and residential buildings
- Increasing resource efficiency in private sector
- Active participatory democracy
- Expanding electromobility
- Positive effect of biomass production on regional development
- International co-operation projects give input to regional development and R&D.
- Positive impact of successful implemented (renovation) projects.
- High environmental awareness is good base for development of public awareness and support to low-carbon economy

Threats

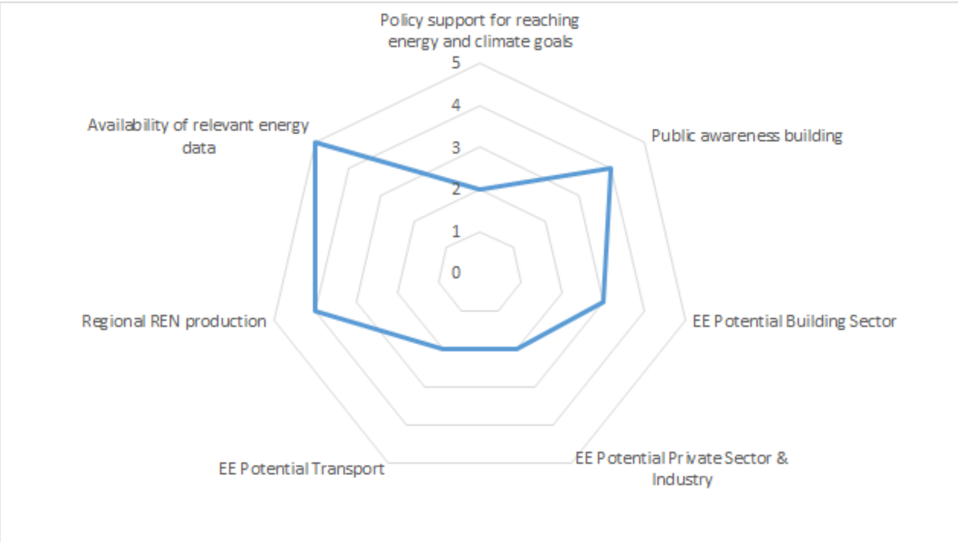
- Threat to energy security - fossil energy production is concentrated near Russian border
- Frequency regulation relays on the Russian energy system
- The regional political stability could be threatened when jobs in the fossil energy based industry decrease.
- Low political acceptance of participatory democracy in some sectors
- Limited regional market and production capacity
- Secured (fossil) energy supply impedes innovation and progress
- Development of subsidised energy system is not sustainable
- Project-based R&D. Projects often financially not sustainable in long-term.

Assess the following trends:

- Policy Support for reaching energy and climate goals
- Public awareness building
- EE Potential Households
- EE Potential Private Sector & Industry
- EE Potential Transport
- Regional REN production
- Availability of relevant energy data

Self-assessment:

Points:
1 … no measures set/ potential unused
to
5 … fully developed/ potential fully used



11. Annex: List of sources /bibliography /List of relevant stakeholders/institutions in the region

Please include your sources/bibliography, a list of identified stakeholders, etc

Sources:

a) Energy Yearbook of Estonia 2016: http://www.taastuvenergeetika.ee/taastuvenergia-aastaraamat-2016/
b) TTU. 2008. Tallinn University of Technology Department of Thermal Engineering. Technology studies and implementation of technologies of biomass in Estonia. Final report. [Biomassi tehnoloogiauuringud ja tehnoloogiate rakendamine Eestis. Lõpparuanne].
c) Energiatalgud.ee, website for energy statistics and future scenarios: https://energiatalgud.ee/
d) Estonian Statistics Bureau, www.stat.ee
e) Wind speeds in Estonia: http://www.taastuvenergia.ee/tuule-kiirus.html
f) https://tradingeconomics.com/estonia/gdp
g) https://ec.europa.eu/energy/sites/ener/files/documents/article7_en_estonia.pdf
h) http://www.diislikeskus.ee/puit58.html

Stakeholders:

a) Estonian Renewable Energy Association
b) Estonian Biogas Association
c) Estonian Biomass Association
d) Estonian Wind Power Association
e) The Foundation Private Forest Centre (Erametsakeskus)
f) MTÜ Eesti Pottsepad (NGO Estonian potters)
g) City of Tartu
h) Eesti Energia
i) Ministry of Economics and Communications
j) Ministry of Environment
k) Union of Estonian Automobile Enterprises
l) University of Tartu
m) Tallinn University of Technology
n) Estonian Research Agency
o) Märja Monte OÜ
p) SEI Tallinn
q) Hendrikson & Ko
r) Fortum
s) Graanul Invest

REGIONAL ENERGY PROFILE

Region: Borsod-Abaúj-Zemplén and Heves

PANEL 2050 – Partnership for New Energy Leadership 2050
Deliverable 3.1 , English version

By: **WWF Hungary**

Date: 126.06.2017

Horizon 2020
European Union funding
for Research & Innovation

Table of Content

1. Methodology

The PANEL 2050 project has the aim to create durable and replicable sustainable energy networks at local (municipality/community) level, where relevant local stakeholders collaborate for the creation of a local energy visions, strategies and action plans. The aim of these networks is to contribute to and actively work for the transition towards low carbon communities in 2050.

The PANEL 2050 partnership will provide support for the creation of first successful local energy networks in the CEE countries. In the course of the project, organisations from 10 CEE countries will collaborate on creating regional energy strategies and action plans.

The present Regional Energy Profile was prepared in order to get a better understanding of the energy-related status quo in Borsod-Abaúj-Zemplén and Heves county, analysing strengths and challenges with regard to the transition towards a low carbon community.
This energy profile constitutes the groundwork for the preparation of a Regional Energy Roadmap and related Action Plans and will be essential for the communication with regional stakeholders.

For completing this Regional Energy Profile the sources listed in chapter 11. were used.

2. General introduction of the region

Name of the region and NUTS identification

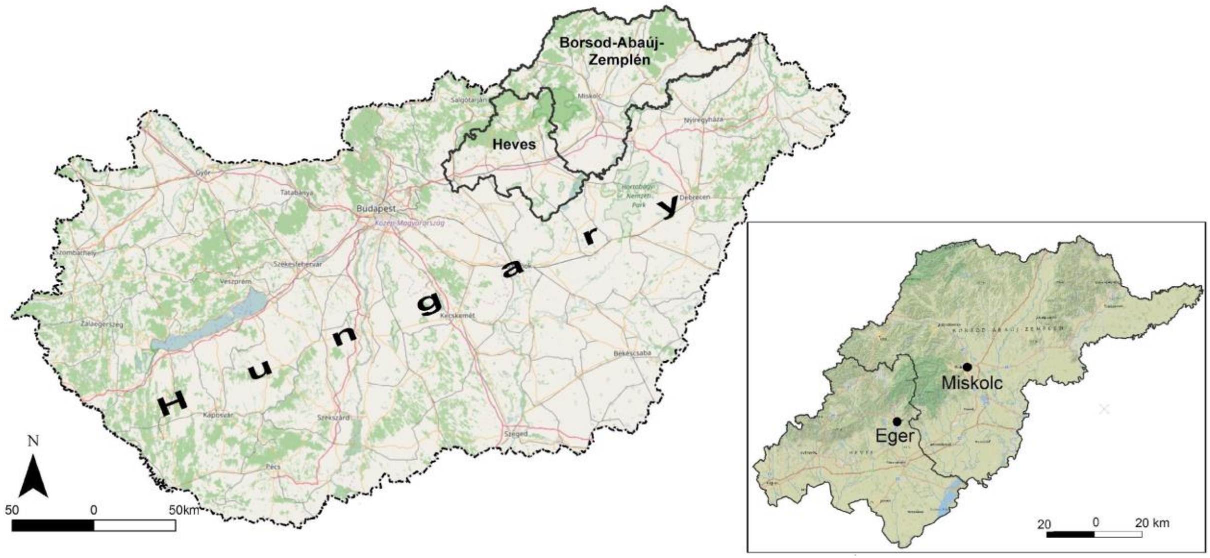
Introduction: originally the Hungarian model region was only Borsod-Abaúj-Zemplén county (further on BAZ conty), however, in the meantime - by reason of language barriers - it revealed that the extension is necessary in order to reach the planned number of forerunners, and also, due to the extension of the scope more adequate stakeholders can be involved and more stronger network can be built. Bearing in mind the data availability, the most logical step was to involve another neighbouring NUTS3 region. In this process Heves county was chosen, since the two regions have similar natural, social and energy profile within the mining and utilization of the worst quality fossil fuel, the lignite is still a significant phenomenon, which means that this two "high-carbon" regions are good models to achieve a low-carbon transition.

The name of the regions: Borsad-Abaúj-Zemplén, Heves
NUTS level: 3

Geography and policy:

Describe the location of the region + provide also a political map showing location of the region in your country

The two regions are situated in the north-eastern part of Hungary bordering Slovakia. Heves County consist of 7 subregions (LAU 1) and 121 municipalities (LAU 1), while in case of BAZ county these numbers are 15 (LAU 1), and 358 (LAU 2), respectively. The capital of Heves is Eger (54 867 inhabitants), and of BAZ is Miskolc (163 939 inhatitants).



Geography of the region, including morphology, geology, climate, hydrology, flora and fauna related to energy (text description)

Morphology: the region is geographically diverse area. The northern part mainly mountainous (the Mátra (peak 1014 m) in Heves and the Bükk (peak 961 m) in BAZ county is the two highest mountain ranges in Hungary), while the plain at south is part of the Great Hungarian Plain. From the south-east it is bordered by river Tisza, the second significant river in the Carpathian Basin after Danube.
Geology: in the area of Miskolc, Salgótarján and Ózd, basins with sub-bitominous coal from the Miocene were discovered in the 18th century. The moderate amounts of resources are almost

completely mined. In the area of Bükk Foothills and Miskolc Foothills significant lignite resources from the Pliocene exist close to the surface where opencast mining is in process. In the plain the lithosphere is thinner than the average; therefore the geothermal gradient is higher. Moreover, the thermal water capacity is also significant; therefore the utilization of the geothermal energy is affordable.

Climate: the mountainous part belongs to climate zone of the Northern Hungarian Mid-Mountains, where the mean annual temperature (20-22,5 °C), the annual precipitation (550-700 mm) and the annual sunshine hours (1850-1950) are below the country-average. However, because of the diverse morphology significant differences can be experimented. The plain are is belongs to the climate zone of the Great Plain where the mean annual temperature is varies between 23-24,5 °C. The annual precipitation and annual sunshine hours in the north part is similar to the mountainous area (550-700 mm, 1900-2050 hours/a) and the winter is more cold then in the south part, where the annual precipitation is lower (500-550 mm), but the amount of the annual sunshine hours is higher (2000-2150). The prevailing wind direction is NE-N in the east part, and NW in the west part. The average wind speed is 2-4,5 m/s in 75 m.

Hydrology: the rivers crossing the region (Hernád, Sajó) have small discharge, however in the mountainous area small-scale energy utilization is possible (e.g. Felsődobsza). Tisza - whose discharge is more significant – reaches the region in the plain area; therefore the energy utilization is limited (e.g. Kisköre).

Flora: the natural flora follows the diversity of the morphology, however it mainly remain in natural protected area because of the intensive land-use. Two-third of the forest area (24,5% of the region) is covered by indigenous species (beech, oak), while the foothills areas are dominated by maple. The plain area covers mainly by plough land. The floodplain areas were reduced artificially; indigenous forests exist only in some areas.

Brief history overview of the region – state the most important milestones related to the industrial / regional development (e.g. significant energy projects, power plants, etc.), ideally related to energy

Before the regime change the region was a thriving area of the Hungarian heavy industry. After its collapse, the energy consumption decreased significantly. In the region subsurface brown coal mining has been completely abandoned since 2006, however, lignite mining is continued even at present, and the lignite power plant cover the ~10-15% of the total national electricity generation. The annual lignite yield is more than 9 million tons. Also, some smaller open-pit brown coal mines also also operating in the region.

The natural gas pipeline was built from the 80s until the beginning of the 2000. Only 59 small villages are not part of the grid, mainly in the Northern part of BAZ County. Altogether 72% of the households are connected to the natural gas grid. The remaining population – mainly with low income – still use old furnace fuelled by firewood and/or lignite and waste. Almost the whole population has access to the electricity grid.

Public administration procedure – brief profile of current energy planning process in your region starting from the national level down to the region (see also your desk research within WP3.1)

The level of the energy planning process is almost exclusively in on national level. There are regional strategies, regulations on NUTS 3 level (environmental protection program, territorial plan), however, these documents are mostly shows the regions preferable development way, but there are no tools for the implementation.

Highlight significant characteristics differentiating region from others and give short (!) introduction of energy targets and challenges in the region

The region traditionally attached to the coal and lignite utilization comparing to the neighbouring area. However, the naturally diverse area has great potential of renewable energy sources, which share of the energy mix is still minor (notwithstanding the fire wood utilization which mainly used in old furnace with low efficiency). The barrier of the renewable energy transition is mainly the economic and legislative environment, however, the lack of knowledge is also an important factor.

3. Basic demographic data and figures

Regional demographic indicators:

Population of region	959 765	cap
Area of region	10 887	km²
Population density	88,2	cap/km²
Number of individual municipalities	479	mun.

Data from 2015

Basic demographic data

Population growth, age distribution in last 20 year – text description

In the last examined 20 years (1996-2016) the decrease of the population was significant: while in 1996 the total number of inhabitants was 1074 thousands, in 2016 960 thousands. This decrease in BAZ County (-11% from the 1996 data) was higher than in the case of Heves (-9%). The population pyramid follows this trend: while the population over 60 years of age in 1996 was 19% (BAZ), and 21% (Heves), respectively, in 2016 this numbers are 25% and 27%. Parallelly, the population under 15 decreased from 20% to 16% (BAZ) and 17% to 14% (Heves).

Socio-economic development of past 3-5 years

	Heves	Borsod-Abaúj-Zemplén	
Unemployment rate	8	9,1	%
Average annual income per capita (gross)	7735	7867	EUR

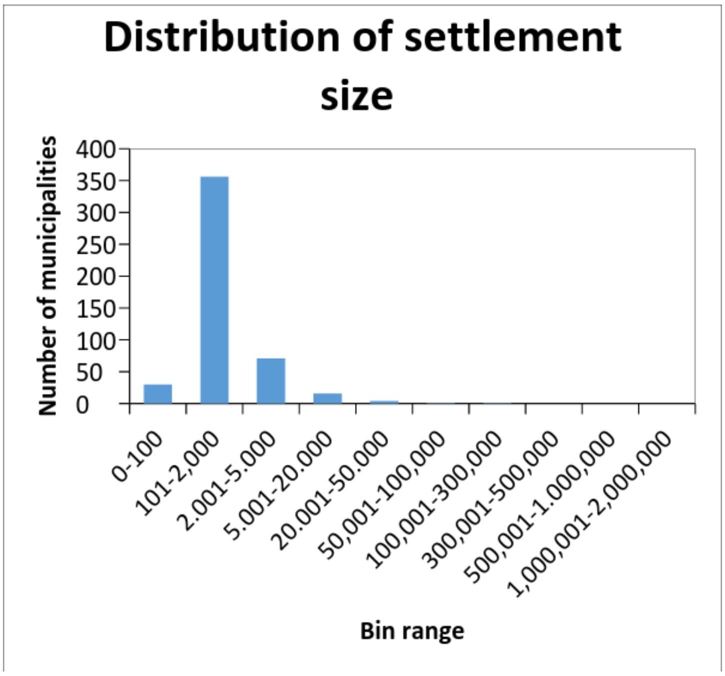
difference from the EU average (34.500 EUR gross annual earning)	-22,1%	-22,8%	%
Share of employees in agriculture industry services		 5,3 36,2 58,5[1]	 % % %
Share of population with tertiary education	12%	14,2%[2]	%

Text description for figures above

The unemployment rate decreased in the last years – mainly because of the public employment programmes, however, it is still above the national average (6,8%). The average annual income per capita is 65% of the national average in BAZ County, 70% in Heves County. The share of employees in the agricultural sector is the same as the national average, however, the share of the industrial sector exceeds the national average with 6,4%. The share of population with tertiary education is slightly higher in BAZ County (14,2%) than in Heves County (12%), however, significantly lower than the national average (18,2%).

The spatial distribution of the population, level of urbanisation

There are 40 cities in the region (municipalities which have particular administrative and legal status), where 57,1% of the population lives. As the histogram shows, the majority of the municipalities are settlements with population less than 2000.



[1] data for North-Hungary, which includes a third NUTS3 region (Nógrád) (2012)
[2] population over 20 years

4. Regional economy and economic trends

Regional economic indicators:

	Heves	Borsod-Abaúj-Zemplén	
GDP, total	2354	5155	million EUR
GDP per capita	7735	7867	EUR/cap
HDI	0,786	0,789	

Data from 2015

GDP per economic sectors:	Heves	Borsod-Abaúj-Zemplén	**Average(weighting with total GDP)**	
Agriculture	5,6	5	5,2	% of total GDP
Industry	42,2	40,4	41	%
Services	52,2	54,6	53,8	%

Data from 2015

Regional economy

Please provide information about the regional economy, past development and trends using GDP and other indicators. If available, include graphs about GDP / HDI development of last 10-20 years.

The former favourable socio-economic situation of the region– as leading heavy industry and mining centre – collapsed after the change in the political system in 1989. Structural change in industry has not ensued – people – the majority of those who could at all –mainly found employment in services and as public employees, and only few in industry and agriculture.

	Heves	**Borsod-Abaúj-Zemplén**		
number of operating entrepreneurs (SMEs, large and individual)	1662	3297		
❼ share of SMEs	96,7	97		% of total number of operating businesses
number of operating nonprofit organisations	2007 (1775 NGO)	3644 (3164 NGO)		
Amount of EU funds (2007-13)	600	1366		million EUR

What are the main contributors/contributing sectors to the regional GDP? How stable are these sectors (qualitative assessment)?

In spite of the collapse of the heavy industry, the industrial sector is still significant: while it contributes the 40,4-42,2% of the GDP in the region, on national level this rate is only 30%. On the contrary, the share of the service sector is 52,2-54,6% in the region (the national rate is 65,4%).

Describe the regional job market, employment/unemployment rates per sectors – agriculture and forestry, industry, services

After the collapse of the heavy industry, the majority of the unemployment people were from the industrial sector. The sectorial change – even within the industrial sector – resulted new job opportunities, which slowly started to decrease the unemployment rate.

Importance of trade; Import/ export balance, if available

No available data.

5. National and local energy strategies

List of relevant and most influencing strategies / roadmaps / measures to local energy situation or development

Brief description of currentsituation on national, regional and local level in the field of energy planning including fullfilment of EU directives	legal requirement OR voluntary initiative	National/ regional/ local level	Original title + link (if possible)	English title + brief description	Organisation in charge	Type
The Directive 2012/27/EU on Energy Effieciency is implenteted in Hungary by the 2015/57th law on Energy Efficiency. The Hungarian parilament adopted it in May 2015, in the last moment before the EU would have start the infringement procedure. The law delegates the implementation to two national strategies: National Energy Efficiency Strategy and National Building Energy Performance Strategy.	Legal requirement	NUTS I	2015. évi LVII. törvény az energiahatékonyságról http://net.jogtar.hu/jr/gen/hjegy_doc.cgi?docid=A1500057.TV	2015/57th law on Energy Efficiency	Government of Hungary Hungarian Eenergy and Public Utility Regulatory Authority (Magyar Energetikai és Közmű-szabályozási Hivatal)	EE
Energy Efficiency Based on Article 3 of the EED, the indicative target notified in April 2013 for 2020 under the joint effort scenario was 1 113 PJ (expected value of primary energy use). That energy use forecast was notified on the basis of the Energy Strategy, based on 2008 data. During the period since the drawing up of the National Energy Strategy, economic growth has been significantly lower than originally expected, which resulted in lower energy use. According to information by the KSH and the Hungarian Energy and Public Utility Regulatory Authority, factual data for 2012 show a value of 992 PJ for primary energy use, which represents 12 % decline in the primary energy demand compared to the 2008 initial data of the Energy Strategy. On the basis of values in 2012, taking into account current	Legal requirement	NUTS I	Magyarország Nemzeti Energiahatékonysági Cselekvési Terve 2020-ig In Hungarian: http://www.kormany.hu/download/1/25/80000/IIINemzeti%20Energiahat%C3%A9konys%C3%A1gi%20Cselekv%C3%A9si%20Terv_HU.PDF In English: https://ec.europa.eu/energy/sites/ener/files/documents/hungary	3rd National Energy Efficiency Action Plan (Hungary's National Energy Efficiency Action Plan until 2020)	Ministry of National Development	EE, EPB, RES

trends, GDP forecasts and proposed energy efficiency measures and based on Government Resolution No 1160/2015 of 20 March 2015 on updating the energy consumption forecasts of the National Energy Strategy, the target value of primary energy consumption in 2020 is 1 009 PJ (under the 'joint effort' scenario). The target value for final energy consumption is 693 PJ. Accordingly, the expected value of gross final energy consumption (the difference between primary energy consumption, conversion, calculation and grid losses and non-energy uses) in 2020 is 603 PJ/year.			ActionPlan2014_en.pdf			
The National Building Energy Performance Strategy follows the requirements of the Directive 2010/31/EU. **Strategic objectives:** • Harmonisation with the energy and environmental objectives of the EU • Modernisation of buildings as a means to reduce the utility costs of the population • Cutting back on budgetary expenses • Reducing energy poverty • Creating jobs • Reducing greenhouse gas ('GHG') emissions **Specific objectives** • The energy savings to be achieved by 2030 should be in line with the relevant energy efficiency requirements set in the National Energy Strategy 2030. • 2020 targets for energy savings from improved building energy performance should be defined on the basis of calculations made with the current condition of the building stock, the requirements applicable to the different building types, the technical modernisation tasks needed to meet these requirements as well as the costs this involves and the available Government and other resources taken into account. • Having regard to Directive 2010/31/EU of the European Parliament and of the Council of 19 May 2010 on the energy performance of buildings, Decree No 20/2014 of 7 March 2014 of the Minister for the Interior amending Decree No 7/2006 of 24 May 2006 of the Minister without Portfolio determining the energy performance characteristics of buildings (the 'Energy Performance Characteristics Decree') provides that, from 1 January 2015, the values corresponding to cost-optimal energy efficiency levels are applicable in the case of support granted under domestic or EU tenders or from the central budget for the improvement of the energy performance of buildings falling within the scope of the Energy Performance Characteristics Decree. • Pursuant to the Energy Performance of Buildings Directive, it will be binding upon Member States to meet nearly zero-energy building ('NZEB') standards for new buildings as from 1 January 2021 and for new public buildings as from 1 January 2019. This means that NZEB requirements will apply whenever a new building is constructed instead of renovating existing buildings. • For public buildings, the obligation laid down in Article 5 of Directive 2012/27/EU, pursuant to which 3 % of the total useful floor area of heated and/or cooled buildings over 500 m2 owned and occupied by the central government of Member States should be renovated each year, must also be observed. That threshold shall be lowered to 250 m2 as of 9 July 2015.	Legal requirement	NUTS I	Nemzeti Épületenergetikai Stratégia In Hungarian: https://ec.europa.eu/energy/sites/ener/files/documents/EU%C3%81T_164_2_2105_Nemzeti%20%C3%89p%C3%BCletenergetikai%20Strat%C3%A9gia%20150225%20pdf.pdf In English: https://ec.europa.eu/energy/sites/ener/files/documents/2014_article4_hungary_en%20translation.pdf	National Building Energy Performance Strategy	Ministry of National Development	EE, EPB, RES

The strategic goals of the National Energy Startegy are: • Energy efficiency measures spanning the entire supply and consumption chain; • Increasing the share of low CO2-intensive electricity generation based primarily on renewable sources of energy; • Promoting renewable and alternative methods of heat generation; • Increasing the share of low CO2-emission modes of transport. The National Energy Strategy delegates the implentation of its goals to the following strategies: • Energy and Climate Awareness Action Plan • Power Plant Development Action Plan • Energy Resource and Stock Management Action Plan • District Heating Action Plan • Energy Industry Development and R&D Action Plan		NUTS I	Nemzeti Energiastratégia In Hungarian: http://2010-2014.kormany.hu/download/4/f8/70000/Nemzeti%20Energiastrat%C3%A9gia%202030%20teljes%20v%C3%A1ltozat.pdf In English: http://www.terport.hu/webfm_send/2658	National Energy Strategy	Ministry of National Development	EE, RES
The District Heating (Development) Action plan is currently a draft documentum under public debate. The action plan's core aims are the following: • Increasing public health situation in urban environments • Greening district heating systems • Increasing energy efficiency by technological development and public awarness raising	Legal requirement	NUTS I	Távhőfejlesztési Cselekvési Terv 2030	District Heating Action Plan	Ministry of National Development Hungarian Eenergy and Public Utility Regulatory Authority (Magyar Energetikai és Közmű-szabályozási Hivatal)	EE, EPB, RES
Under the EU Directive 2009/28/EC member countries of the European Union are obliged to draft and submit to the European Commission National Renewable Action Plans (NREAPs) outlining pathway which will allow them to meet their 2020 renewable energy, energy efficiency and GHG cuts targets. Hungary 2020 renewable energy targets: • Overall target: 14.65% of share of energy generated from renewable sources in gross final energy consumption; • Heating and cooling: 18.9% of heat consumption met by renewable sources; • Electricity: 10,9% of electricity demand met by electricity generated from renewable energy sources; • Transport: 10% of energy demand met by renewable energy sources; In order to achieve above enlisted targets Hungary implements and runs number of programmes supporting deployment of renewable energies financially, fiscally and also by creating appropriate legislation and administrative framework: • Feed-in tariff, • Various fiscal incentives; • Promotion of pilot projects; • Trainings for installers;		NUTS I	Magyarország Megújuló Energia Hasznosítási Cselekvési Terve In Hungarian and English: https://ec.europa.eu/energy/sites/ener/files/documents/dir_2009_0028_action_plan_hungary.zip	Renewable Energy Utilisation Action Plan	Ministry of National Development	RES

The Directive 2010/31/EU on energy performance of buildings was implemented in 2015 by 2 governmental regulations. The regulatiopns follwing the the directive but there are no additional voluntary initiatives in them.	Legal requirement	NUTS I	Az egyes építésügyi és területrendezési tárgyú kormányrendeletek módosításáról szóló 105/2012. (V. 30.) Korm. Rendelet http://net.jogtar.hu/jr/gen/hjegy_doc.cgi?docid=A0800176.KOR Az épületek energetikai jellemzőinek meghatározásáról szóló 7/2006. (V. 24.) TNM rendelet módosításáról szóló 40/2012. (VIII. 13.) BM rendelet http://net.jogtar.hu/jr/gen/hjegy_doc.cgi?docid=A0600007.TNM		Ministry of National Development	EPB
The National Development and Territorial Development Concept is the highest level regional development of Hungary. Regarding energy the concept aims: • Reducing energy dependency • Development of local energy supply • Increasy general energy efficiency • Reduce energy powerty	Legal requirement		Nemzeti Fejlesztés 2030 - Országos Fejlesztési és Területfejlesztési Koncepcióról http://www.terport.hu/webfm_send/4204	National Development and Territorial Development Concept	Ministry for National Economy Ministry of National Development	EE, RES
In general local (county level (NUTS III) and municipality level (LAU2)) governments' role in planning and development is limited. The regional development programmes are more like the region's or the municipality's preferable development pathway than a binding startegy.	Legal requirement	NUTS II	Borsod-Abaúj-Zemplén Megye Környezetvédelmi Programja	Environemntal Protction Programme of Borsod-Abaúj-Zemplén megye	Local Government of Borsod-Abaúj-Zemplén megye	EE, RES
			Borsod-Abaúj-Zemplén Megyei Területrendezési Terv	Territorial Plan of Borsod-Abaúj-Zemplén megye	Local Government of Borsod-Abaúj-Zemplén megye	RES
			Heves Megyei Területrendezési Terv	Territorial Plan of Heves megye	Local Government of Heves megye	RES
The Assiation of Climate Friendy Municipalities is a voluntary initiative with more than one hundred members aiming to help municipalities to solve climate change related problems.	Voluntary initiative	Local level	Klímabarát Települések Szövetsége	Association of Climate Friendly Municipalities	Klímabarát Települések Szövetsége	EE, RES, Adaptation

6. Energy Production

6.1. *Conventional energy production capacities (fossil fuels and nuclear power)*

Give an overview of energy production by fossil fuels and nuclear power plants – concentrate on the most significant 3 to 5 power plants.

Name & Location (city, town)	Owner	Year of commissioning (refurbishment)	Type of plant & fuel	Capacity in MW	Annual energy production in MWh	Annual CO_2-emissions in t	Utilization rate (qualitative assessment)
	[choose: Public / private SME / private large enterprise]			[state: electr. and/or heat]			[choose: Constantly used / sometimes / seldom / to be decommissioned]
Mátrai Power Plant [1] - Visonta	private and state-owned large enterprise (51% RWE (German), 22% EnBW (German), 22% MVM (Hungarian Electricity Private Limited Company – state-owned)[3]	1969-1972 (1998-2000	lignite and biomass (8%), natural gas	882 lignite + 66 natural gas	6 179 000 [2]	6 483 882 [3]	constantly used (~ 72-73% capacity factor) [4]
Tisza II. Tiszaújváros [5]	private large enterprise (IFC)	1978	natural gas	900	0	0 [4]	to be decomissioned
Lőrinci Power Plant [6]	Public (MVM (Hungarian Electricity Private Limited Company – state-owned)	2000	fuel oil	173	3 030	2 499 [3]	seldom (0,2% capacity factor)
Sajószöged Power Plant[6]	Public (MVM (Hungarian Electricity Private Limited Company – state-owned)	1998	fuel oil	121	2073	2591	seldom (0,2% capacity factor)
BorsodChem	private	2001	natural	80 t/h +	667 000	285 753	constantly used

[3] The RWE would like to sell ist part but currently there is only rumours about the new potential owner.

industrical CHP [7] - Berente	large enterprise		gas	50 MW	MW_{th} (no data about the electricity production)	(thermal heat)	
TVK industrial CHP [8] - Tiszaújváros	private large enterprise	2003	natural gas	35		168 445 (thermal heat) [3]	constantly used

Add additional details to describe the conventional energy production capacities in the region. What are current trends? What influence have age, regional economy, fuel imports, and fuel prices on the current status?

The Hungarian electric power system is highly centralized. Beside of Paks Nuclear Power plant (which covers ~ 40% of the electricity demand), the second biggest power plant is the Mátra Power Plant which corresponds to around 15% of the generated electricity. However, in terms of CO2 emission, it is the top one in Hungary: 10% of the emission of Hungary derives from the power plant. It fuelled by low-quality lignite (with high moisture and sulphur content) and operates with low efficiency. The I. block (100 MW) will be decommissioned in 2020, the II. block (also 100 MW) in 2023. According to the plan of the current owners, the three other blocks (one 220 MW and two 232 MW) will operate in the next 10 years. However, from 2021 there will be a stricter air-pollution limit, which questions the relevance of these three blocks. A new 500 MW block is under licensing procedure, however, the environmental impact assessment in now under court proceeding, and it is likely that in can be only start to operate only when the existing blocks will be decommissioned.

The Mátra Power Plant also sells lignite for the residential sector. In 2015, the amount was 370 thousand tons [9]. The calorific values varies between 8-9,2 MJ/kg.

The Mátra Power Plant (source: mert.hu)

The Tisza II. power plant is under decommission because of its age and low efficiency, however, due to high oil price, the more modern power plants are only functioning as back-up capacities (with 0,2% capacity factor).

6.2. *Renewable energy production*

Energy production capacities

Give an overview of energy production by renewable energy capacities (e.g. small/large hydro, solar PV, solarthermal, biomass, geothermal & other production capacities – concentrate on the most significant 3 to 5 power plants or aggregation of production facilities.

Name & Location (city, town)	Owner	Year of commissioning (refurbishment)	Type of plant & fuel	Capacity in MW	Annual energy production in MWh	Annual CO_2-emissions in t	Utilization rate (qualitative assessment)
	[choose: Public / private SME / private large enterprise]			[state: electr. and/or heat]			[choose: Constantly used / sometimes / seldom / to be decommissioned]
Kisköre Hydroelectric Power Plant [10]	Public	1974	hydro	26,6	118 460 [11]	0	constantly used
Kesznyéten [11]	Public	1944	hydro	4,4	20 680	0	constantly used
Kistokaj [12]	Private large	2013	geothermal	50-60 MW_{th}	216 666 (thermal heat)		constantly used
Miskolc biomass heating plant	Public and private SME (MIHŐ Miskolci Hőszolgáltató Kft. andWIS Holding Zrt)	2010	biomass	3 MW_{th}			constantly used
Mátrai Power Plant	private large enterprise (51% RWE (German), 22% EnBW (German), 22% MVM (Hungarian Electricity Private Limited Company – state-owned)[4]	2015	PV	16 MW	20 000 – 23 000 [13]	0	constantly used

[4] The RWE would like to sell ist part but currently there is only rumours about the new potential owner.

Add additional details to describe the renewable energy production capacities in the region. What are current trends? What influence have age, regional economy, fuel availability or renewable energy potential, and subsidy systems on the current status?

Biomass

The biggest biomass consumer in the region is the Mátra Power Plant which applies co-firing. In the case of the biomass the maximum rate is 20% in terms of heat production (because of technical barriers), in the case of solid waste it is 5% in terms of weight (regulatory limit). Becase of the regulation the rate is rate of the biomass is now 8%. The amount of co-fired materials now is 360 000 t annually, but according to the plan of the power plant it will grow to 400 000 t (there is no splitting to biomass and waste). The source of the used biomass is corn stalk, straw, seed-coat, mushroom compost, sunflower stalk, and wood chips. The source of the latter is the power-plant-owned energy plantation plans, waste from timber industry and tree pruning, but no forestry biomass. Since the biomass sources are lower-quality, calculating with the heating value of 13 MJ/kg, the utilized energy content of the biomass is around 1 444 GWh.

In the previous EU programming period (2007-2013) funds were available for biomass furnace for municipalities and companies. In the frame of these projects, small-scale biomass-based furnaces were installed in several municipalities. Mostly fuelled by wood chips, but in some cases by straw (in agricultural areas e.g. Bőcs).

At the left: staw-fired furnace provides heat to the public buildings in Bőcs. At the right: wood-chips furnace in Bükkszentkereszt (source: Adam Harmat)

In Miskolc Heating Plant with 3 MW_{th} (annual biomass demand 4 500 t) provide heat to 918 block of flats, 18 public buildings and to an industrial building [14].

Biomass heating plant in Miskolc (source: Miho.hu)

The firewood on household level is a significant energy resource. There is no regional or national statistic publicly available about the firewood utilization. However, until March, 2017 the residential based biomass utilization did not count on the share of the renewable energy sources in the final energy consumption. But the Hungarian Statistical Office recalculated the share – this time including the household level biomass utilization as well. The rate of the renewable energy according to the original calculation was 9,6% in 20145, the recalculated is 14,6% [15]. Since the final energy consumption in 2014 was 742 591 TJ, it means that 37 129 TJ was the firewood utilization (with 20% moisture content is 3,8 million m^3 wood, which correlates with the forestry statistical data, which says in 2014 the gross felling volume was 7,5 million m^3 [16] , and around – depending on the market – half or the felling wood will be used for energy production.

There is no regional statistical data about the residential based firewood utilization, however, as it is calculated in chapter 7.1, the primary heat consumption of the household sector is 4 865 GWh annually, and statistical data is existing about the natural gas consumption of the household sector which was 2 519 GWh in average of 2011-2015, the average annual consumption of the district heating sector was 461 GWh between 2011 and 2015, respectively. The rest uncovered heat demand is 1 884 GWh. There is no data that how big part of the sold lignite is fired in the region. If we assume 75%, it means that around 280 thousand tons of lignite is utilized in the region, which is ~ 650 GWh. The rest heat demand (1230 GWh) is likely covered by biomass – if the heating with residential waste is ignored. In volume it is around 455 thousand m^3, which means that 12% of the total firewood in the country was utilized in the region.

Biogas

The biogas utilization is very under-developed in the region. Animal manure based biogas utilization only existing in two animal breeding facilities in Onga (500 kW) [17] and in Harsány (1189 kW_e, 1177 kW_{th}). Beside of that, biogas are produce based wastewater treatment facilities, in Gyöngyös, Kazincbarcika and Miskolc. And also in Miskolc a municipal solid waste-based biogas power plant is in operation, which is the only one from this type of biogas plant in the region.

The fermentors of the biogas power plant in Harsány. Source: [18]

Hydro

The biggest hydro power plant in Hungary is operating in the region (Kiskore Hydroelectric Power Plant). Beside of that, there are only a few small-scale hydro power plant (Gibárt – 500 kW, Felsődobsza – 1 MW [19], Bódva - 30 kW [20].

The Kisköre hydro power plant. Source: [21]

Solar

The forerunner of the PV utilization was one of the Leader community in the region (Bükk-Leader, consists 42 municipalities), with the help of EU funds they installed 23 small-scale PV (3-5 kW,) and parabolic PVs as well in the previous EU period. In the last few year the penetration of the solar energy is increasing in Hungary. However, the environmental protection fees is the highest in the EU, 0,37 €/kg. In 2015 in the area of the electric utility company ÉMÁSZ (the region covers around the two third of its hole service area) the sum-up installed capacity of residential PV was 16 MW [22], however, in the last two years the installation of PV panels continuous to rise steeply.

Geothermal

There is only one geothermal heating plant in the region. The Kistokaj geothermal plant has 2 geothermal well, with a depth of 1500-2300 m and the outlet water temperature is 95-105 °C. It corresponds to the 54% of the heat supply of the biggest city in the region, Miskolc through its district heating system [23].

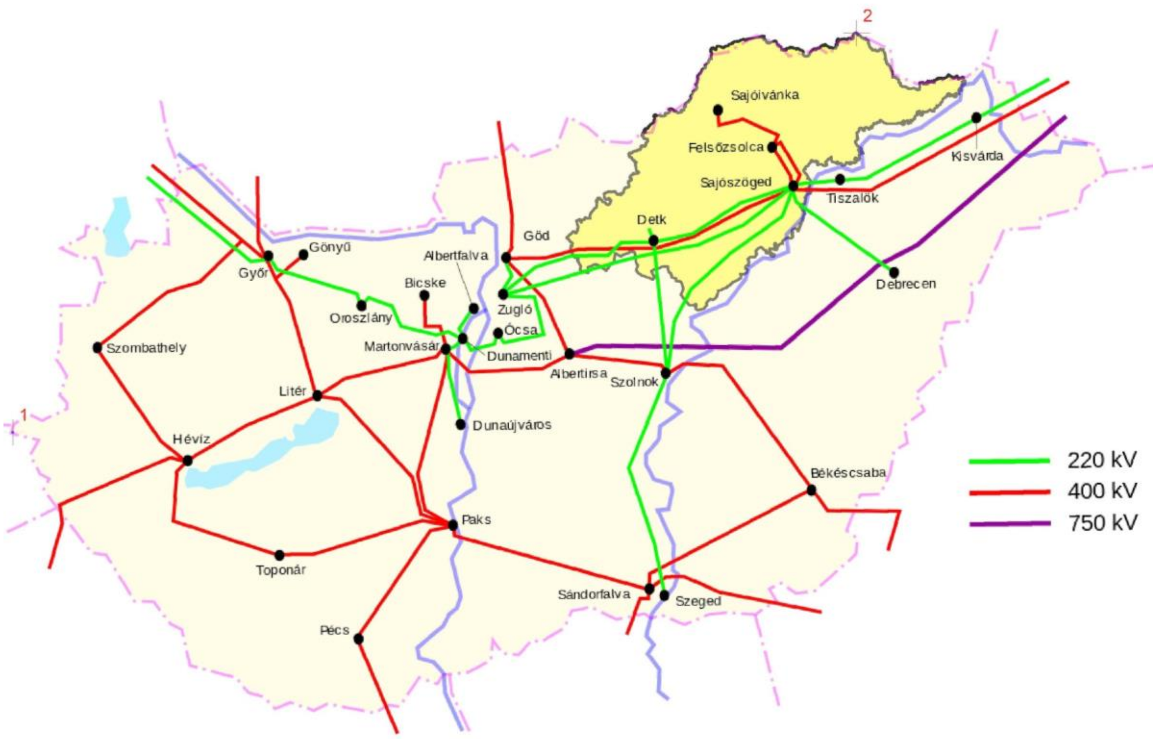
Wind

According to the a new Hungarian law no wind turbine can be built within a 12 km buffer zone of any built-up areas which practically banned the further development of the current 330 MW capacity in the country. There are only two wind turbines in the region: one in Bükkaranyos (225 kW) and one in Felsőzsolca (1,8 MW). They were built in 2005 and 2006. The first one is already excluded from the feed-in-tariff system, and in the market its production it is not economically viable [24].

6.3. *Transmission and distributions*

What kind of facilities constitute the electric transmission and distribution system? Who are the owners? Who are the operators? Please add relevant map if available.

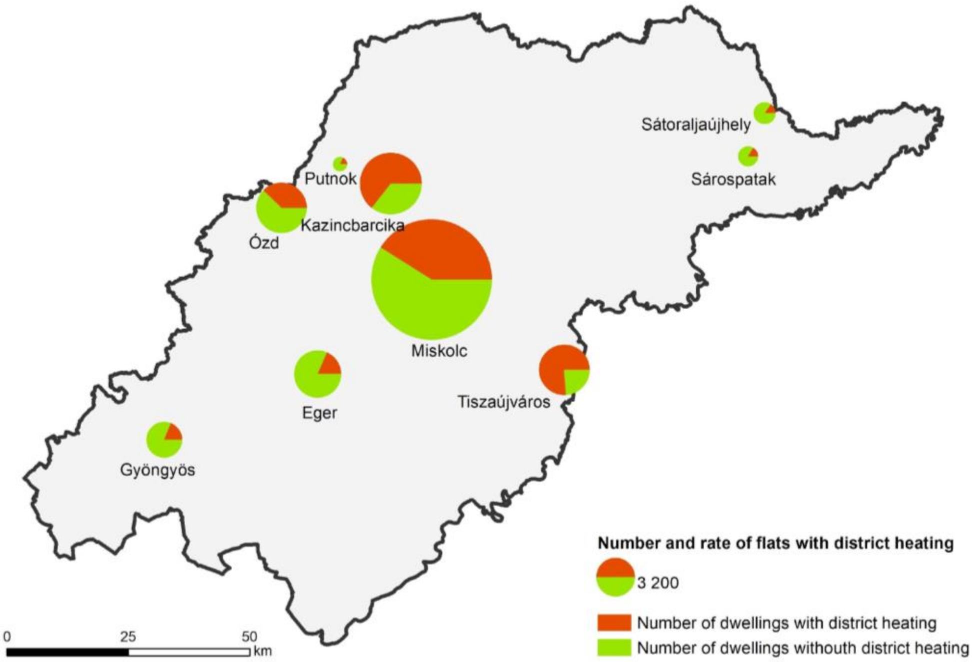
The electric transmission and distribution system is centralized and the owner is the state-owned MVM Zrt, and the operator is the also state-owned Mavir Zrt. The universal service provider is the Émász owened by the German RWE. The Region's cities and large industrial customers are directly fed from the 120kV sub-transmission grid [11].



High voltage power line network in Hungary. Source: [25]

Give an overview of other centralised or decentralised energy distribution systems (e.g. natural gas pipelines, heat grids, etc.).

District heating is in operation in 9 cities in the region. The total number of dwellings connected to the district heating is 60 828 (14,5% of the total number of dwellings). Half of the relevant dwellings are in Miskolc, but the highest share of dwellings connected to the district heating system is in Kazincbarcika, 65%. However, the average connecting rate is only 36%.



Cities with district heating. Source of the data: [26]

The gas pipeline is well developed. Altogether in 59 municipalities have no access to the national gas grid (12% of the municipalities).

Main natural gas pipeline in Hungary. Source: [27]

Give an overview on interconnections of regional energy production with the rest of the country. Are there large production facilities in the region on which the rest of the country's energy supply might depend?

In 2015 the 13,2% of the gross generated electricity was produced in the Mátra Power Plant (other significant producer is the Paks Nuclear Power Plant with 36%, 31% of the consumed electricity was imported).

6.4. *Jobs in the energy sector*

Give an overview about the status of the energy sector in the regional economy. How many jobs are there at the moment in the energy sector. How important are new "green job" for regional economy development. If possible, quantify investments in the energy sector.

The Mátra Power plant is one of the biggest employer in the region: it has 2100 employee – in the power plant and in the two mines. On the other side, the whole RES sector in Hungary provides 7500 jobs.

In terms of the renewable, the biomass is the most significant source of energy. The two state-owned forestry company have around 800 employee [28].

Are coal and lignite mining undertaken in the region? What role does fossil fuel mining play for the regional economy and for regional energy security?

The coal mining has a long history in the region, going back to the late 19th century. Now the two largest strip mines in the country are operating in the region. In Visonta, (just next to the power plant) the operation started in the 1960's, in Bükkábrány in the 1980's. In 2016, the amount of the extracted lignite was 8,7 million tons [29]. However, because of the rising energy price some smaller mines are under the process of re-opening or establishment which endangers the low-carbon transition in the region.
Sajókápolna and Felesőnyárád are small-scale operating open pit lignite mines int he region.

7. Final energy consumption

***Final energy** is a form, which might already been subject to conversion from the raw fuel. It is the energy made available to the user.*

For the sectoral analysis please use regional statistics as far as they are available to you and quote your sources.
If no regional data is available please use the Excel tool, which will give you a suggestion to estimate the needed indictors using national statistics.

Please always use kWh, MWh, GWh, etc. You can find a good conversion tool here:
https://www.iea.org/statistics/resources/unitconverter/

7.1. *Households*

Regional final energy consumption of household sector	6 041	GWh

Heat consumption

Total heat energy consumption of households sector (heating and hot water consumption)	4 865	GWh
Average heat energy consumption per household	11 580	kWh/hh

Describe the average building standard. What is their average age of existing building stock? Are energy efficient renovations in progress?

The National Building Renovation Strategy (NBRS) distinguishes 15 types of building. However, it only groups the building stock on national level. Nevertheless, statistical data is available on municipality level regarding the number of flats per room numbers (four categories: dwelling with one room, - with two rooms, - with three rooms, - with four or more rooms). The categories were matched to the categories of the NBRS according to average floor areas. In this way the share of the different categories in the region could be compared to the national data, and according to the differences the number of dwelling per category were defined (see table below).

The primary energy consumption for heat and hot water production in the region is 11 523 GWh. This volume is supposed to be valid without any renovation (the primary energy consumption of only two categories are less than the ENTRANZE value 146 kWh/m2*a).

On the other hand, calculating with the national ENTRANZE data the energy consumption for heating and hot water is only 4 865 GWh, which is 42% of the value without any renovation. There is no regional data about building renovation , however, this value assumes high energy efficient renovation activities, however, this cannot be observed in the region. But this is true for the whole country, since for instance from the 2,85 million family house 2,5 million have no insulation at all [30]. There is renovation programme and credit scheme on renovation, however, only in very limited scale.

In addition, the primary energy consumption according to the “cost-optimal” renovation scenario would be 3 269 GWh.

There are huge gaps among the different results (11 523 GWh – NBRS, 4 685 GWh - ENTRANZE, 3 269 NBRS “cost-optimal” version), however, the real value is likely to be closest to the value based on the ENTRANZE data. Therefore, for further calculation the 4 865 GWh value was used.

Type number	type of building	Construction time	Walling	number of dwellings/building (db)	average floor area (m2)	Statistical category (1 - with one room, 2 - with two rooms, 3 - with three rooms, 4 – with four or more rooms)	ratio of dwellings in the region (%)	primary energy consumption (kWh/m2/a) - with original condition	**primary energy consumption (GWh) - with original condition**	primary energy consumption after "cost-optimal" renovation (kWh/m2/a)	**primary energy consumption after "cost-optimal" renovation (GWh)**	**According to ENTRANZE (146 kWh/m2/a)**
1.	family house smaller then 80 m2	-1945		1	58	2	7	551	**878**	109	**174**	**233**
2.	family house bigger then 80 m2	-1945		1,1	99	3	8	408	**1 305**	95	**304**	**467**
3.	family house smaller then 80 m2	1946-1980		1	61	2	10	517	**1 334**	123	**317**	**377**
4.	family house bigger then 80 m2	1946-1980		1	104	3	20	405	**3 696**	84	**767**	**1 332**
5.	family house	1981-1990		1	105	4	8	335	**1 211**	80	**289**	**528**
6.	family house	1991-2000		1	111	4	5	227	**487**	80	**172**	**313**
7.	family or row house (1-3 dwellings)	2001 után		1,1	102	3	5	173	**420**	85	**206**	**355**
8.	multihousehold building with 4-9 dwellings	-2000		6	62	2	7	312	**541**	99	**172**	**253**
9.	multihousehold building with 4-9 dwellings	after 2001		5,6	67	2	1	125	**37**	99	**29**	**43**
10.	multihousehold building with 10 or more dwellings	-1945		23,7	58	2	6	344	**488**	114	**162**	**207**
11.	multihousehold building with 10 or more dwellings	1946-2000	brick, other	15,2	53	2	5	299	**308**	135	**139**	**150**
12.	multihousehold building with 10 or more dwellings		pre-cast concrete products	22,2	61	2	4	244	**274**	111	**125**	**164**

13.	multihousehold building with 10 or more dwellings	1946-1980	panel	22,2	49	1	6	218	**261**	140	**167**	**175**
14.	multihousehold building with 10 or more dwellings	1981-	panel	25,7	53	2	4	200	**198**	139	**138**	**145**
15.	multihousehold building with 10 or more dwellings	after 2001		24,9	53	1	4	100	**85**	128	**108**	**123**
	Sum								**11 523**		**3 269**	**4 865**

Electricity

Electricity consumption of households	911,2	GWh
Average electricity consumption per household	2 168	kWh/hh

Describe if there are any national or regional programmes for reducing household electricity consumption (e.g. washing machine or refrigerator replacement programme). If yes, please elaborate it briefly.

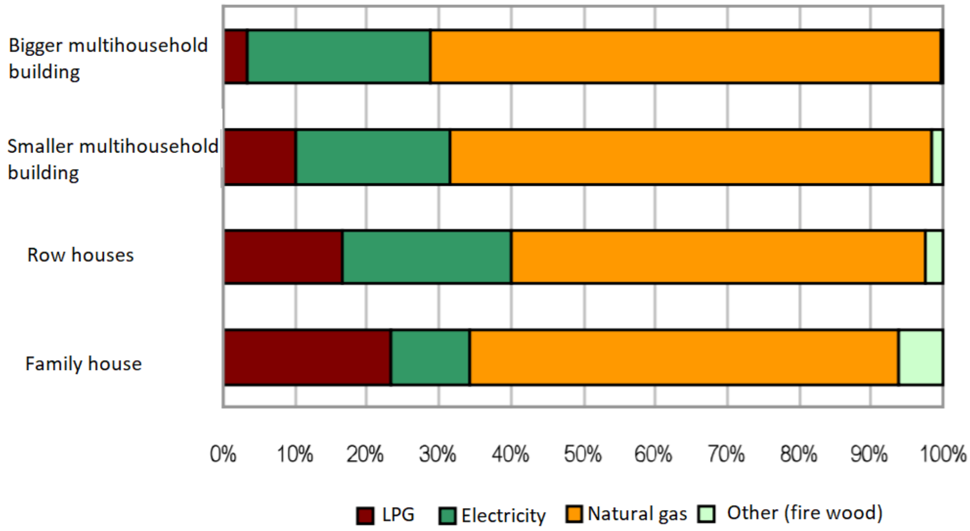
The government supports the households with household machines replacement programme in 2014, 2015 and 2017, however, the amount of the fund is very low. E.g. in the case of the recent programme, where housholds can apply for refrigerator-change, In average in the region only around 1 500 households can get support, which is the 0,35% of the total number of households.
The source of the fund is the income from the greenhouse gas allowances trading system.

Cooking

Gas consumption for cooking appliances of households	265	GWh

Describe if gas is a significant energy source for cooking in the household sector.

There is no statistical data about the used energy resource for cooking. The only statistic which is available is for national level from 2008 [31]. However, since the cooking devices expected lifetime is relatively long, it is assumed that the current status cannot be significantly difference as the 2008 year's statistic. In the calculation it was assumed that the 70% of the households using natural gas for cooking.



The share of households regarding the building type and used energy source. Source: [31]

General information

Household electricity price	0,1213 [32][5]	EUR/kWh (incl. taxes)
Household natural gas price	0,0335 [32]	EUR/kWh (incl. taxes)
Household district heating price	0,0302 [33]	EUR/kWh (incl. taxes)
Household price: other energy sources – specify:		EUR/kWh (incl. taxes)
Energy expenditure by household	4,6 [32]	% of income

Is there any element of Demand Side Management of electricity on household level in place? If yes, please describe it (e.g. peak price, smart metering)

In Hungary an average family house has a “night-meter” . The universal servie provider serves electricity to this appliances for at least 8 hours per a day, but the timing are not pre-determined [34]. It basically means that only boilers are connected to this meter. The price is slightly lower of this type of electricity (around 2 €cent).

Is energy poverty an issue in the region? If yes, please describe how many people are affected, in what extent?

No regional data exists for the energy poverty. According to [35], the one-fifth of Hungarian households threatend by energy poverty. By population rate it means that 15% of the households in the regions can be classified to this category, however, due to the economic situation in the region,

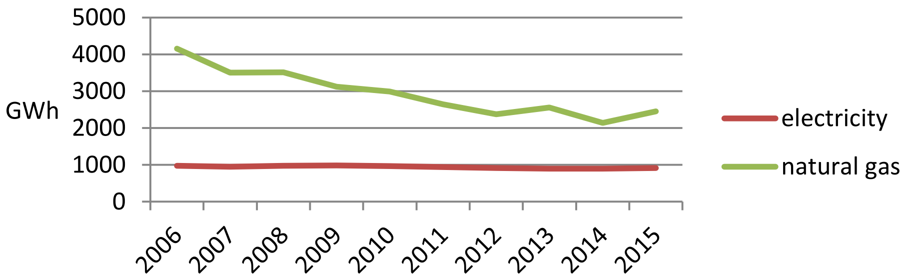
5 Universal service prices are determined by the Minister of National Development by decree

this number is likely higher. They cannot heat up their home to the appropriate temperature, and it costs more then the 15% of their income. After paying their bills they living standard is below the poverty threshold.

One of the most serious consequence of energy poverty is the air pollution during winter time, caused by low-efficient boilers heated by wet firewood, lignite, or even by residential waste. According to the WHO, 8 453 premature death are occured annally because of the residential heating [36].

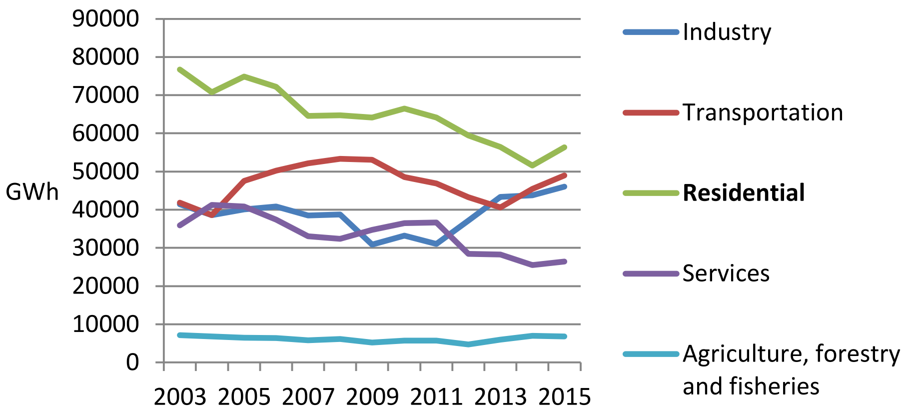
Give an estimate of the trend in final energy consumption in the household sector using values from –5- to +5 where (-5 is a strong reduction, 0 means neither growth nor reduction, +5 strong growth).

-3: Statistical data only available for natural gas and electricity consumption. The natural gas consumption decreased rapidly from 2006, and was replaces by lignite and wood. It does not mean that the energy consumption is decreasing, but it assumes that the consumers try to optimize their energy consumption.



Electricity and natural gas consumption in the household sector between 2006 and 2015

Nevertheless, on national level the energy consumption of the residential sector decreased significantly. Even though in the last examined year the consumption increased, the reduction was 25% from 2005 to 2015.



Final energy consumption per sector. Source: [37]

7.2. *Service Sector*

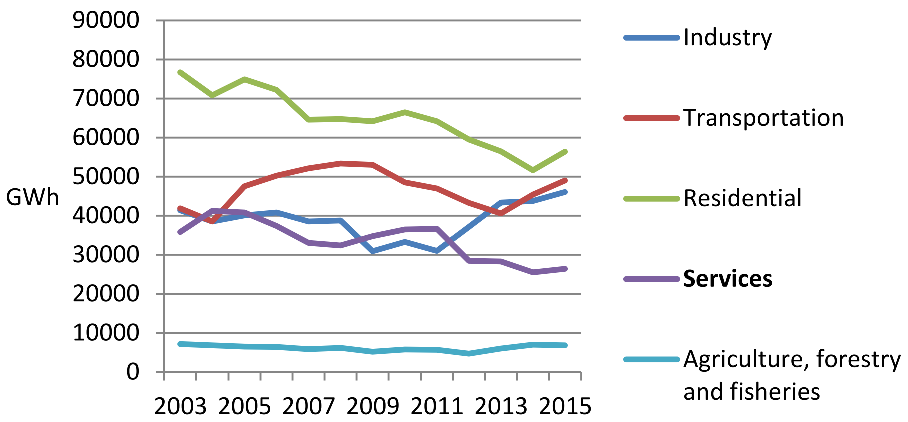
Regional final energy consumption of service sector	1 793	GWh

What are the main sub-sectors driving energy consumption in the in the service sector (building standard, number of businesses, …)? How important is service sector for the regional economy?

The service sector is the main driver for the regional economy with its 52% share from the GDP.

The total area of retailer buildings in the region is 8% of the total area of retailer buildings in the country, however, the GDP of the service sector contributes only to the 5,2% of the GDP sector of the country.

Give an estimate of the trend in final energy consumption in the service sector using values from -5- to +5 where (-5 is a strong reduction, 0 means neither growth nor reduction, +5 strong growth).



Final energy consumption per sector. Source: [37]

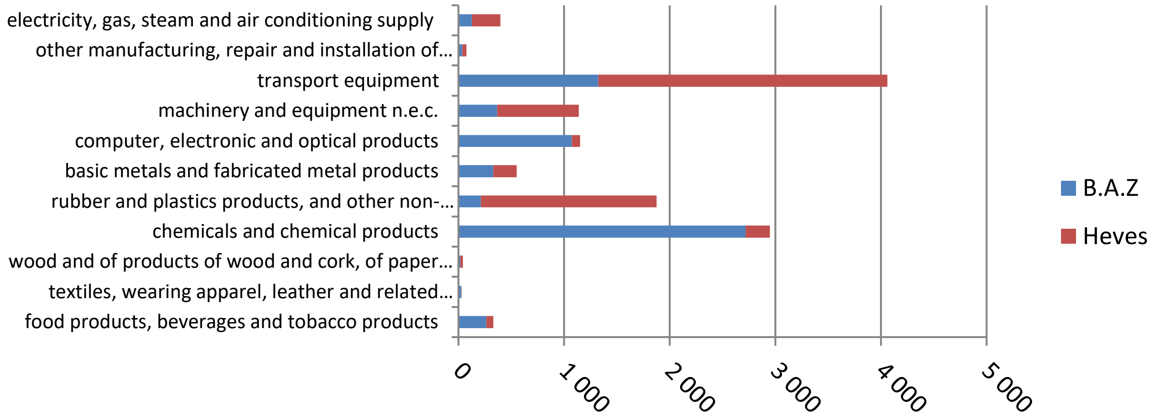
7.3. *Industry*

Total energy consumption of the industrial sector	8 936[6]	GWh
Industry electricity price	0,11047 [38]	EUR/kWh (incl. taxes)
Industry natural gas price	0,0309 [38]	EUR/kWh (incl. taxes)
Industry district heating price	no data	EUR/kWh (incl. taxes)
Industry price: other energy sources – specify:		EUR/kWh (incl. taxes)

What are the main sub-sectors driving energy consumption in the in the industrial sector? How important is industry for the regional economy?

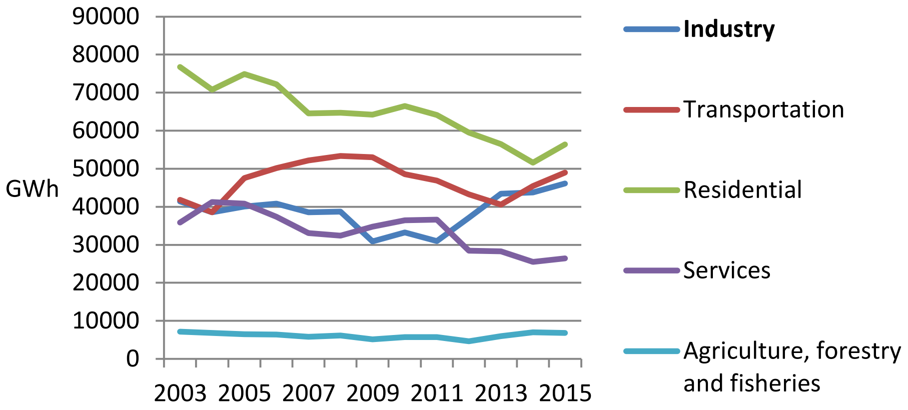
[6] The value was calculated from statistical data [26]

The main sub-sectors driving the economy is typically the energy intensive sectors, like transport equipment, chemicals and chemical products. These two sectors correspond to more than the half of the total added gross value in the region. The high energy intensity confirmed also by the fact that the regional industry sector contributes with 7,7% [39] of the total industrial GDP of the country, however, 19,4% of the energy for industrial purposes realized in the region.



Gross value added by industrial sectors, 2016. Source: [15]

Give an estimate of the trend in final energy consumption in the industry sector using values from -5- to +5 where (-5 is a strong reduction, 0 means neither growth nor reduction, +5 strong growth).



Final energy consumption per sector. Source: [37]

7.4. *Transport*

Regional final energy consumption of transport sector	3 950[7]	GWh

Describe the main characteristics of the transport sector: transport infrastructure, motorisation rate, availability of public transport and differences between urban and rural environments.

The topography of the region affects the characteristic of the transportation network. The main transport axes is the M3 highway, which is part of the „Helsinki corridors” number V. (Venice – Trieste – Koper – Ljubljana – Budapest – Ungvár – Lvov – Kijev) which crosses the territory of the county. The other significant road on European level is the northern-southern TINA corridor that crosses the county via Tornyosnémeti – Miskolc – Emőd (it starts with Kaunas – Lublin – Kassa and leaving the county it reaches Nagyvárad via Debrecen – Berettyóújfalu and Biharkeresztes. The total long of the road network is 3 766 km (2127 km in Heves and 2 492 km in BAZ County), which is 12,4% of the total length of the national road network. The density is 34,6 km/100 km^2, which is slightly higher than the national average 32,74 km/100 km^2.

Also regarding to the railway network, the main axes is the number 80 (Hatvan-Miskolc-Szerencs) which at a significant part, from Hatvan to Miskolc is parallel with the M3 higway. The total length of the railway system in the region is 663 km, which is 9,33% of the length of the national railway system [40,41].

The only significant river port is situated in Tiszaújváros. There is no civil airport in the region.

Regarding to the rail transport, around the two-third of the settlements have railway station, but with bus almost all settlements accessible. However, the average age of the bus fleet is high, 14 years, and also the comfort values of the bus and rail stations are low. The lack of connectivity between the bus and rail transport can be experienced: the timetables are not connected to each other, and also there are multiple parallel bus and rail lines operating in the same time [40].

Passenger transport

Motorisation rate - number of passenger cars/1 000 inhabitants	284,7	
Regional energy consumption of passenger transport in the region	2 368	GWh

Freight transport

Regional energy consumption of road freight transport	1 412	GWh

If the rail, or transport by pipeline is a significant way of the freight transport, please describe their main characteristics.

The importance of the road transport is increasing, especially the volume of the road freight transport, since in the last decade the national highway-system reached the east part of the country.

[7] The value was calculated with the excel table.

Use of alternative fuels

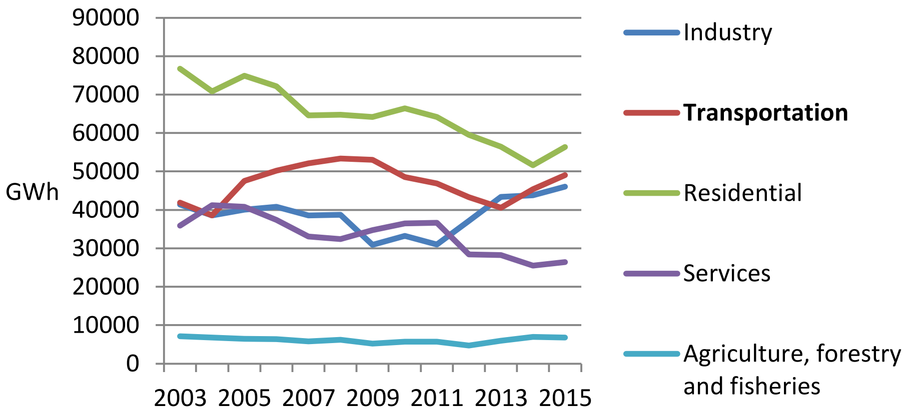
Describe the market development for alternative fuel vehicles (natural gas, biogas, electric cars). What supporting mechanisms for alternative fuel are available on national and regional level? Describe challenges and barriers, e.g. infrastructure, technological, supply, financial barriers, etc..

Before 2011 the E85 fuel was very popular because of the reduced taxes, now the amount of tax is the same as in other fuel, and nowadays its role is very minor. In accordance with the EU regulatory, the complementary share of biofuels in road transport fuels is now 4,9%. After 2020, the complementary share will be 10% [42].

Electrification of the transport sector is supported through the E-mobility Programme (the Jedlik Ányos Plan), with incentive schemes in favour of electric vehicles (EV) and plans for increasing the number of EV charging stations.

Give an estimate of the trend in final energy consumption in the transport sector using values from -5- to +5 where (-5 is a strong reduction, 0 means neither growth nor reduction, +5 strong growth).

0 – The energy consumption of the transport sector decreased resulting from the economic crises at the end of the 2000’s decade, but from 2013 it increased and reached the previous level.



Final energy consumption per sector. Source: [37]

7.5. *Summary*

7.5.1. Final energy indicators

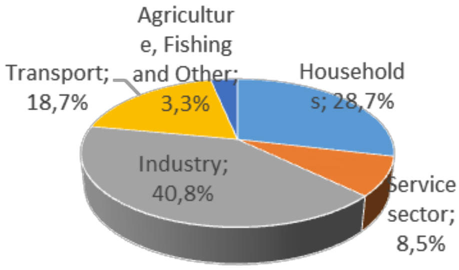
General indicators for the region

Use the Excel tool to fill the following tables and generate graphs.
If regional data is available, use this information and quote your sources.

Total final energy consumption	21 083,8	GWh
Final energy consumption per capita	21 968	kWh/cap
Electricity consumption per capita	4 835	kWh/cap
Heat consumption per capita	12 654	kWh/cap
% of total country consumption	11,4	%

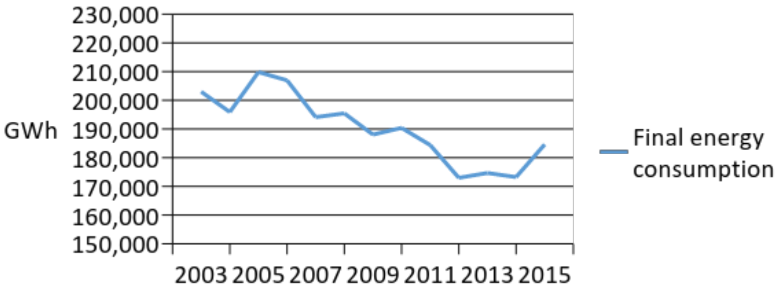
Final energy consumption per sector

Year: 2015			%
Households	6 041	GWh	28,7
Service sector	1 793	GWh	8,5
Industry	8 614	GWh	40,8
Transport	3 950	GWh	18,7
Agriculture, Fishing and Other	696	GWh	3,3
Sum	**21 083,8**	**GWh**	**100,0%**



Give an estimate of the trend in final energy consumption using values from -5- to +5 (where -5 is a strong reduction, 0 means neither growth nor reduction, +5 strong growth).

0 - As a result of the economic crises, from 2006 until 2013 the energy consumption reduced by 17% compared to the 2006's level. From 2013 the consumption is growing again.



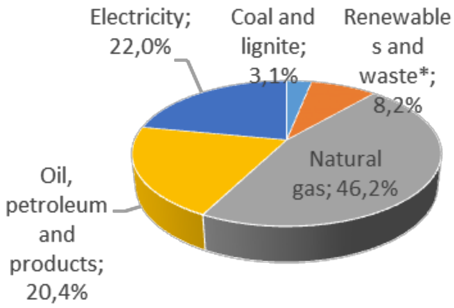
Final energy consumption. Source: [35]

7.5.2. Final energy consumption by fuel

Use the Excel tool to fill the following tables and generate graphs.
If regional data is available, use this information and quote your sources.

Total final energy consumption by fuel

Year: 2015			%
Coal and lignite	655	GWh	3,1
Renewables and waste*	1 739	GWh	8,2
Natural gas	9 751	GWh	46,2
Oil, petroleum and products	4 297	GWh	20,4
Electricity	4 640	GWh	22
Other fuels	0	GWh	0
Sum	**21 083,5**	**GWh**	**100,0%**



*Hydro, wind, solar, tide/wave, biomass and waste, geothermal

7.5.3. Primary energy equivalent

Primary energy *is an energy form found in nature that has not been subjected to any conversion or transformation process. It is energy contained in raw fuels.*

If regional data is not available for these indicators, use specific national indicators to break energy supply down to regional level. Refer to Excel tool for suggestions on calculation methodologies. Quote your sources and assumptions

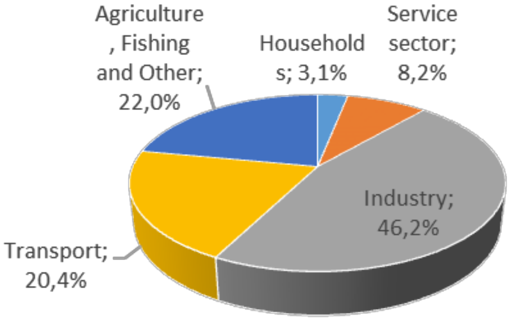
Total Primary Energy Consumption	33 128	GWh
Primary energy consumption per capita	34 516	kWh/cap
Primary energy factor of electricity	3,36	-
Energy intensity	4 412	kWh/1000 EUR

Give an overview of the regional primary energy supply by fuel.
Use the Excel conversion tool using primary energy coefficients suitable for your region.

Primary energy equivalent by sector

Use the Excel tool to fill the following tables and generate graphs.
If regional data is available, use this information and quote your sources.

Year: 2015			%
Households	8 467	GWh	25,6
Service sector	3 188	GWh	9,6
Industry	16 363	GWh	49,4
Transport	4 345	GWh	13,1
Agriculture, Fishing and Other	765	GWh	2,3
Sum	**33 126**	**GWh**	**100,0%**



What is the level of primary energy supply dependencies: Which fuels need to be imported form the rest of the country and internationally.

Dependency on fuel imports: very high / **high** / average / low / very low

From the final energy consumption, only the consumed renewable energy and the lignite are from the region (altogether 9,5% of the final consumption), however, the latter – as it was stated above – is highly inefficient and harmful on the environment.

There is no natural gas or oilfield in the region, and also, Hungary is very dependent on the import. In the case of oil, the production was 36,2 PJ, the import (extracted with the export) was 276 PJ, in the case of natural gas, the production was 57 PJ, the import (extracted with the export) was 180,3 PJ [15].

The energy dependence of the country was 53,7% in 2015 according to the Eurostat. Nevertheless, it does not include the import of the nuclear fuel, however Paks Nuclear Power Plant corresponds to almost the half of the electricity production of the country.

7.5.4. Regional CO_2-emissions associated with energy consumption

Use the Excel tool to fill the following tables and generate graphs.
If regional data is available, use this information and quote your sources.

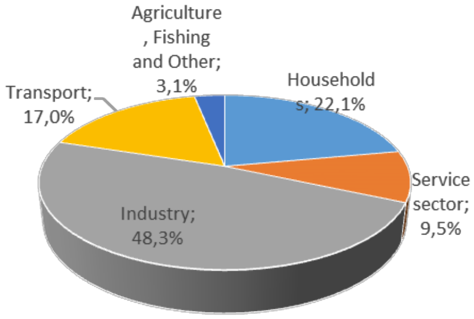
Total CO_2-emission associated with energy sector	5,9	Mio t
CO_2-emissions per capita	6,15	t/cap
CO_2-emissions per GDP	0,79	t/€ GDP

Give an overview of the regional primary energy supply by fuel.

Use the Excel conversion tool using CO_2-emission coefficients suitable for your region.

Energy-related CO_2-emissions by sector

Year: 2015			**%**
Households	1 303	thousand t CO_2	22,1
Service sector	558	thousand t CO_2	9,5
Industry	2 9849	thousand t CO_2	48,3
Transport	1 003	thousand t CO_2	17,0
Agriculture, Fishing and Other	186	thousand t CO_2	3,1
Sum	**898**	**thousand t CO_2**	**100,0%**



8. Renewable energy sources – status and potential

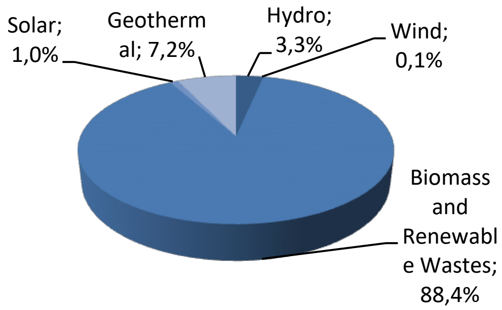
8.1. *General information*

Use the Excel tool to fill the following tables and generate graphs.
If regional data is available, use this information and quote your sources.

Renewable Energy Targets:		
2020 RES share in gross final energy consumption	14,65[8]	%
2030 RES share in gross final energy consumption	no data	%
Jelenlegi megújuló részarány (2015)	14,2	%

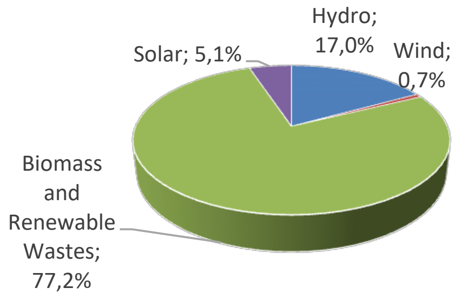
Share of final energy demand covered by renewable fuels

Year: 2015			%
Hydro	99[9]	GWh	3,9
Wind	3,24[10]	GWh	0,1
Biomass, biofuels and renewable wastes	2656[11]	GWh	86,5
Solar	29,85	GWh	1,2
Geothermal	216,6	GWh	8,4
Sum	**3 004**	**GWh**	**100,0%**



Share of total electric demand covered by renewable fuels

Year: 2015			%
Hydro	99	GWh	17
Wind	4,27	GWh	0,7
Biomass, biofuels and renewable wastes	449,8[12]	GWh	77,2
Solar	29,85	GWh	5,1
Geothermal	0	GWh	0
Tide, Wave, Ocean	0	GWh	0
Sum	**583**	**GWh**	**100,0%**



[8] national target
[9] Kisköre – 93 GWh (26,6 MW) [10], Gibárt – 2,5 GWh (500 kW) [43], Felsődobsza – 3,5 GWh (1 MW) [44]
[10] Felsőzsolca – 3,8 GWh (1,8 MW), Bükkaranyos – 0,475 GWh (225 kW), with the capacity factor of 24,1% [45]
[11] Heat: residual biomass – 1494 GWh (based on previously described calculation), Miskolc Biomass Heat Plant – 11,38 GWh (3MW) [14], Miskolc Biogas Power Plant – 6,4 GWh [46], Harsány Biogas Power Plant 8,2 GWh (1,17 MW) [18]. Biofuel: 266,5 GWh (calculated from national data (share of biofuel in the transport sector – 6,2% [15])). Electricity: see next footnote
[12] Matra Power Plant – 433,2 GWh (based on previously described calculation), Harsány – 8,32 GWh (1,2 MW) [18], Miskolc Biogas Power Plant – 6,2 GWh [46]

Describe if and how renewable energy sources are integrated in the transport sector, e.g. biofuels, electric vehicles.

Before 2011 the E85 fuel was very popular because of the reduced taxes, now the amount of tax is the same as in other fuel, and no its role is very minor. In accordance with the EU regulatory, the complementary share of biofuels in road transport fuels is now 4,9%. After 2020, the complementary share will be 10% [42]. Accorcing to the statistics, the share of RE in the transport sector is 6,2% [15].

Electrification of the transport sector is supported through the E-mobility Programme (the Jedlik Ányos Plan), with incentive schemes in favour of electric vehicles (EV) and plans for increasing the number of EV charging stations. Now in the whole country only around 1 thousand cars have green licence table which means they can run at least 25 km with only electric drive (or 50 km if the car is hybrid) [47].

In the territory of the Bükk-Leader region, in the frame of the "1 village – 1MW" programme, 26 electric car charging points were installed from which 5 are quick chargers [48]. This high amunt is uniqe in the region ther Leader region only covers the 9% of the region.

Describe the status of REN production in the region. % of total energy and electricity demand covered by REN. If available give a historic overview of the REN production capacities for the last 5 to 10 years.

Currently the share of the renewable energy in the final consumption is 12,6%. This velue on national level was 14,5% in 2015. However, it must take into consideration that the share of energy intensive industry in the fnal energy consumption is 40% in the region, but on contrary on national level only the half of it, ~ 25%.

The 14,5% ratio on national level equals to 26 770 GWh, which means that the region produces the 9,6% of the renewable energy, which matches to the population ratio.

Describe if there are incentive programmes/schemes (financial and non-financial) in place to support REN-development. Are these programmes on national, regional or local level?

At the beginning of 1017, a new operational support system, METÁR was introduced for renewables-based electricity generation. The current feed-in-tarfiff system, the so-called KÁT system continues to operate for existing plants following the introduction of METÁR. According to the new system, renewable electricity generators, with the exception of non-wind power plants under 0.5 megawatts (MW) and those already receiving a FIT, shall sell electricity on the market. Different market premiums will apply depending on the capacity of the power plants:

- In case of smaller power plants of less than 0.5 MW capacity (excluding wind energy) and demonstration projects, the electricity produced shall be purchased by MAVIR, the TSO, and sold by the TSO on the electricity wholesale market (HUPX). These producers, remain in the same position as before.

- In case of power plants of medium capacity (between 0.5 MW and 1 MW), an administrative premium, at a level similar to the KÁT, will be paid to producers without any competitive bidding procedure (no tenders).

- In case of larger power plants (over 1 MW) and wind farms, premium support shall be granted only via competitive tendering procedures (except for demonstration projects) [38]

Following approval from the EU Commission, METÁR will also introduce a brown premium for depreciated biomass and biogas power producers. The purpose of this measure is to avoid the shutdown of these plants or the switch to fossil fuels in depreciated plants. Also, becuase of the lack of the approval, now the whole budget of the system is limited. However, the investors on REN submitted their purpose of connection before the end of 2016, therefore the interest on the new system is now low [49].

Describe the top 5 regulatory barriers slowing down current and future REN-development. Should these barriers be addressed at national, regional or local level?

1. According to the a new Hungarian law (277/2016. (IX. 15.)) no wind turbine can be built within a 12 km buffer zone of any built-up areas which practically banned the further development.
2. Environmental protection fees on PV panels which is the highest in the EU, 0,37 €/kg
3. The feed-in-tariff system indirectly support the co-firing and the low-efficient use of biomass
4. Permitting process length
5. Lack of predictable support scheme

Give an estimate of the trend in renewable energy production using values from -5- to +5 (where -5 is a strong reduction, 0 means neither growth nor reduction, +5 strong growth). Describe supporting factor as well as barriers.

2 – almost 90% of the renewable energy cames from biomass. The three main sources are:

- Residual use: in the last decade as the gas price increased, paralelly the residual use of firewood increased rapidly, and it price followed the gas price. Because of that, and the act on the enforcement of utility cost reduction, now the residual utilisation stagnates.
- Mátra Power Plant: the power plant applies co-firing, with 8% biomass in terms of weight. Since the power plant get extra income through the feed-in-tariff system, it does not likely they will reduce the share of biomass.
- Biofuel: according to the law the complementary share of biofuels in the road transport fuel will be 10%, therefore in this sector an increasement will happen.

In case of other renewables, only the capacity of PV is likely to grow. In 2015 on national level the total installed capacity of PV was 837 MW. At the end of 2016 – just before the old feed-in-tariff system closed down for new installations – almost 2500 request arrived to the Hungarian Energy and Public Utility Regulatory Authority (MEKH). According their calculation, until the end of 2018, the total installed capacity will grow to 2 100 MW (without the residential installations) [50].

8.2. *Available natural resources in the region*

8.2.1. Biomass

How are forest areas used? For what purpose? What is the regional energy potential using existing forest areas? Please state whether it is a theoretical or technical potential and describe regulatory support systems as well as barriers.

Forest areas covers the 28% of the region, which is lower then the EU average (35%), but heigher then the national average 22%. The 38% of the forest area in BAZ county, and the 39,6% in Heves county owned by private owner, the rest owned by the state [16]. In the region, two state-owned forestry company are on duty: the Északerdő mainly in BAZ county, the Egererdő mainly in Heves county. Almost all the forest areas are managed forests, regaled by strcit forest management plans.

According to [51] forests in BAZ county yield 405 179 t/a dry fire wood, the energy content of which is 1 462,5 GWh, however, there is no county-level calculation for Heves county. But it is important to note, that only 30% of the forest in the region situated in Heves County. If it is assumed, that the yield in Heves is the same as in BAZ County, then the total yield is 2 089 GWh.

According to the previously described calculation in chapter 6.2, the utilization of forestry biomass is 1 506 GWh. That means that the utilization is the 75% of the potential.

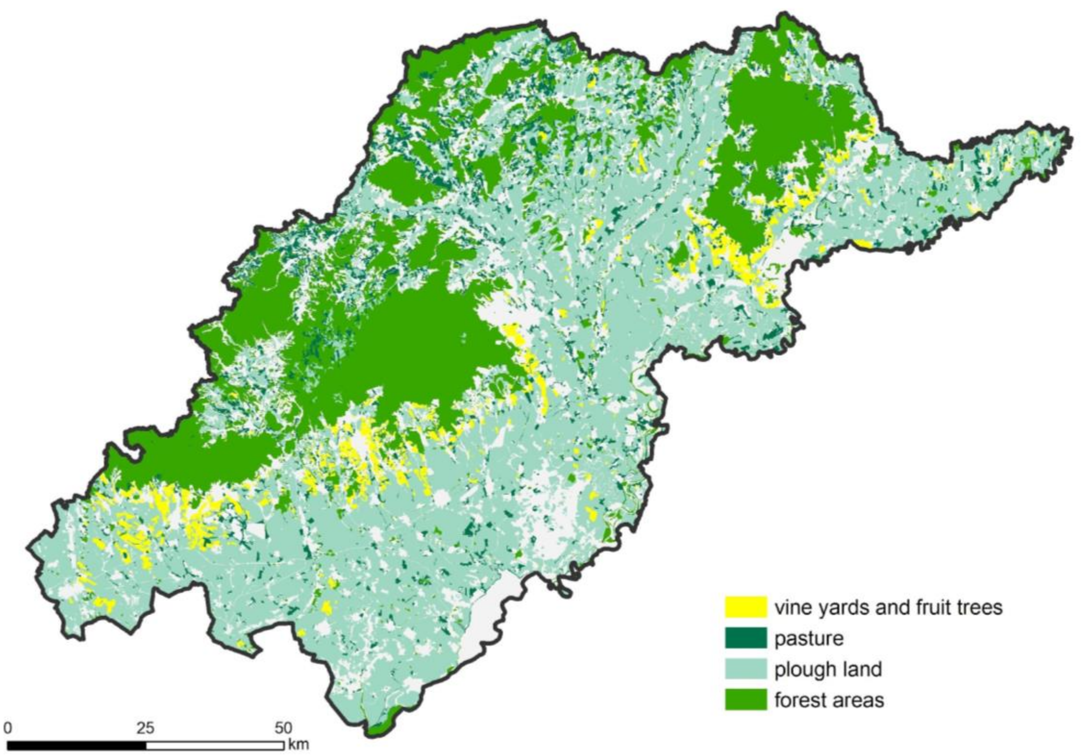
What are main agricultural products at the moment? What is the regional energy potential from agricultural products? Please state whether it is a theoretical or technical potential and describe regulatory support systems as well as barriers.

Half or the agricultural land is occupied by cereals (which consists practically 5 plants: wheat (half of the cereals), maize (quarter of the cereals), barley, rye, oat), 25% by industrial crops, 14% of green manure, and 7% by fodder plants.

If it is assumed that the 40% of the cereal straw can be used to energetic purpose, then the heating value of five cereal plants is 1 882 GWh (40% of the total average 1,4 million t straw)[13]. In some settlements in the agricultural area – as it was described above – straw is utilized locally in small-scale furnaces and heat plants. However, the utilization on big-scale can cause serious problems, as it was experienced when a straw-fired biomass power plant was plant to build in Szerencs in 2010. Finally, the plant was cancelled because of the heavy public opposission. In addition, the planned location was in the buffer zone of an UNESO World Heritage are of Tokaj.

Provide a land use map or map indicating biomass energy potential of the region, if available.

[13] see calculation in the excel file worksheet „straw"



The land cover of the region

	Territory (km2)	% of the total area
forest	3044,8	28
plough land	4561,6	42
pasture	666	6
vine yard	356	3

8.2.2. Hydro power (incl. tide and wave power)

Give an overview of hydro power sources used at the moment and describe the energy potential for the different technologies: run-of-river hydropower plants, reservoir hydropower plants, use of tide and wave power, if applicable. Differentiate between small and large hydro power. Describe the energy potential based on geographical and political frameworks.

Tisa is the second biggest river in the country, which also the border from the east side of the region. Since in the area of the region it flows throw floodplains, the energetic utilization is only possible with dams, which is already existing in Kiksöre where the biggest hydro power plant of Hungary is operating with installed capacity of 26 MW.

Beside of that, small rivers cross the region, e.g. Hernád, Sajó, Bódva, which could be possible areas for small and micro hydro power plant. Now only three of these kind of plans are in operation (Gibárt – 500 kW, Felsődobsza – 1 MW [19], Bódva - 30 kW [20].

8.2.3. *Solar power*

Solar irradiation (on optimally inclined plane) per year	from 1150 to 1332 [51]	kWh/m²

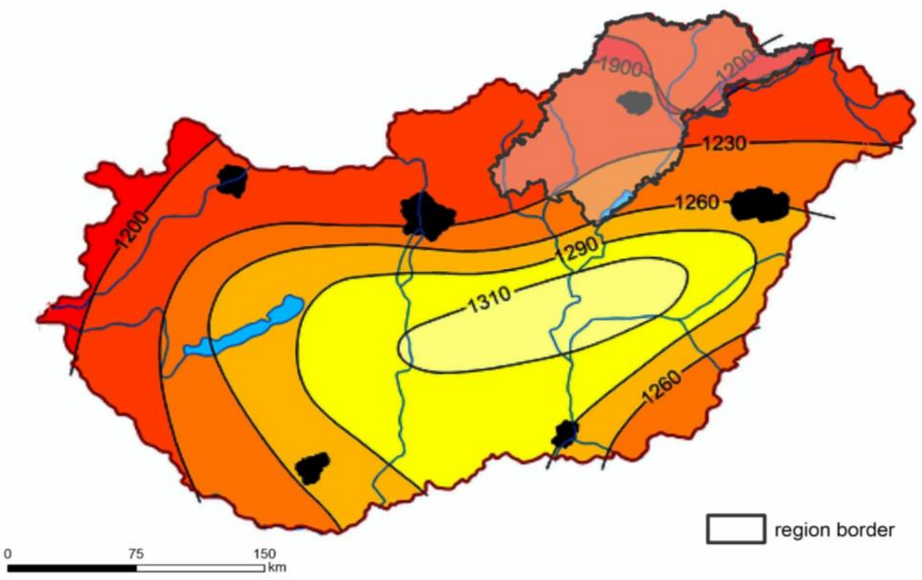
Give an overview of both solar thermal and PV usage at the moment and describe the energy potential based on geographical and political frameworks.

Now around 28,4 MW PV is on operation in the region (see table below), and this capacity is likely to grow. As it was stated above, at the end of 2016 – just before the old feed-in-tariff system closed down for new installations – almost 2500 request arrived to the Hungarian Energy and Public Utility Regulatory Authority (MEKH) from the whole country. According their calculation, until the end of 2018, the total installed capacity will grow to 2 100 MW (without the residential installations) [50]. Also, the Matra power plant plans to increase its PV capacity from 16 MW to 60 MW in 2017-2018 [29].

Altough the region is not the most suitable area for PV installation according to the solar irridation from the country’s viewpoint, but from a European perspective it is (see map below).

Location	Capacity (kW)	Estimated production (GWh)
Sajóbábony [52]	500	0,52
Sóstófalva [53]	465	0,48
Tibolddaróc [54]	467	0,48
Visonta-Markaz [13]	16 000	16,8
Demjén [55]	499	0,49
small-scale PV	10 500	11
Total	28 431	29,85

Provide a map indicating solar irradiation in the region, if available.



Solar irridation in Hungary (kWh/m2) [56]

8.2.4. Wind power

Average wind velocity at 100 m	from 3 to 5	m/s
Full load hours	2 024	h/a

Give an overview of wind power use at the moment and describe the energy potential based on geographical and political frameworks. Differentiate between offshore and onshore potential

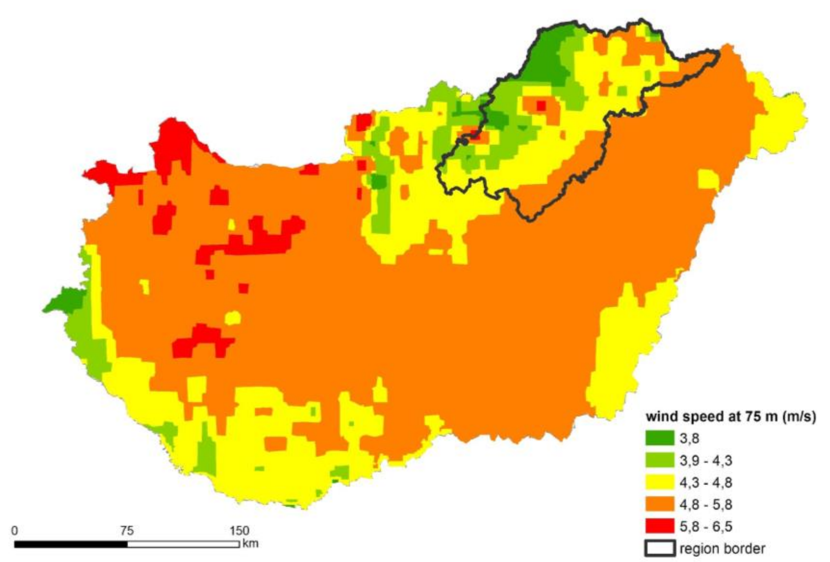
In the region there is a 225 kW turbine operating in Bükkaranyos, and one 1800 kW turbine in Felsőzsolca. The first one is already excluded from the feed-in-tariff system, and in the market its production it is not economically viable, and the second one will also excluded soon [24].

According to the previous regulation, strict rules limited the available area for wind energy penetration, which includes different kind of areas which have to be excluded (e.g. protected natural areas, protected landscapes, eneronmentally sensitive areas, forests, settlements with buffer zone, roads with buffer zone). As a result, only the 5,8% of the area was suitable for wind energy utilization [57]. Also, the last time when the Hungarian TSO gave permission for building capacities was in 2006. In 2010 a new announcement was made for 440 MW, but then it was rejected by the new government.

According to the a new Hungarian law no wind turbine can be built within a 12 km buffer zone of any built-up areas which practically banned the further development of the current 330 MW capacity in the country.

In 75 m high the wind speed in the region is not so favourable, but in 100 m – which is more realistic for the new wind turbines – in some areas would be suitable for wind energy utilization.

Provide a wind map for the region, if available



8.2.5. Geothermal energy

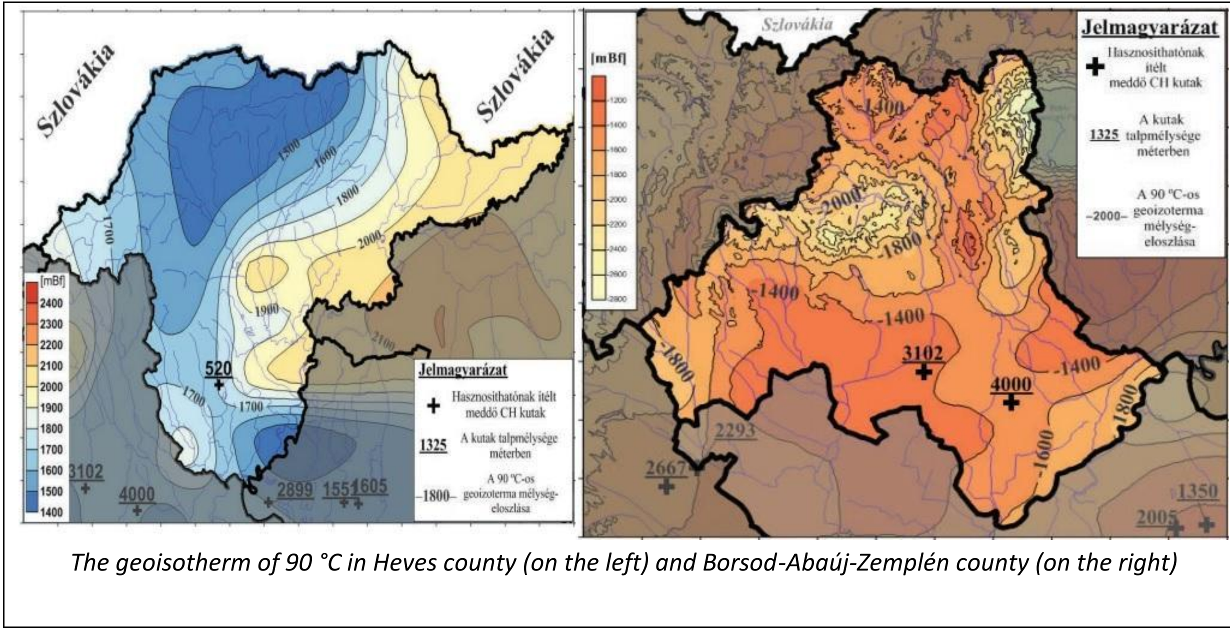
Give an overview of use of geothermal energy at the moment and describe the energy potential based on geographical and political frameworks.

BAZ county: thermal waters wells are in operation in 20 settlements in the county, most of them for balneological purpose. The only exception is in Kistokaj, where 2 geothermal well are on operation, with a depth of 1500-2300 m and the outlet water temperature is 95-105 °C. It corresponds to the 54% of the heat supply of the biggest city in the region, Miskolc through its district heating system. The cooled geothermal water is injected back to the earth, but no cascade usage is applied, however, it would be suitable since its temperature is 57 °C. Also, in two bigger cities, Sárospatak and Tiszaújváros the district heating system could be supplied by geothermal energy.

The wells of the most famous bathes (Mezőkövesd-Zsóry, Bogács, Tiszaújváros) were discovered in search of potential oil-fields. In the east and south part of the county 90 °C the temperature can be observed at 1500 m depth [58].

Heves county: 64 thermal water wells are in operation, however, the number of wells where the temperature of the outlet water is at least 60 °C is only 6. The utilization is only for balneological purpouse (Eger, Egerszalók, Bükkszék, Demjén, Hatvan, Mátraderecske), the only exception is in Egerszalók, where the building of the bath and the hotel next to the well is heated by geothermal energy. The potential are for geothermal usage is the south part of the county where the 90 °C the temperature can be observed at 1400 m depth [58].

Provide a geothermal map for the region, if available



The geoisotherm of 90 °C in Heves county (on the left) and Borsod-Abaúj-Zemplén county (on the right)

8.2.6. Waste

Describes overlaps between waste management and energy sector. Is municipal solid waste used for energy production? How is the energy from waste incineration plants used, e.g. electricity generation, district heating (cogeneration)?

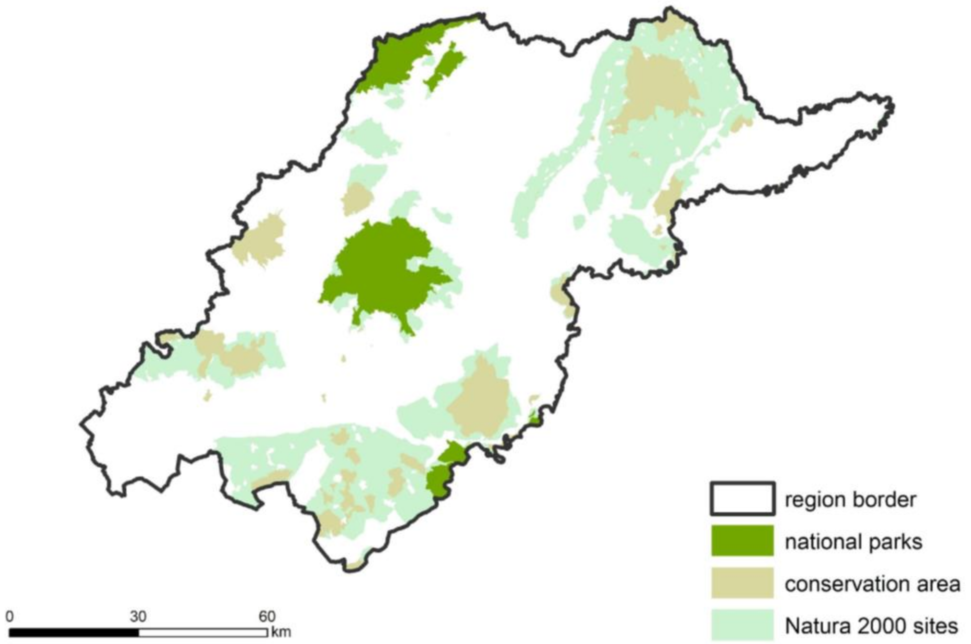
The only power plant where energy production fueled by waste is in operation is the Mátra Power Plant in the region who applies co-firing. In the case of the biomass the rate of co-firing is 8%, in the case of solid waste it is 5% in terms of weight (regulatory limit). The amount of co-fired materials now is 360 000 t annually, but according to the plan of the power plant it will grow to 400 000 t (there is no splitting to biomass and waste).

Besides of that settlement with high energy poverty are suffering from air pollution coused by heating with residential waste.

8.2.7. Restriction through protected areas

Are there environmentally protected areas, which are not available for REN facilities or restrict the overall potential?

The territory of protected areas(Natura 2000 sites, conservation areas, national parks) is 4610 km^2, which is the 42,3% of the region, where special agriculutral-forestry activities are needed. These areas restricted the available land for wind energy penertration, however, due to the regulation barriers this is irrelevant currently.



9. Energy efficiency – status and potential

What is the status of the implementation of the Energy Efficiency Directive?

In the third and latest National Energy Efficiency Action Plan (furthermore NEEAP) in 2015, Hungary established 2020-targets for total primary energy supplay at 1009 PJ and total final consumption at 693 PJ. Hungary has calculated a total energy savings target of 73 PJ to 2020. The greatest savings potential is found in the residential sector, both in real terms and as percentage of the 2012 consumption.

According to [38], the 2020 energy intensity targets in the NEEAP could be more ambitious than recent energy consumption trends. A revision of the NEEAP is under way in 2017 and provides an ideal opportunity to increase its ambition. However, the total final energy consumption increased by 5% between 2012 and 2015 to 707 PJ. This is 30 PJ above Hungary's projected value for 2020, and 2% above the target of 693 PJ.

What is the status of the implementation of the Energy Performance of Buildings Directive (e.g. data on low/zero energy buildings)?

The main focus of the National Building Energy Performance Strategy is on implementing energy modernisation of the domestic building stock. The strategy states targets for savings from improving the energy performance of residential, public and business buildings. From 2012 to 2020, the energy savings target is 49 PJ, of which 40 PJ should come from renovation of residential buildings (38.4 PJ) and public buildings (1.6 PJ).

In 2015, stricter building energy requirements were introduced with the regulation 39/2015. (IX.14.). New standard regulations with stricter U-values for façades and windows must be used for any significant refurbishment with EU or national support, and for new building construction or major renovations [38]. From 2018 if the renovation or the construction is in frame of EU or national fund, from 2021 in every cases.

Analyse the sectors:
Households: Are energy efficiency measures implemented in this sector? Are there awareness campaigns to highlight the potential? Is there support for the implementation (financial and non-financial)?

Regrding the household sector, public awareness campaings are running usually on a low level, mainly doing by NGOs. One exception is the „Heat wisely" campaign which raise awareness of the adequate heating techniques, equipments and fuels in residential homes.

As from the financial side, the Green Economy Financing Scheme funded through the revenue from the sale of emission allowances in the EU Emissions Trading System. A sub-programme is the Warmth of Home Programme, was launched in 2014 to further reduce energy costs in households. In 2016, the programme included a scheme to support the renovation of family homes. Another multi-annual programme financed by the European Regional Development Fund starts in 2017 and provides financial support, such as interest rate subsidies, for energy-saving measures in all types of dwellings. In the case of building refurbishment, an energy audit is to be carried out before and after the improvement to assess the results of the investments on the energy efficiency of the dwelling [38]. The National Development Bank offers credits with no interests rate for energy savings measures.

Service sector: Are energy efficiency measures implemented in this sector? Are there awareness campaigns to highlight the potential? Is there support for the implementation (financial and non-financial)?

There is no special energy efficiency measure implemented in the service sector, it can be handeled with the industrial sector in tems of energy efficiency.

Industry: Are energy efficiency measures implemented in this sector? Are there awareness campaigns to highlight the potential? Is there support for the implementation (financial and non-financial)?

The main policy for industrial energy efficiency is energy auditing requirements for large enterprises, driven by Union's EED. The energy audits are performed by either in-house experts or qualified auditors. They implement the energy audits and make recommendations for energy reduction.

Transportation: Are energy efficiency measures implemented in this sector? Are there awareness campaigns to highlight the potential? Is there support for the implementation (financial and non-financial)?

With the electro-mobility programme, the Hungarian government intends to promote the use of electric vehicles in the frame of the e-mobility programme (Jedlik Ányos Plan), including green licence plates for hybrid and electric vehicles, permitting the use of bus lanes, as well as introducing parking and road toll incentives. The government will also formulate an authority protocol for the installation of electric vehicle chargers.

As part of the Transport Infrastructure Development National Strategy, Hungary developed a Transport Energy Efficiency Improvement Action Plan (furthermore TEEIAP). In the TEEIAP, the government is introducing initiatives for the development of bicycle lanes, improving energy efficiency in rail transport (railway electrification and network modernisation), encouraging public transport through improving facilities to combine different ways of commuting, as well as introducing road taxes, a bus-replacement programme and eco-driving training [38].

Give an estimate of the trend in energy efficiency development using values from -5- to +5 where (-5 is a strong reduction, 0 means neither growth nor reduction, +5 strong growth).

2 – a grow can be observed, and it will be stronger when the new stricter building energy requirement will be implemented. Also, in this year the National Energeticist Network was estabilished in every subregion. Their role is to support the municipalites, the local SMEs and the housholds regarding to energy efficiency.

However, the avobe describe actions are all obligatory by EU laws, and Hungary always undertakes the minimum expectations.

Demand side management, smart metering, storage

The distributor system operators implemented smart metering pilot projects in 2013 and 2014, which were completed by the end of 2014. The main focus of the smart grid pilot projects was to establish functions for the electricity and gas networks by creating and testing measurement solutions, data collection and other smart grid applications [38].

10.SWOT analysis

Please make a SWOT-analysis for the development of your region towards a low-carbon economy in 2050. Include stakeholders in the process.

Strengths	Weaknesses
• High potential on RES • High potential on EE including households and transport sector • Good examples are already existing in the region	• Economic weakness • Lack of public support
Opportunities	**Threats**
• Strong EU regulations • The payback time of REN production is likely to shorten	• Lack of governmental support • Strong coal lobby • Regulation barriers

Assess the following trends:

- Policy Support for reaching energy and climate goals
- Public awareness building
- EE Potential Households
- EE Potential Private Sector & Industry
- EE Potential Transport
- Regional REN production
- Availability of relevant energy data

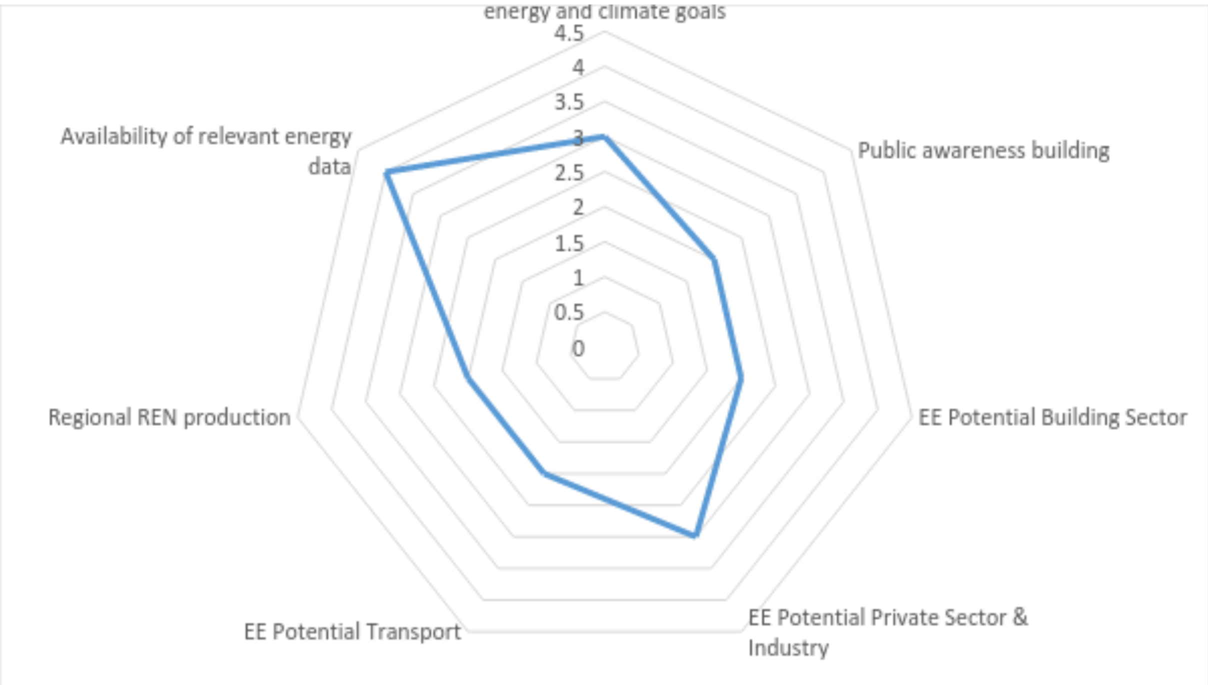
Self-assessment:

See Excel template or modify the graph provided here (right-click).

Points:

1 … no measures set/ potential unused

to
5 … fully developed/ potential fully used



11. Annex: List of sources /bibliography /List of relevant stakeholders/institutions in the region

Please include your sources/bibliography, a list of identified stakeholders, etc

[1] Mátrai Erőmű Zrt. Mátrai Erőmű - Cégtörténet n.d. http://www.mert.hu/cegtortenet (accessed June 20, 2017).

[2] Mátrai Erőmű Zrt. Mert magazin - 2016. nyár 2016.

[3] European Commission. Union Registry | Climate Action n.d. https://ec.europa.eu/clima/policies/ets/registry_en#tab-0-1 (accessed June 20, 2017).

[4] Hungarian Transmission System Operator (MAVIR). A magyar villamosenergia-rendszer adatai 2016.

[5] IFC Group. Tisza Erőmű Kft. n.d. http://tiszapower.eu/tevekenysegunk (accessed June 20, 2017).

[6] MVM. Gázturbinás erőművek. Httpwwwgterhubemutatkozastevekenyseggazturbinas-Eromuvek n.d. http://www.gter.hu/bemutatkozas/tevekenyseg/gazturbinas-eromuvek/ (accessed June 20, 2017).

[7] MOL Zrt. BorsodChem Ipari Erőmű Avatási ünnepség - MOL Magyarország n.d. https://mol.hu/hu/molrol/mediaszoba/kozlemenyek/2119-borsodchem-ipari-eromu-avatasi-unnepseg (accessed June 20, 2017).

[8] Bercsi G. A A TVK erőműve - új lehetőségek független ipari erőmű-beruházásokra Magyarországon. Magyar energetika 2003;11:5–12.

[9] Greenfo. És akkor mi van, ha betiltják a lignit lakossági árusítását? | Hírek | Greenfo - Zöld iránytű a neten n.d. http://greenfo.hu/hirek/2016/01/14/es-akkor-mi-van-ha-betiltjak-a-lignit-lakossagi-arusitasat (accessed June 22, 2017).

[10] Tiszavíz Vízerőmű Kft. Tiszavíz Vízerőmű Kft. n.d. http://www.tiszavizvizeromu.hu/kiskore-vizeromu.php (accessed June 20, 2017).

[11] PYLON Kft. REGIONAL ENERGY SUPPLY ANALYSIS OF Borsod – Abaúj – Zemplén County - „Introducing Regional Energy Concepts” project Borsod-Abaúj-Zemplén County concept region, Hungary - Report 4.2.1., CEP_REC project 2014.

[12] Pannergy. Projektek | PannErgy n.d. http://pannergy.com/projektek/#miskolc (accessed June 20, 2017).

[13] Villanyszerelők lapja. 16 MW-os fotovillamos erőmű a Mátrában n.d. https://www.villanylap.hu/lapszamok/2016/november/4320-16-mw-os-fotovillamos-eromu-a-matraban (accessed June 20, 2017).

[14] Miho. Biomassza hasznosítás | MIHŐ - “Környezetbarát energia a jövőnkért” n.d. http://www.miho.hu/biomassza-hasznositas (accessed June 20, 2017).

[15] Hungarian Energy and Public Utility Regulatory Authority (MEKH). Yearly data n.d. http://www.mekh.hu/eves-adatok (accessed June 22, 2017).

[16] National Food Chain Safety Office (Nébih). Erdővagyon és erdőgazdálkodás Magyarországon 2015-ben 2016.

[17] Stallprofi Kft. Biogáz referenciák n.d. http://www.stallprofi.hu/biogazuzem-referenciak (accessed June 21, 2017).

[18] Biogáz Unió Zrt. Harsány biogázüzem n.d. http://www.biogazunio.hu/projektek/harsany/ (accessed June 21, 2017).

[19] boon.hu. Kétszeresére nőtt a felsődobszai vízi erőmű kapacitása | BOON n.d. http://www.boon.hu/ketszeresere-nott-a-felsodobszai-vizi-eromu-kapacitasa/2366128 (accessed June 20, 2017).

[20] vg.hu. Újabb törpe vízerőmű létesül | Világgazdaság n.d. https://www.vg.hu/vallalatok/energia/ujabb-torpe-vizeromu-letesul-408707/ (accessed June 20, 2017).

[21] gyereatiszara.blog.hu. A KISKÖREI VÍZERŐMŰ - A TISZA-TÓ BÖLCSŐJE - Gyere a Tisza-tóra n.d. http://gyereatiszatora.blog.hu/2015/04/15/a_kiskorei_vizeromu (accessed June 29, 2017).
[22] Hungarian Energy and Public Utility Regulatory Authority (MEKH). NEM ENGEDÉLYKÖTELES KISERŐMŰVEK ÉS HÁZTARTÁSI MÉRETŰ KISERŐMŰVEK ADATAI 2008-2015 n.d. http://www.mekh.hu/nem-engedelykoteles-kiseromuvek-es-haztartasi-meretu-kiseromuvek-adatai-2008-2015-villamos-energia (accessed June 21, 2017).
[23] City of Miskolc. MISKOLC MEGYEI JOGÚ VÁROS FENNTARTHATÓ ENERGIA AKCIÓTERV (SEAP) FELÜLVIZSGÁLATA 2016.
[24] Nagy J. Personal talk with the owner 2017.
[25] Bars R, Vámos T, Nagy D, Monos E, Max G. Rendszerek a szakképzésben. BME Tanárképző Központ; n.d.
[26] Hungarian Central Statistical Office (Központi Statisztikai Hivatal. KSH Statinfo n.d. http://statinfo.ksh.hu/Statinfo/index.jsp (accessed June 22, 2017).
[27] energiapedia.hu. Honnan jön a földgáz? n.d. http://energiapedia.hu/honnan-jon-a-foldgaz (accessed June 22, 2017).
[28] Északerdő Zrt. Újabb közfoglalkoztatási program az ÉSZAKERDŐ Zrt.-nél n.d. http://www.eszakerdo.hu/magyar/aktual/2016/kozfoglalkoztatasi_program_cikk.htm (accessed June 20, 2017).
[29] Mátrai erőmű Zrt. Mert magazin - 2016. tél n.d.
[30] Greenfo. A fűtés letekerésével csak keveset spórolhatunk | Hírek | Greenfo - Zöld iránytű a neten n.d. http://greenfo.hu/hirek/2015/02/17/a-futes-letekeresevel-csak-keveset-sporolhatunk (accessed June 22, 2017).
[31] Hungarian Central Statistical Office (Központi Statisztikai Hivatal. A háztartások energiafelhasználása, 2008 2010.
[32] Hungarian Energy and Public Utility Regulatory Authority (MEKH). A lakossági villamos energia és földgázárak nemzetközi összehasonlító vizsgálata 2017. május 2017.
[33] MIHŐ. Díjtételek | MIHŐ - "Környezetbarát energia a jövőnkért" n.d. http://www.miho.hu/dijtetelek (accessed June 22, 2017).
[34] E.ON. E.ON HU - Éjszakai áram (vezérelt mérő) n.d. http://www.eon.hu/ejszakai_aram_(vezerelt_mero) (accessed June 22, 2017).
[35] Energiaklub. POVERTY OR FUEL POVERTY? Defining fuel poverty in Europe and Hungary 2012.
[36] World Health Organization (WHO). Economic cost of the health impact of air pollution in Europe. 2015.
[37] Hungarian Central Statistical Office (Központi Statisztikai Hivatal. 3.1.2. Energia (2003–2015) n.d. http://www.ksh.hu/thm/3/indi3_1_2.html (accessed June 23, 2017).
[38] International Energy Agency (IEA). Energy Policies of IEA Countries - Hungary, 2017 Review 2017.
[39] Hungarian Central Statistical Office (Központi Statisztikai Hivatal. Magyarországi térképek – Nemzeti számlák, GDP n.d. https://www.ksh.hu/interaktiv/terkepek/mo/gdp.html?mapid=QPT011 (accessed June 23, 2017).
[40] Borsod-Abaúj-Zemplén Megyei Közgyűlés. Borsod-Abaúj-Zemplén Megye Területfejlesztési Koncepciója - Helyzetértékelés 2013.
[41] Szlávik J. HEVES MEGYE TERÜLETFEJLESZTÉSI KONCEPCIÓJA (2014-2020) - HELYZETELEMZÉS, HELYZETÉRTÉKELÉS 2013.
[42] 2017. LV. law: a megújuló energia közlekedési célú felhasználásának előmozdításáról és a közlekedésben felhasznált energia üvegházhatású gázkibocsátásának csökkentéséről szóló 2010. évi CXVII. törvény módosításáró. n.d.
[43] encs.hu. Gibárti Vízerőmű , Encs n.d. http://encs.varosom.hu/latnivalok/muemlekek/Gibarti-Vizeromu.html (accessed June 27, 2017).
[44] RWE Hungária. Fenntarthatósági jelentés 2012.

[45] Tóth L, Schrempf N. CAPACITY AND STRUCTURE OF THE INSTALLED WIND POWER PLANTS ON HUNGARY n.d.

[46] miviz.hu. Kész a biogázüzem: zöld áram lesz a szennyvíziszapból | MiVíz - „Bükki forrásból" n.d. http://www.miviz.hu/hirek/kesz-biogazuzem-zold-aram-lesz-szennyviziszapbol (accessed June 27, 2017).

[47] zoldautok.hu. Egyre több a zöld rendszám Magyarországon - ZoldAutok.hu n.d. http://zoldautok.hu/2016/09/10/egyre-tobb-zold-rendszam-magyarorszagon/ (accessed June 28, 2017).

[48] Pócz A, Harmat Á. Az elektormos közlekedés jelene és jövője a Bükk LEADER Térségben. Az Energ. Irányváltás Küszöbén Energiaföldrajzi Kut. Magyarországi Mintaterületeken, Budapest: ELTE TTK Földrajz- és Földtudományi Intézet, Földrajztudományi Központ, Környezet- és Tájföldrajzi Tanszék; 2016.

[49] NRG Regport. Szabályozás - Kevesen érdeklődnek a kis METÁR iránt n.d. http://nrgreport.com/cikk/2017/02/15/kevesen-erdeklodnek-a-kis-metar-irant (accessed June 28, 2017).

[50] Hungarian Energy and Public Utility Regulatory Authority (MEKH). KÉT ÉS FÉLSZERESÉRE NÖVEKEDHET MAGYARORSZÁGON A MEGÚJULÓ ERŐFORRÁSBÓL SZÁRMAZÓ VILLAMOSENERGIA-TERMELÉS n.d. http://www.mekh.hu/ket-es-felszeresere-novekedhet-magyarorszagon-a-megujulo-eroforrasbol-szarmazo-villamosenergia-termeles (accessed June 28, 2017).

[51] PYLON Kft. REPORT ON THE RESULTS OF MAPPING AND QUANTITATIVE ASSESSMENT OF RENEWABLE ENERGY SOURCE POTENTIALS IN BAZ COUNTY 2014.

[52] boon.hu. Naperőmű épült Sajóbábonyban | BOON n.d. http://www.boon.hu/naperomu-epult-sajobabonyban/3101463 (accessed June 26, 2017).

[53] zoldtech.hu. 465 kilowattos napelemes rendszer épült Borsod-Abaúj-Zemplén megyében n.d. http://zoldtech.hu/cikkek/20150930-Sostofalva-napelem (accessed June 26, 2017).

[54] E-Solar. Tibolddaróc 467 kWp Generál kivitelezés – Napelemek n.d. https://et-solar.hu/2015/09/07/tibolddaroc1/ (accessed June 26, 2017).

[55] zoldtech.hu. Közel négyezer napelemet telepítenek a Heves megyei Demjén mellett n.d. http://zoldtech.hu/cikkek/20150415-napelem-Demjen (accessed June 26, 2017).

[56] Bartholy J. Éghajlattan. EDUTUS; 2012.

[57] Munkácsy B, Kohlheb N, Harmat Á, Sáfián F. Environmental Limits to Sustainable Energy Production in Hungary. Geogr Locality Stud 2016;4–Locality and the Global Challenges of Energy Transition:820–53.

[58] Tóth AN, editor. Magyarország geotermikus felmérése 2016. Hungarian Energy and Public Utility Regulatory Authority (MEKH); 2016.

REGIONAL ENERGY PROFILE

Region: Ignalina NPP Region

PANEL 2050 – Partnership for New Energy Leadership 2050
Deliverable 3.1

By: INPP region development agency

Date: 01.08.2017

Horizon 2020
European Union funding
for Research & Innovation

Table of Content

1. Methodology

The PANEL 2050 project has the aim to create durable and replicable sustainable energy networks at local (municipality/community) level, where relevant local stakeholders collaborate for the creation of a local energy visions, strategies and action plans. The aim of these networks is to contribute to and actively work for the transition towards low carbon communities in 2050.

The PANEL 2050 partnership will provide support for the creation of first successful local energy networks in the CEE countries. In the course of the project, organisations from 10 CEE countries will collaborate on creating regional energy strategies and action plans.

The present Regional Energy Profile was prepared in order to get a better understanding of the energy–related status quo in the Ignalina Nuclear Power Plant (afterwards Ignalina NPP), analysing strengths and challenges with regard to the transition towards a low carbon community.

This energy profile constitutes the groundwork for the preparation of a Regional Energy Roadmap and related Action Plans and will be essential for the communication with regional stakeholders.

For completing this Regional Energy Profile the following sources were used:

Majority of information used in this document come from regular statistics and publication by Iganlina District, Zarasai District and Visaginas Municipalities, Statistics Lithuania, the main energy producers and providers in Ignalina NPP region, as well as from publications of Ministry of Energy.

2. General introduction of the region

Name of the region and NUTS identification

Ignalina Nuclear Power Plant region consists of Ignalina district, Zarasai district, and Visaginas municipalities. It is part of Utena County (NUTS identification LT009).

Geography and policy:

Describe the location of the region + provide also a political map showing location of the region in your country

Ignalina Nuclear Power Plant (NPP) region is situated in the north–eastern part of Lithuania, near the country's border with Belarus and Latvia. Region consists of three municipalities – Ignalina district, Zarasai district and Visaginas. The region is called Ignalina NPP region due to proximity to Ignalina NPP.

Figure 1 illustrates the location of Ignalina NPP (which is marked in red).

Figure 1. The Location of Ignalina NPP

Geography of the region, including morphology, geology, climate, hydrology, flora and fauna related to energy (text description)

Ignalina NPP region is distinguished from other Lithuanian regions by its numerous lakes. There are 505 lakes covering 24.9 k hectares (almost 9% of the total territory). It is the highest proportion across the country. Moreover, the region is relatively abundant in forests covering approximately 36% of the total territory. As a result, the region is rich in wood and peat resources as well as biodiversity of aquatic and terrestrial organisms. It also has national and regional parks such as Aukštaitija National Park, Gražutė Regional Park, and Ažušilė Landscape Reserve.

Ignalina NPP region has the most continental climate in Lithuania. Here winters are colder and snowier, while summers are hotter, drier and less windy compared to other parts of the country. The region has the lowest average annual temperature (of around 6°C) and the longest period with snow (around 90 days; its depth is 30 – 40 cm). On the other hand, sun shines around 1707 hours per year and the average speed of wind is only 2 m/s in this region.

Ignalina NPP region is hilly and its soil consists of sandy loam. Thus conditions for agricultural and rural development are not very favorable.

Brief history overview of the region – state the most important milestones related to the industrial / regional development (e.g. significant energy projects, power plants, etc.), ideally related to energy

The development of Ignalina NPP region is closely linked to Ignalina Nuclear Power Plant. The establishment of nuclear power plant led to the creation of Visaginas municipality. Visaginas is Lithuania's youngest municipality which was built as a town for workers engaged in the construction and exploitation of the Ignalina NPP. The plant was a major employer in the region, it stimulated local economy providing services and products necessary for NPP and its staff, lead to improvement in local regional infrastructure. However, its shutdown in 2009 resulted in numerous socio–economic problems such as increased unemployment and economic decline.

Public administration procedure – brief profile of current energy planning process in your region starting from the national level down to the region (see also your desk research within WP3.1)

Most energy planning in Lithuania is conducted at a national level. Based on the current needs and international requirements the national energy strategies are developed (for example National Renewable Energy and National Energy Efficiency Action Plans). The national energy policy is shaped by the Ministry of Energy of the Republic of Lithuania. Also, all laws and fundamental strategies have to be approved by the Lithuanian Parliament which is the supreme legislative body. Before approval, they are analysed by the Energy commission as well as other relevant commissions and committees of the Lithuanian Parliament. Though legal acts also have to be signed by the President, the Parliament can override a President rejection to pass a law.

At a regional level, every Lithuanian county sets out a region's development plan covering regional measures related to energy production and use. Regional plans have to be in line with national priorities and strategies. The local municipalities have a great influence on regional development plan. The municipalities of Ignalina NPP region are included in the regional development plan of Utena County.

The local–level decisions are made by municipalities. Each municipality prepares its strategy, action and development plans which define local objectives and planned actions to increase energy efficiency, use of renewable energy sources and develop the energy sector. Municipalities have to adhere national and regional priorities while developing their strategies but they are able to set highly specific local goals and actions to be taken.

Highlight significant characteristics differentiating region from others and give short (!) introduction of energy targets and challenges in the region

After the establishment of Ignalina NPP, the regional economy was closely linked to the plant. Having lost one of its major economic drivers in 2009, the region is still suffering from relatively high unemployment, slow economic growth. Before the plant was closed, the region used to be the main energy producer supplying most of the electricity used in Lithuania. Now, most energy in the region is imported leading to high spike in energy price as well as interest in energy efficiency or production form local resources.

The objectives of Ignalina NPP region comply with the national priorities. Currently Lithuanian energy policy is focused on renovation of public buildings and various other energy efficiency measures. The National Renewable Energy Action Plan sets out the goal to produce 23% of all consumed energy from renewable sources and thus fulfill the EU target

Energy strategy of Ignalina NPP region covers three municipalities. It promotes smart energy consumption (renovation of public and apartment buildings, modernisation of heating system), energy production from local renewable sources and developing Ignalina NPP region into smart, "green" and environmentally–friendly region.

3. Basic demographic data and figures

Regional demographic indicators:

Population of region	54 090	cap
Area of region	2 839	km²
Population density	19	cap/km²
Number of individual municipalities	3	mun.

Source: Statistics Lithuania. Data from 2015

Population growth, age distribution in last 20 year – text description

The population of Ignalina NPP region is decreasing and aging. Currently, most people (61%) are of working age (15–64 years), 25% of inhabitants are above 65 years–old and the rest 14% are younger than 15 years[1]. The median age of the inhabitants of the region is 50 years which is significantly higher than the median population age in Lithuania (43 years). The main reasons causing decrease in population are negative natural growth (very low birth rates) and emigration.

Basic demographic data:

Socio–economic development of past 3–5 years

Unemployment rate	14	%
Average annual income per capita (gross)	7 758	EUR
difference from the EU average (34 500 EUR gross annual earning)	–78	%
Share of employees in		
agriculture	12	%
industry	30	%
services	59	%
Share of population with tertiary education	34	%

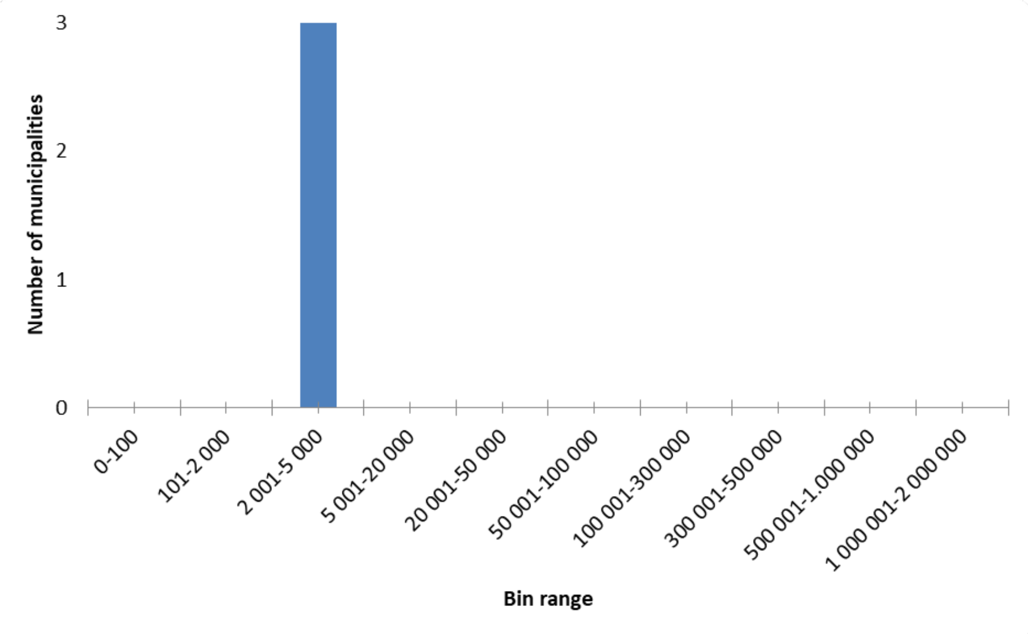
Source: Statistics Lithuania

The spatial distribution of the population, level of urbanisation

The urbanization level in the region is around 63% and is increasing over time. The highest concentration of people is in Visaginas town, while approximately half of population of Zarasai district and Ignalina district municipalities live in rural areas and residents are spread widely across the region.

[1] Statistics Lithuania

Figure 2. The Distribution of Municipalities by Settlement Size (Units)



4. Regional economy and economic trends

Regional economic indicators:

GDP, total	440	million EUR
GDP per capita	8 145	EUR/cap
HDI	0.839[2]	

Source: Statistics Lithuania. Data from 2015

GDP per economic sectors[3]:		
Agriculture	6	% of total GDP
Industry	33	%
Services	61	%

Source: Statistics Lithuania, United Nations. Data from 2015

Regional economy

Please provide information about the regional economy, past development and trends using GDP and other indicators. If available, include graphs about GDP / HDI development of last 10–20 years.

Compared to the other parts of Lithuania, the region is economically distressed. Ignalina NPP used to be the key economic driver providing employment and relatively high wages. Therefore, the region hasn't fully recovered from the shutdown of Ignalina NPP.

Ignalina NPP region accounts for around 1% of Lithuanian GDP. The conditions for agriculture are unfavorable. On the other hand, the share of service sector of total GDP has been increasing recently as a result of tourism development and small local businesses such as retail shops.

[2] *HDI is provided for whole Lithuania as data for Ignalina NPP region is not available*

[3] *Data is provided for Utena region as an estimate as data for Ignalina NPP region is not available*

Even though, there is no information over regional HDI, the Lithuanian HDI has been constantly growing 0.73 in 1990 to 0.84 in 2015 due to economic growth and increasing standards of living in the country. Similar trend is expected to be followed in the region.

number of operating entrepreneurs (SMEs, large and individual)	1 259	
→ share of SMEs	99%	% of total number of operating businesses
number of operating non–profit organisations	338	
Amount of EU funds (2007–13)	97.96	M EUR

What are the main contributors/contributing sectors to the regional GDP? How stable are these sectors (qualitative assessment)?

The main contributor to regional GDP is service sector, including tourism, wholesale, retail and other small businesses. Yet this sector is not expected to grow significantly, as its potential is limited. Visaginas municipality stands out from the region due to strong industrial sector. Here the main contributors to GDP are industrial companies producing construction equipment, furniture, energy and etc.

Current economic structure does not ensure the proper development of the region and recovery from the shutdown of Ignalina NPP. Thus, municipalities are focusing on development of technology, energy and tourism sectors. Tourism is seen as having the highest potential in the region due to the attractive landscapes, lakes and other tourists' attractions. What is more, the region is abundant in natural resources (wood and peat) and skilled labour, making it favorable for industry development. According to region's development plan, the potential industries include energy efficient technologies, production of energy equipment, wood manufacturing, etc.

Describe the regional job market, employment/unemployment rates per sectors – agriculture and forestry, industry, services

The highest proportion of people are currently working in service sector, especially in wholesale, retail and construction companies. Moreover, the number of people working in service sector has been increasing for the last few years due to establishment of new companies.

However, around 14% of people are unemployed. The increase of unemployment was triggered by the closure of Ignalina NPP. As region's economy strives to recover, there is a need for investments and new or expanding businesses.

Importance of trade; Import/ export balance, if available

The region is exporting only few goods and the value of its exports is insignificant with respect to total GDP. Therefore, even though the exact imports/exports data is not available, this region is assumed to have trade deficit.

5. National and local energy strategies

List of relevant and most influencing strategies / roadmaps / measures to local energy situation or development –

Region	Brief description of current …	Legal requirement OR voluntary initiative	National/ regional/ local level	Original title + link (if possible)	English title + brief description	Organisation in charge	Type (EE,EPB,RES, etc. or combination)
Lithuania	In 2012 the Lithuanian Parliament approved The National Strategy for Climate Change Management Policy for 2013–2050. It outlines short–term, medium–term and long–term climate change–related goals and objectives. Energy–oriented goals such as improvement of the efficiency of energy production and use, and the use of renewable energy sources are defined.	Legal	National	Nacionalinė klimato kaitos valdymo politikos strategija	The National Strategy for Climate Change Management Policy	The Government of the Republic of Lithuania; The Ministry of Environment of the Republic of Lithuania	All
Lithuania	The National Strategy for Sustainable Development sets out tasks how to make Lithuanian energy sector safe, environmentally–friendly, and integrated into the single EU energy system, ensure reliable and diversified energy supply, raise efficiency of energy generation, distribution and consumption as well as expand the use of renewables and waste energy.	Legal	National	Nacionalinė darnaus vystymosi strategija	The National Strategy for Sustainable Development	The Ministry of Environment of the Republic of Lithuania	All
Lithuania	The National Energy Independence Strategy sets main targets for the energy sector to be reached until 2020 and outlines the energy sector vision of the up until 2050. The key objective of the strategy is to ensure energy independence for Lithuania by 2020.	Legal	National	Nacionaline energetikos nepriklausomybes strategija	The National Energy Independence Strategy	The Ministry of Energy of the Republic of Lithuania	All
Lithuania	The Law on Renewable Energy sources and the National Strategy for the Development of Renewable Energy Sources defines objectives and tasks helping to increase the share of renewable energy to at least 23% by 2020.	Legal	National	Lietuvos Respublikos atsinaujinančių išteklių energetikos įstatymas; Nacionalinė atsinaujinančių energijos išteklių plėtros strategija	The Law on Renewable Energy sources; The National Strategy for the Development of Renewable Energy Sources	The Ministry of Energy of the Republic of Lithuania	RES

Lithuania	The Lithuanian Power Market Development Plan aimed to liberalise the Lithuanian energy industry. After its implementation electricity users can choose the independent energy suppliers instead of paying regulated electricity tariffs. The plan set out actions to increase competition, reduce trade barriers in power sector as well as prepare for the establishment of common Baltic power market.	Legal	National	Lietuvos elektros rinkos plėtros planas	Lithuanian Power Market Development Plan	The Ministry of Energy of the Republic of Lithuania	Power market
Lithuania	The Law on Heat sector and The National Programme Heat Sector Development in 2015–2021 provides a roadmap for heating sector development. It defines goals aiming to increase heating sector efficiency, use of biofuels and renewable energy sources and reduce the environmental impact of the sector.	Legal	National	Lietuvos Respublikos šilumos ūkio įstatymas; Nacionalinė šilumos ūkio plėtros 2015–2021 metų programa	The Law on Heat sector; The National Programme Heat Sector Development in 2015–2021	The Ministry of Energy of the Republic of Lithuania	Heating sector
Lithuania	The Energy Efficiency Action Plan overviews key measures for increase of energy efficiency and energy savings focusing on areas of energy supply, transmission, distribution and final consumption. It was developed in line with Directive 2012/27/EU.	Legal	National	Energijos vartojimo efektyvumo veiksmų planas	Energy Efficiency Action Plan	The Ministry of Energy of the Republic of Lithuania	EE
Utena country	The development plan discusses energy related issues such as sustainable use of resource, increase of energy efficiency and development of alternative and renewable energy use. It includes the plans for building renovations, modernisation of heating and public lighting systems.	Legal	Regional	Utenos regiono plėtros 2014–2020m. planas	Development Plan for Utena Region for 2014–2020	Regional Development Department; Utena district municipalities	All
Ignalina NPP	The Ignalina NPP region energy strategy and related action plans provide a plan for the development of local renewable energy resources and intelligent energy use in Ignalina NPP region for 2012 – 2035.	Legal	Regional	Ignalinos AE regiono energetikos strategija 2012–2035; Zarasų rajono savivaldybės, Ignalinos rajono savivaldybės, Visagino savivaldybės veiksmų planai Ignalinos AE regiono energetikos sektoriaus strateginio plano įgyvendinimui	Ignalina NPP Region Energy Strategy for 2012–2035; Action Plans for Implementation of Ignalina NPP Region Energy Strategy for Ignalina District Municipality, Zarasai District Municipality and Visaginas Municipality	Ignalina District Municipality, Visaginas Municipality and Zarasai District Municipality	All

6. Energy Production

6.1. *Conventional energy production capacities (fossil fuels and nuclear power)*

Give an overview of energy production by fossil fuels and nuclear power plants – concentrate on the most significant 3 to 5 power plants.

Name & Location (city, town)	Owner	Year of commissioning (refurbishment)	Type of plant & fuel	Capacity in MW	Annual energy production in MWh	Annual CO_2– emissions in t	Utilization rate (qualitative assessment)
Thermal plant of Visagino energija (Visaginas, Karlų village)	State enterprise Visagino energija	• 2006 (natural gas plants) • 2013, 2014 (biomass plants)	Natural gas / biomass plants	388.9	254 320	62 388	Constantly used
Steam plant and reserve diesel power station	State enterprise Ignalinos atominė elektrinė	• 2005	Natural gas/ diesel plants	33.6	n/a	4 585	Constantly used
Plants in Didžiasalis and Naujasis Daugėliškis vilages (Ignalina district municipality)	Didžiasalio komunalinės paslaugos (Ignalina district municipality is the major shareholder)	• 2001	Liquid fuel/ biomass plants	9.53	9 850	n/a	Constantly used

Sources: National Commission for Energy Control and Prices, The Environmental Protection Agency, State Enterprise Energy Agency, the official websites of energy producers

Add additional details to describe the conventional energy production capacities in the region. What are current trends? What influence have age, regional economy, fuel imports, and fuel prices on the on the current status?

The conventional energy production in the region is shrinking. Conventional energy producers are investing into renewable energy sources and switching from imported fossil fuels to biomass. For example, the main heat producer in Zarasai district municipality Panevežio Energija refurbished their plants in Ignalina NPP region and moved from fuel oil to biomass. Currently the main conventional energy producer is Visaginas Energija (major heat producer in Visaginas municipality) which mostly uses natural gas for energy production, however the company plans to increase the share of biomass from 42% in 2016 to 60% in 2019[4].

The move from fossil fuels to renewable energy sources is facilitated by political and economic factors. The major energy providers in Ignalina NPP region belong to state or municipalities and thus they have to follow the national strategies focusing on higher energy efficiency and lower environmental impact. Moreover, the price of fossil fuels is increasing. Therefore, moving to renewable energy sources allow energy producers to reduce their costs and stay competitive. Finally, the refurbishment of energy production plants is encouraged by the availability of EU funds partially financing the projects.

[4] Visagino energija (2017) "Valstybės įmonės „Visagino energija" veiklos strategija 2017–2020 m."

6.2. *Renewable energy production*

Energy production capacities

Give an overview of energy production by renewable energy capacities (e.g. small/large hydro, solar PV, solar thermal, biomass, geothermal & other production capacities – concentrate on the most significant 3 to 5 power plants or aggregation of production facilities.

Name & Location (city, town)	Owner	Year of commissioning (refurbishment)	Type of plant & fuel	Capacity in MW	Annual energy production in MWh	Annual CO_2– emissions in t	Utilization rate (qualitative assessment)
Thermal plant of Visagino energija (Visaginas, Karlų village)	State enterprise Visagino energija	• 2006 (natural gas plants) • 2013, 2014 (biomass plants)	Natural gas / biomass plants	388.9	254 320	62 388	Constantly used
Zarasai biomass plants (2 biomass plants in Zarasai city and 1 in Užtiltė village)	Panevėžio energija (98% shares of which belong to various municipalities)	• 2001 (plant in Užtiltė) • 2012, 2016 (plants in Zarasai)	Biomass plant	28.68	28 730	18 520	Constantly used
Plants in Ignalina, Dūkštai and Vidiliškės	Ignalinos šilumos tinklai (Ignalina district municipality is the major shareholder)	• Plants refurbished in 2001–2004 • Solar collectors installed in 2011	Biomass plants/ solar panels	23.82	24 370	n/a	Constantly used
Plants in Didžiasalis and Naujasis Daugėliškis villages (Ignalina district municipality)	Didžiasalio komunalinės paslaugos (Ignalina district municipality is the major shareholder)	• 2001	Liquid fuel/ biomass plants	9.53	9 850	n/a	Constantly used
Plant in Karlų village (Visaginas municipality)	Belongs to private company Visagino linija	• 2007	Biomass plant	5.2	35 856	n/a	Constantly used

Sources: National Commission for Energy Control and Prices, The Environmental Protection Agency, State Enterprise Energy Agency, the official websites of energy producers

Add additional details to describe the renewable energy production capacities in the region. What are current trends? What influence have age, regional economy, fuel availability or renewable energy potential, and subsidy systems on the current status?

The major part of fuel and energy consumed in Lithuania and in Ignalina NPP region is imported. Having shutdown Ignalina Nuclear Power Plant, Lithuania is no longer able to satisfy its energy demand. Therefore, it is natural that the share of electricity generated using renewable energy sources is increasing. This increase is further stimulated by the availability of national or EU funds for establishment of renewable energy plants.

The Ignalina NPP region stands out from other parts of Lithuania by its extensive use of biomass energy. It is the most popular energy source in the region due to its availability. There are plenty wood, straw, waste and other materials that can be used to produce biomass in Ignalina NPP region leading to relatively low price. Other types of the renewable energy sources used in the region are solar energy, hydropower and biogas. However, the conditions are unfavourable for wind or geothermal energy production.

6.3. *Transmission and distributions*

What kind of facilities constitute the electric transmission and distribution system? Who are the owners? Who are the operators? Please add relevant map if available.

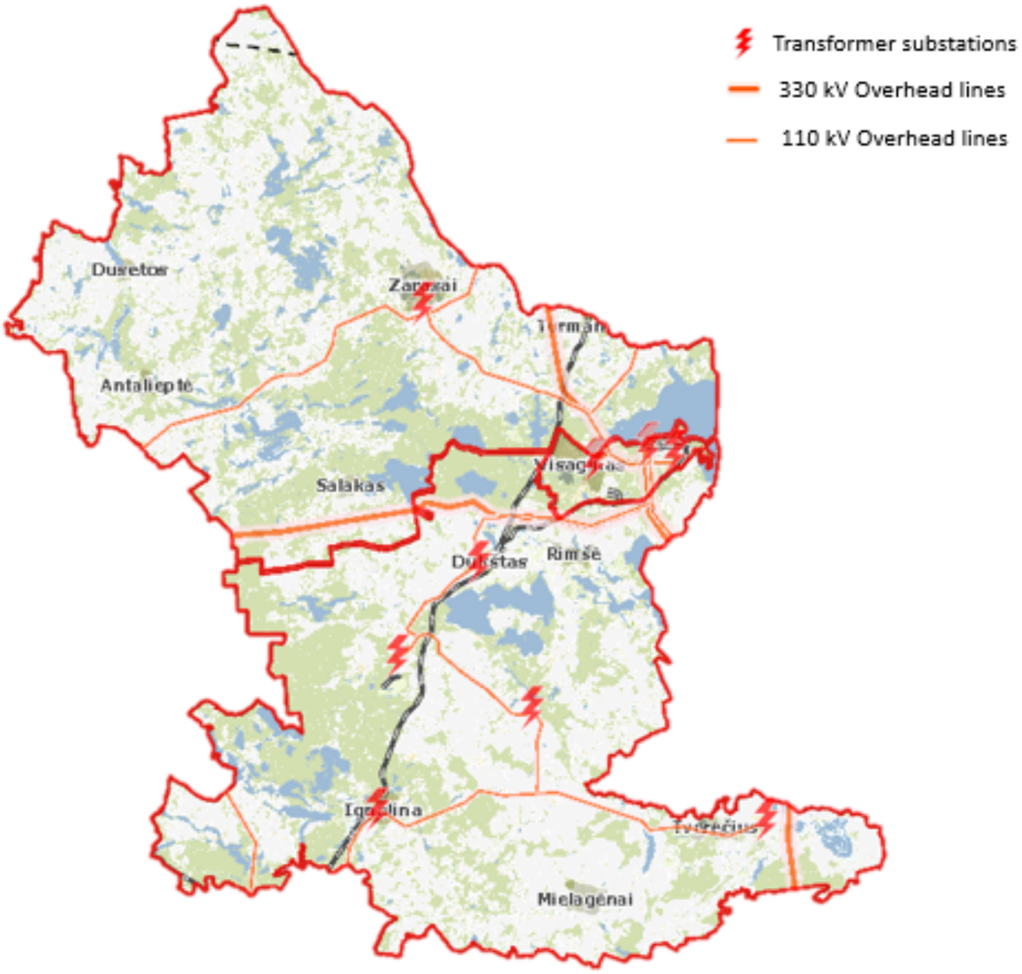
Ignalina NPP region is part of Lithuanian power market. Its main group of players are electricity producers, transmission operator, distribution network operator and electricity consumers.

Lithuanian electricity transmission system operator is Litgrid responsible for power flows in the country, stable functioning of the power system, and strategic projects in the power sector. Its main shareholder is EPSO–G owned by the Ministry of Energy of the Republic of Lithuania.

Lithuanian electricity distribution network operator is Energijos Skirstymo Operatorius who manages electricity and natural gas supply and distribution, ensures the development and security of electricity and gas distribution networks. The company is controlled by state–owned group of energy companies Lietuvos Energija.

The electric transmission and distribution network of Ignalina NPP region is provided in Figure 3.

Figure 3. The electric transmission and distribution network of Ignalina NPP region



Source: State enterprise "Registrų centras"

Give an overview of other centralised or decentralised energy distribution systems (e.g. natural gas pipelines, heat grids, etc.).

Natural gas

Ignalina NPP (or to be more exact Visaginas city) is part of Lithuanian gas network (shown in Figure 4). The main group of players in Lithuanian gas market are gas producers, transmission operators, distribution network operators and consumers. The activities of gas transmission, distribution and supply are subject to licensing by the National Commission for Energy Control and Prices.

Lithuanian gas transmission system consists of gas transmission pipelines, gas compressor stations, gas metering and distribution stations, cathodic protection systems, and remote data transmission and telecommunication systems. The system is interconnected with gas transmission systems of the Latvia, Belarus, Kaliningrad Region, Klaipeda Liquefied Natural Gas Terminal and distribution systems[5].

Lithuanian gas transmission system is operated by Amber Grid. Besides being responsible for gas transmission, the company maintains and develops natural gas transmission system. Its main shareholder is EPSO–G owned by the Ministry of Energy of the Republic of Lithuania.

Even though 5 natural gas distributors operate in Lithuania, only Energijos skirstymo operatorius operates in Ignalina NPP region. It is the main gas distributor in Lithuania having around 99% of the market[6]. Energijos skirstymo operatorius is controlled by state–owned group of energy companies Lietuvos Energija. In Ignalina NPP region Energijos skirstymo operatorius provides gas only to the business clients the main of which are the thermal plants of heat providers.

Heat grids

Each municipality of Ignalina NPP region has a separate heat supplier who produce most of the heat themselves:

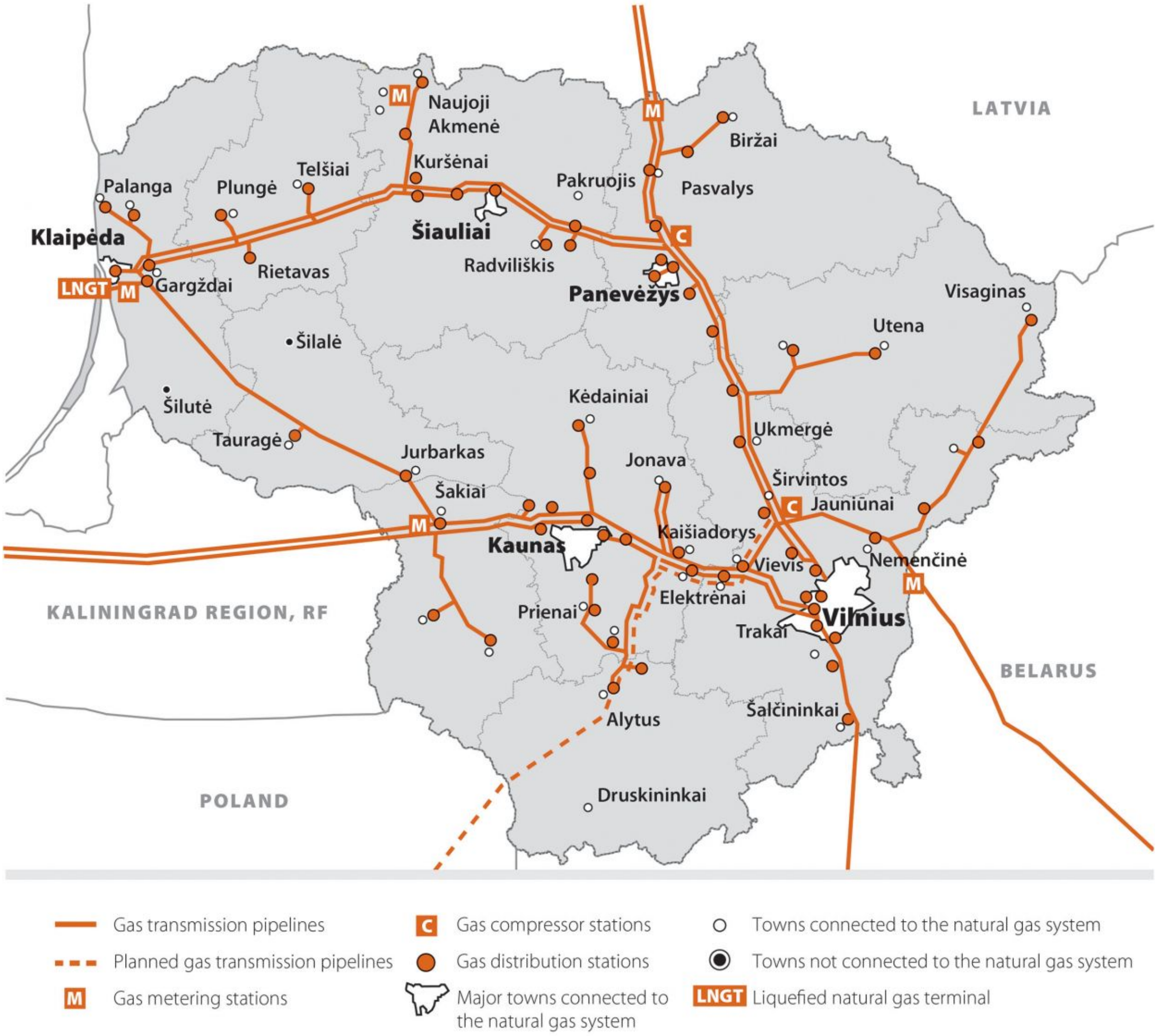
• In Ignalina district municipality heat providers and main producers are Ignalinos šilumos tinklai and Didžiasalio komunalinės paslaugos both of which belong to Ignalina district municipality.

• In Zarasai district municipality the heat is supplied and produced by Panevėžio energija. This company is owned by a number of Lithuanian municipalities.

• In Visaginas municipality the heat is supplied and produced by Visagino energija belonging to Visaginas municipality.

[5] Amber Grid (2017) „Gas Transmission System in Lithuania“
[6] National Commission for Energy Control and Prices (2016) “Gamtinių dujų skirstymo sistema”

Figure 4. Gas distribution network in Lithuania



Source: "Amber Grid"

Give an overview on interconnections of regional energy production with the rest of the country. Are there large production facilities in the region on which the rest of the country's energy supply might depend?

After the shutdown of the Ignalina NPP in end of 2009, there are no large energy production facilities in Ignalina NPP region

In general only around 40% of energy consumed in Lithuania is produced inside the country[7]. The major energy producer in Lithuania is Lietuvos energijos gamyba producing around 1.835 TWh or around about 20% of Lithuanian demand[8]. It owns 3 energy production facilities – Elektrėnai Complex, Kruonis Pumped Storage Hydroelectric Plant and Kaunas Algirdas Brazauskas' Hydroelectric Power Plant but none of them are in Ignalina NPP region.

[7] National Commission for Energy Control and Prices (2016) "Elektros energijos gamyba"
[8] Lietuvos energija (2015) "Electricity Generation"

6.4. *Jobs in the energy sector*

Give an overview about the status of the energy sector in the regional economy. How many jobs are there at the moment in the energy sector. How important are new "green job" for regional economy development. If possible, quantify investments in the energy sector.

The importance of energy sector for regional economy declined dramatically after the shutdown of Ignalina NPP in 2009. The NPP used to employ significant share of the population in the region. Also, it used to buy services and products from local companies. Even though Ignalina NPP stays the major employer in energy sector, the number of its personnel was reduced from 3087 in 2007 to 1966 in 2010[9]. It stayed around 2000 employees in 2010 – 2017 and it is planned to be further reduced to 1100 by 2029[10]. Initially, a new nuclear plant was planned to be built in Visaginas but its implementation is suspended until it becomes necessary or economically beneficial[11].

Despite the decrease of contribution of energy sector to regional economy, this sector is seen among the top areas for further development[12]. To facilitate the development of energy sector, an Energy Sector Training Center as well as Visaginas Technology and Energy Park were established.

According to Statistics Lithuania, there are 7 companies operating in energy sector in Ignalina NPP region. This number has stayed stable in the period 2015–2017. The tangible investments in Energy and Utilities sectors combined corresponded to € 54 million.

Are coal and lignite mining undertaken in the region? What role does fossil fuel mining play for the regional economy and for regional energy security?

No coal or lignite mining is undertaken in the region. All fossil fuels are being imported. But as the main fuel used for the regional energy production is biomass, it does not have significant impact on the economy and security of the region.

[9] Ignalina Nuclear Power plant (2011) „Valstybės įmonės Ignalinos atominės elektrinės veiklos ataskaita už 2010 m.“

[10] Visaginas City Local Action Group (2016) „Visagino miesto vietos plėtros strategija 2016–2022 m.“

[11] The Ministry of Energy (2016) „Rekomendacijos dėl pagrindinių Lietuvos Respublikos energetikos strategijos krypčių“

[12] Visaginas municipality (2016) “VIsagino savivaldybės 2016–2022 m. strateginis plėtros planas”

7. Final energy consumption

7.1. *Households*

Regional final energy consumption of household sector	393.7	GWh

Source: Based on data from *Energijos skirstymo operatorius, Statistics Lithuania, The Lithuanian District Heating Association, Panevežio energija, Didžiasalio komunalinės paslaugos*

Heat consumption

Total heat energy consumption of households sector (heating and hot water consumption)	319.9[13]	GWh
Average heat energy consumption per household	12 042	kWh/hh

Source: Based on data from *Statistics Lithuania, The Lithuanian District Heating Association, Panevežio energija, Didžiasalio komunalinės paslaugos*

Describe the average building standard. What is their average age of existing building stock? Are energy efficient renovations in progress?

The building stock of Ignalina NPP region is 2.1 M m^2 (0.8 M m^2, 0.7 M m^2 and 0.6 M m^2 in Ignalina district, Zarasai district and Visaginas municipalities respectively)[14]. While less than 70% of Ignalina and Zarasai district residents live in independent houses, virtually all inhabitants of Visaginas municipality live in apartment houses[15].

Around 69% of apartment houses were built 28 – 38 years ago[15]. Back then the energy efficiency requirements for buildings were very low. Moreover, while Ignalina NPP was operating, real estate owners had no incentive to invest in energy efficiency due to low heating costs. Due to low energy efficiency, an average apartment (of less than 60 m^2) if not renovated consumes around 140 kWh/m² heat a year[16].

Each municipality of Ignalina NPP region has started an energy efficient renovations program for apartment houses called "EnerVizija". As the programme is co–financed by the Lithuanian Government, Climate change and Ignalina programs, the owners of selected buildings have to pay only around 50 – 55% of the renovation costs[17]. The renovation programme is highly successful in Ignalina district municipality where 50% (or 80 out of 162) of apartment buildings have been renovated by August 2017[18]. Other municipalities in the region are by far less successful. Only 11 (4%) apartment buildings are renovated in Zarasai district and none in Visaginas municipalities, but they have plans to expand the renovation programmes[19].

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[13] In calculating the heat energy consumption, an assumption is made that households with central heating and decentralized heating use the same amount of energy (measured in kWh) to heat 1 m^2.
[14] Statistics Lithuania
[15] Investicijų Partneris (2012) "Ignalinos AE regiono energetikos strategija 2012–2035"
[16] Ignalina district municipality (2016) "Ignalinos rajono energinio efektyvumo didinimo daugiabučiuose namuose programa „Ignalinos Enervizija""
[17] Zarasų būstas
[18] Ignalina district municipality (2016) "Ignalinos rajono energinio efektyvumo didinimo daugiabučiuose namuose programa „Ignalinos Enervizija""; Housing Advisory Agency (2017) „Top 10 savivaldybių renovacijos lyderiai"
[19] Visaginas municipality (2017) "Strateginis veiklos planas 2017–2019", Zarasai district municipality (2017) "Zarasų rajono savivaldybės 2017–2019 metų strateginis veiklos planas", Aina Naujienos (2017) "Daugiabučių

Electricity

Electricity consumption of households	54.5	GWh
Average electricity consumption per household	1 007	kWh/hh

Source: Based on data from *"Energijos skirstymo operatorius", Statistics Lithuania*

Describe if there are any national or regional programmes for reducing household electricity consumption (e.g. washing machine or refrigerator replacement programme). If yes, please elaborate it briefly.

A few small–scale national awareness–raising campaigns have been launched teaching how electricity consumption can be reduced in households. No large scale programs have been implemented.

Cooking

Gas consumption for cooking appliances of households	n/a	GWh

Describe if gas is a significant energy source for cooking in the household sector.

Three types of cookers are used for food preparation in households: (1) electric, (2) gas, and (3) induction. Electric and gas cookers are the most widely used at the moment.

General information

Household electricity price	0.10	EUR/kWh (incl. taxes)
Household natural gas price	0.38 – 0.64	EUR/kWh (incl. taxes)
Household district heating price	0.05– 0.06	EUR/kWh (incl. taxes)
Energy expenditure by household	5.4[20]	% of income

Sources: Based on data from *National Commission for Energy Control and Prices, the official websites of heat, gas and electricity providers, The Ministry of Finance*

Is there any element of Demand Side Management of electricity on household level in place? If yes, please describe it (e.g. peak price, smart metering)

The main demand side management measures include smart metering systems and pricing models. All electricity consumers have smart metering and pay for electricity they actually consume. Moreover, the consumers are offered different pricing options. First of all, they can select price plan (Standard, Home, and Home plus) each having monthly subscription price on the top of fee per kWh. Additionally, users can select either single time tariff or dual time tariff. If dual time tariff is chosen, higher price is payed for daytime energy consumption than for electricity consumed at night or weekends. This way electricity consumers can select the optimal pricing plan minimizing their costs and are encouraged to save electricity during daytime.

renovacija Zarasuose įgauna pagreitį", Vilnius Gediminas Technical University (2012) "Zarasų rajono savivaldybės daugiabučių gyvenamųjų namų energijos efektyvumo didinimo galimybių studija"

[20] The value is based on the assumtption that energy expenditure by houshold (as % of income) for Ignalina NPP region is equal to energy expenditure by household in Lithuania

Is energy poverty an issue in the region? If yes, please describe how many people are affected, in what extent?

During summertime energy poverty is not a common problem in Ignalina NPP. However, for some households it becomes an issue during heating season. They are either unable to warm their houses adequately or to pay for their heating costs on time. The average net wage in the region is € 563.5[21] while the heating monthly bill for an average household living in an old 60 m^2 apartment consuming a lot of heat would be around € 100 – € 146 during winter months or around 22% of an average wage[22]. Additionally, the households have to pay for electricity, hot water and other essentials making energy costs a burden to some households.

There is no statistics on the energy poverty in the region. But the number of indebted energy consumers serves as a rough estimate. As of January 2017, 2320 (14.6%) domestic consumers of central heat services were indebted to heat providers in the region[23].

Give an estimate of the trend in final energy consumption in the household sector using values from – 5 to +5 where (–5 is a strong reduction, 0 means neither growth nor reduction, +5 strong growth).

–1. The final energy consumption in the household sector is decreasing. In 2013 – 2017 the population of Ignalina NPP decreased by 9.9% leading to the lower number of energy consumers[21]. Moreover, the reduction in energy consumption is facilitated by the renovation of buildings and more energy efficient technologies currently available on the market. However, the decrease is relatively moderate due to more intense use of electronic devices and very few campaigns encouraging residents to save energy they use.

7.2. *Service Sector*

Regional final energy consumption of service sector	35.1[24]	GWh

Sources: Based on data from Statistics Lithuania, ENTRANZE

What are the main sub–sectors driving energy consumption in the in the service sector (building standard, number of businesses, …)? How important is service sector for the regional economy?

Service sector is very important for regional economy. It accounts for approximately 53% of the turnover and 52% of the workforce in the Ignalina NPP region[21]. The main subsectors include wholesale and retail trade, repair of motor vehicles and motorcycles and transport and storage. Besides the transport sector (analyzed in more detail in section 7.4.), other service subsectors are not energy–intensive and consume little energy compared to industry or households.

[21] Statistics Lithuania
[22] Didžiasalio komunalinės paslaugos "Heat analysis"
[23] The Lithuanian District Heating Association (2017) "Šilumos tiekimo bendrovių 2016 metų ūkinės veiklos apžvalga"
[24] The number is estimated from total regional energy balance – on the basis of GDP per service sector.

Give an estimate of the trend in final energy consumption in the service sector using values from –5 to +5 where (–5 is a strong reduction, 0 means neither growth nor reduction, +5 strong growth).

0. The service sector is expected to consume similar amount of energy in the future. Though service sector is expanding in the region, this effect is expected to be offset by the investments in energy efficiency (renovation of buildings and more efficient appliances).

7.3. *Industry*

Total energy consumption of the industrial sector	81.5	GWh
Industry electricity price	0.01–0.03	EUR/kWh (incl. taxes)
Industry natural gas price	0.04–0.06	EUR/kWh (incl. taxes)
Household district heating price	0.05– 0.06	EUR/kWh (incl. taxes)

Sources: Based on data from National Commission for Energy Control and Prices, "Energijos skirstymo operatorius", the official websites of heat, gas and electricity providers,

What are the main sub–sectors driving energy consumption in the in the industrial sector? How important is industry for the regional economy?

Industry is highly important for regional economy. It accounts for approximately 44% of the turnover and 49% of the workforce in the Ignalina NPP region[25]. Most of the regional industry is concentrated in Visaginas with the dominant subsectors of furniture, energy, food, construction, textiles production. Out of them food and textile production are relatively energy – intensive industries.

7.4. *Transport*

Regional final energy consumption of transport sector	210.6	GWh

Sources: Based on data from Statistics Lithuania

Describe the main characteristics of the transport sector: transport infrastructure, motorisation rate, availability of public transport and differences between urban and rural environments.

There were 23 275 vehicles registered in the Ignalina NPP region in 2016. This number has increased by 3% since 2014[25]. Out of them cars are the most popular vehicle type accounting for 90.4% of the vehicles in the region leading to the motorization rate of 391 passenger car per 1000 inhabitants. This number is just below the Lithuanian average (402). The highest motorization rate in the region is in Zarasai district municipality (422) and the lowest in Visaginas municipality (352).

In general, the traffic in the region is not highly intense. The highest traffic volume on the main and national roads are on road Kaunas – Zarasai – Daugpilis equal to 6 500 average vehicles per day including 787 freight transport vehicles[26].

The region has a developed network of public transport. The region can be reached using rail or busses from major Lithuanian and close Latvian cities. Also, a bus network is developed inside

[25] Statistics Lithuania

[26] Lithuanian Road Administration under the Ministry of Transport and Communications (2017) "Annual average daily traffic (AADT) in 2016"

Visaginas city. The buses used for public transport are old and inefficient. Public transportation services are unprofitable and thus partially subsidized by the regional municipalities[27].

Passenger transport

Motorisation rate – number of passenger cars/1 000 inhabitants	391.1	
Regional energy consumption of passenger transport in the region	182.3[28]	GWh

Based on data from Statistics Lithuania

Freight transport

Regional energy consumption of road freight transport	16.9	GWh

Based on data from Statistics Lithuania

If the rail, or transport by pipeline is a significant way of the freight transport, please describe their main characteristics.

Despite the relatively good location (proximity to the border of Latvia or Belarus), Ignalina NPP region is far from the main Lithuanian rail corridors. Therefore, railway is inconvenient for international transport and its potential is limited. In general, there are two main stations for freight transportation in Ignalina NPP region: Ignalina and Dūkštai. They have small storage areas (750 m^2 and 100 m^2 in Ignalina and Dūkštai respectively) where wood or similar freight could be stored.

The pipelines are mainly used to provide gas to Visaginas. Its share within the Ignalina NPP transportation sector is marginal.

Use of alternative fuels

Describe the market development for alternative fuel vehicles (natural gas, biogas, electric cars). What supporting mechanisms for alternative fuel are available on national and regional level? Describe challenges and barriers, e.g. infrastructure, technological, supply, financial barriers, etc.

Alternative fuel vehicles are quite unpopular in Ignalina NPP region. Hybrid and alternative fuel cars account for 10% and 1% respectively in Lithuania[29]. Looking at the newly registered cars, the alternative fuel cars accounted for more than 4% of all newly imported cars in the first half of 2017[30] indicating the increasing popularity of the alternative fuel.

The low share of alternative fuel cars can be partially attributed to lack of supporting mechanisms for alternative fuel in Lithuania and Ignalina NPP region. The benefits are offered only for electric car owners and are limited to:

[27] Visaginas municipality (2016) "Visagino savivaldybės 2016–2022 m. strateginis plėtros planas"; Zarasai municipality (2015) "Zarasų rajono savivaldybės 2015–2021 m. strateginis plėtros planas"
[28] The number is estimated from total regional energy balance – on the basis of nuber of vehicles in the region, GDP per transportation sector and population.
[29] Ministry of Energy of the Republic of Lithuania (2015) "Atsinaujinančių energijos išteklių naudojimas Lietuvos transporto sektoriuje"
[30] Autoplius.lt (2017) "Ketvirtinė automobilių rinkos apžvalga, 2017 m. 2 ketvirtis"; Autoplius.lt (2017) "Ketvirtinė automobilių rinkos apžvalga, 2017 m. 1 ketvirtis"

1) The right not to pay parking fee (if the electric car owner has a permit which is granted for an annual fee)

2) The right to charge the electric cars for free in the public charging points

3) The right to use traffic lanes devoted to public transport and taxis that are market with electric car symbol.

Currently there are no charging points in Ignalina NPP region and the volume of traffic is relatively low, thus none of the supporting mechanisms provide incentives to use alternative fuel.

The main barrier for electric car use in the region is the lack of necessary infrastructure. As have been mentioned before, there are no charging points for electric cars in Ignalina NPP region. This barrier will be reduced in the future as Visaginas and Zarasai district municipalities aim to establish charging points for electric cars by 2021[27]. Moreover, the electric cars are around 1.5 – 2 times more expensive than diesel cars.

Most of the support schemes for alternative fuels are focused on biofuel. For example, the Law on Energy from Renewable Sources imposes a requirement on fuel traders to include 5–10% of biofuel into petrol and diesel they sell. Also, biofuel producers can get a partial reimbursement for biofuel production costs. Also excise tax relief and environmental pollution tax exemption is applied to biofuels for transport. All of the schemes are administrated at the national level.

Give an estimate of the trend in final energy consumption in the transport sector using values from –5– to +5 where (–5 is a strong reduction, 0 means neither growth nor reduction, +5 strong growth).

3. The energy consumption in transport sector is increasing due to an increasing number of vehicles in the Region. In Lithuania the use of energy in transport sector increased by 18.9%[31]. Similar trend was followed in Ignalina NPP region.

[31]Ministry of Energy (2015) "Atsinaujinančių energijos išteklių naudojimas Lietuvos transporto sektoriuje"

7.5. *Summary*

7.5.1. Final energy indicators

General indicators for the region

Total final energy consumption	743.0	GWh
Final energy consumption per capita	13 736.0	kWh/cap
Electricity consumption per capita	2 397.1	kWh/cap
Heat consumption per capita	6565.7	kWh/cap
% of total country consumption	1.3	%

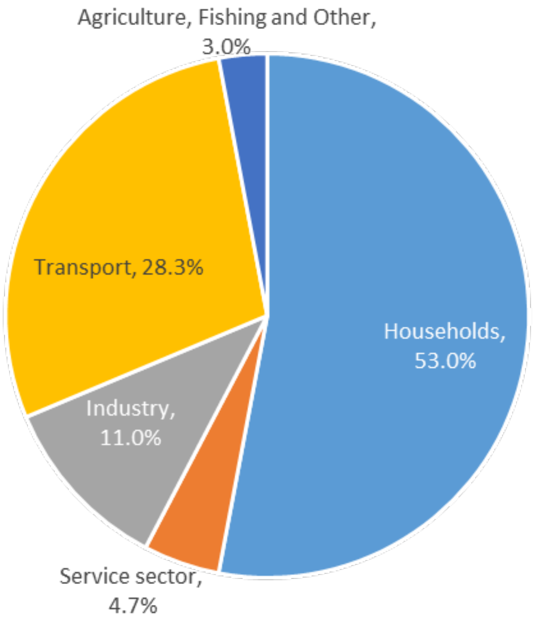
Based on data from Statistics Lithuania, Energy providers, Enerdata, and David MacKay FRS

Final energy consumption per sector

Year: 2016			%
Households	393.7	GWh	53.0%
Service sector	35.1	GWh	4.7%
Industry	81.5	GWh	11.0%
Transport	210.6	GWh	28.3%
Agriculture, Fishing and Other	22.1	GWh	3.0%
Sum	**743.0**	**GWh**	**100%**

Based on data from Statistics Lithuania, Energy providers, Enerdata, and David MacKay FRS

Figure 5. Share of Final Energy Consumption per Sector



Based on data from Statistics Lithuania, Energy providers, Enerdata, and David MacKay FRS

Give an estimate of the trend in final energy consumption using values from –5– to +5 (where–5 is a strong reduction, 0 means neither growth nor reduction, +5 strong growth).

–1. The energy consumption is slowly decreasing in the region mainly due to lower energy consumption in household and service sectors.

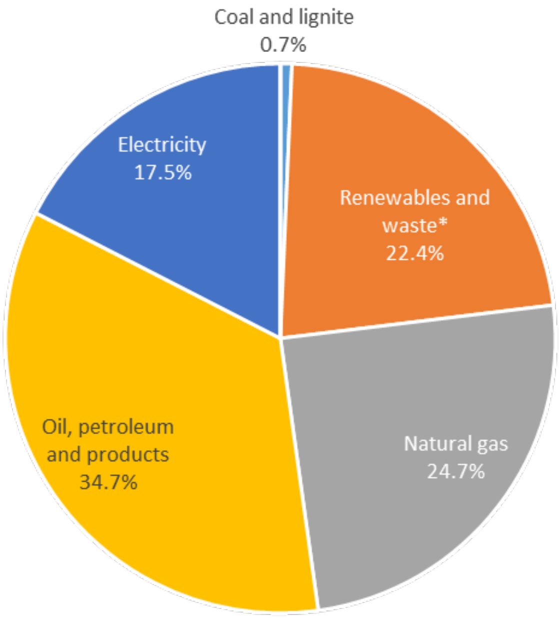
7.5.2. *Final energy consumption by fuel*

Total final energy consumption by fuel

Year: 2015			%
Coal and lignite	5.02	GWh	0.7%
Renewables and waste[32]*	166.4	GWh	22.4%
Natural gas	183.8	GWh	24.7%
Oil, petroleum and products	258.2	GWh	34.7%
Electricity	129.7	GWh	17.5%
Other fuels	0.0	GWh	0.0%
Sum	**743.0**	**GWh**	**100.0%**

Based on data from Statistics Lithuania, Energy providers, Enerdata, David MacKay FRS, Energy Agency, National Commission for Energy Control and Prices

Figure 6. Share of Final Energy Consumption by Fuel



Based on data from Statistics Lithuania, Energy providers, Enerdata, David MacKay FRS, Energy Agency, National Commission for Energy Control and Prices

[32] Hydro, wind, solar, tide/wave, biomass and waste, geothermal

7.5.3. Primary energy equivalent

Total Primary Energy Consumption	920.5	GWh
Primary energy consumption per capita	17 018.2	kWh/cap
Primary energy factor of electricity	2.5	–
Energy intensity	0.0	TPES/GDP

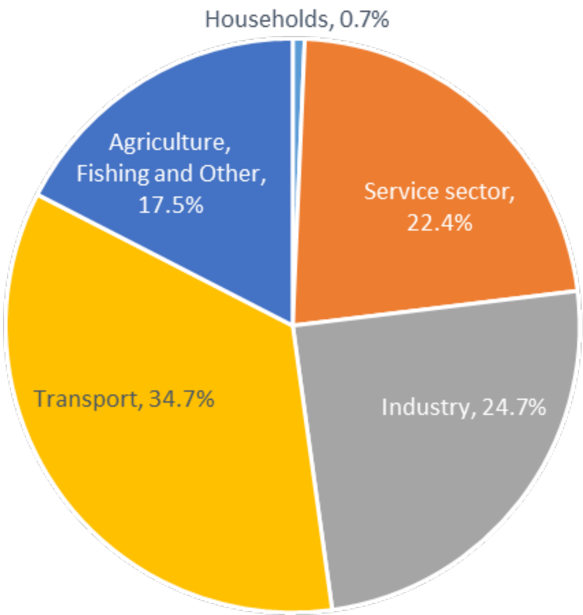
Based on data from European Commission, Statistics Lithuania, Energy providers, Enerdata, David MacKay FRS, Energy Agency, National Commission for Energy Control and Prices

Primary energy equivalent by sector

Year: 2015			%
Households	393.7	GWh	50.7%
Service sector	35.1	GWh	7.3%
Industry	81.5	GWh	16.9%
Transport	210.6	GWh	25.2%
Agriculture, Fishing and Other	22.1	GWh	0.0%
Sum	393.7	**GWh**	**100.0%**

Based on data from European Commission, Statistics Lithuania, Energy providers, Enerdata, David MacKay FRS, Energy Agency, National Commission for Energy Control and Prices

Figure 7. Share of Primary Energy Equivalent by Sector



Based on data from European Commission, Statistics Lithuania, Energy providers, Enerdata, David MacKay FRS, Energy Agency, National Commission for Energy Control and Prices

What is the level of primary energy supply dependencies: Which fuels need to be imported form the rest of the country and internationally.

Dependency on fuel imports: very high / high / average / low / very low
After the shutdown of Ignalina NPP, most of the primary energy and fuels are imported to the region. There are no large scale energy producers or fossil fuels in the region. The only locally available resources are biomass (vastly used to produce heat in the region), solar, wind and water.

7.5.4. Regional CO_2–emissions associated with energy consumption

Total CO_2–emission associated with energy sector	0.0001	Mio t
CO_2–emissions per capita	0.0023	t/cap
CO_2–emissions per GDP	0.0000	t/€ GDP

Based on data from European Commission, Statistics Lithuania, Energy providers, Enerdata, David MacKay FRS, Energy Agency, National Commission for Energy Control and Prices, International Panel on climate change

Energy–related CO_2–emissions by sector

Year: 2015			%
Households	49.15	t CO_2	39.5%
Service sector	5.02	t CO_2	4.0%
Industry	11.68	t CO_2	9.4%
Transport	56.18	t CO_2	45.1%
Agriculture, Fishing and Other	2.41	t CO_2	1.9%
Sum	49.15	t CO_2	**100.0%**

Based on data from European Commission, Statistics Lithuania, Energy providers, Enerdata, David MacKay FRS, Energy Agency, National Commission for Energy Control and Prices, International Panel on climate change

8. Renewable energy sources – status and potential

8.1. *General information*

Renewable Energy Targets:		
2020 RES share in gross final energy consumption	23	%
2030 RES share in gross final energy consumption	45[33]	%
Current RES share (2015)	22.4	%
thereof RES out of the region	n/a	%

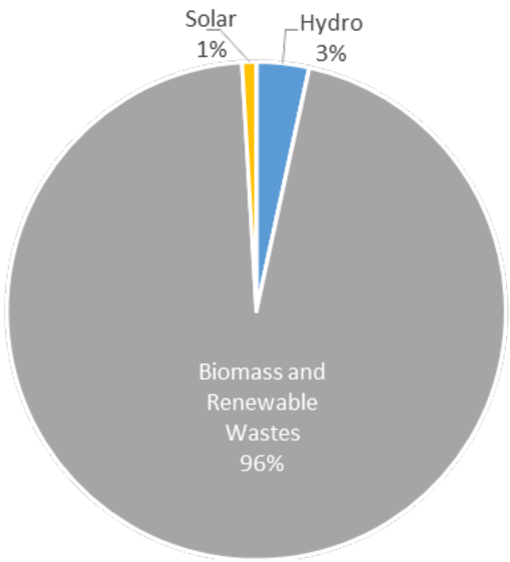
Sources: The National Energy Independence Strategy

Share of final energy consumption produced by renewable fuels

Year: 2015			**%**
Hydro	5.7	GWh	3.4%
Wind	0	GWh	0.0%
Biomass, biofuels and renewable wastes	159.2	GWh	95.7%
Solar	1.5	GWh	0.9%
Geothermal	0	GWh	0.0%
Tide, Wave, Ocean	0	GWh	0.0%
Sum	**166.4**	**GWh**	**100.0%**

Based on data from European Commission, Statistics Lithuania, Energy providers, Enerdata, David MacKay FRS, Energy Agency, National Commission for Energy Control and Prices, International Panel on climate change

Figure 8. Share of Final energy consumption produced by renewable fuels



Based on data from European Commission, Statistics Lithuania, Energy providers, Enerdata, David MacKay FRS, Energy Agency, National Commission for Energy Control and Prices, International Panel on climate change

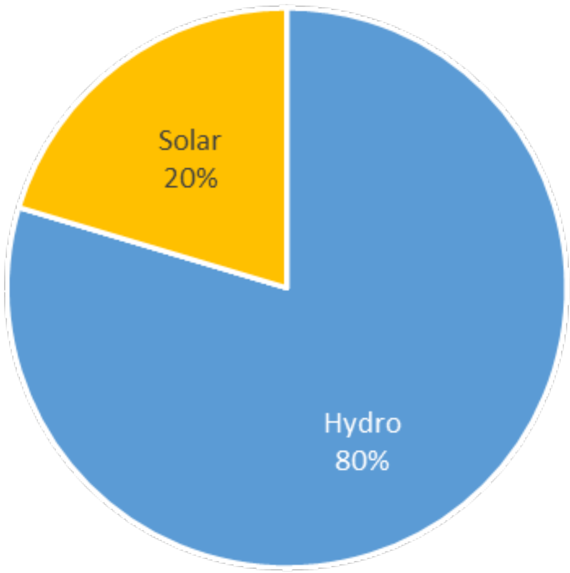
[33] The target is set in the project of The National Energy Independence Strategy which is currently under approval

Share of total electric demand covered by renewable fuels

Year: 2015			%
Hydro	5.674	GWh	3.4%
Wind	0	GWh	0.0%
Biomass, biofuels and renewable wastes	0	GWh	0.0%
Solar	1.45	GWh	0.9%
Geothermal	0	GWh	0.0%
Tide, Wave, Ocean	0	GWh	0.0%
Sum	5.674	GWh	3.4%

Based on data from European Commission, Statistics Lithuania, Energy providers, Enerdata, David MacKay FRS, Energy Agency, National Commission for Energy Control and Prices, International Panel on climate change

Figure 9. Share of Total Electric Demand Covered by Renewable Fuels



Based on data from European Commission, Statistics Lithuania, Energy providers, Enerdata, David MacKay FRS, Energy Agency, National Commission for Energy Control and Prices, International Panel on climate change

Describe if and how renewable energy sources are integrated in the transport sector, e.g. biofuels, electric vehicles.

The use of renewable energy sources in energy sector is very low in region as well as in the country. The share of renewable energy sources in final energy consumption of transport sector decreased from 4.8% in 2012 to 4.6% in 2015[34] in Lithuania Also, Hybrid and alternative fuel cars account for only 10% and 1% respectively of all cars used in the country[35]. The same trends are expected to hold in Ignalina NPP region. Most of renewable energy sources in transport sector are consumed by blending biofuel with petrol and diesel to comply with the legal requirements.

[34] Ministry of Energy of the Republic of Lithuania (2017) "Atsinaujinantys energijos ištekliai"
[35] Ministry of Energy of the Republic of Lithuania (2015) "Atsinaujinančių energijos išteklių naudojimas Lietuvos transporto sektoriuje"

Describe the status of REN production in the region. % of total energy and electricity demand covered by REN. If available give a historic overview of the REN production capacities for the last 5 to 10 years.

Currently REN account for around 22.4% of all energy used in the region and this share is increasing. The main driver for REN is the use of biomass in the heating sector. Also, the solar energy is increasing used in the region growing from 0,805 MWh in 2011 to around 1.5 GWh in 2016[36].

Describe if there are incentive programmes/schemes (financial and non–financial) in place to support REN–development. Are these programmes on national, regional or local level?

Various national–level incentive programs promoting production and use of REN exist. Main incentive schemes for REN energy producers include sliding feed–in premium. National Commission for Energy Control and Prices sets tariff rates for RES plants with a generating capacity of up to 10 kW. RES plants with the installed capacity exceeding 10 kW acquire the guaranteed tariff rate by participating in tenders37. Also, energy produced from RES is exempt from excise duty and environmental pollution tax. Gas system operators have to inject biogas into the natural gas transmission and/ or distribution system. Finally, partial financing might be offered for:

1) Installation of REN generation capacities in industrial companies, development and installation of REN technologies

2) Solar power project development

3) Installation of biofuel heating systems and biomass cogeneration devices

4) Replacement of worn–out biofuel heat generation devices

5) Installation REN production devices in independent houses (up to 30%)

Other supporting measures include priority connection to the grid and the obligation of heat to purchase all heat produced from renewable energy sources suppliers.

No local or regional level schemes exist.

Describe the top 5 regulatory barriers slowing down current and future REN–development. Should these barriers be addressed at national, regional or local level?

Lithuania has reached most of its goals for REN–development set for 2020 in the Law on Energy from Renewable Sources. However, the objective to reach the combined 141 MW capacity of Hydro energy plants by 2020 has not been met yet. It is mainly attributed to strict environmental protection laws[38]. The environmental protection laws are stricter than in other EU countries but they can be changed only at the national level.

Another barrier is the fact that RES plants with a generating capacity higher than 10 kW do not qualify for the premium feed–in tariff set by National Commission for Energy Control and Prices. Also, quotas limit how much electricity is bought using the premium feed–in tariff (e.g. the total power for wind energy is 500 MW, 141 f MW for hydro energy and etc.). Those quotas are distributed through auction. The feed–in tariffs are a key measure which makes renewable energy an

36

37 Jurga Tallat–Kelpšaitė (2017) "Lithuania: Overall summary"

38 National Audit Office of the Republic of Lithuania (2010) "Valstybinio audito ataskaita atsinaujinančių energijos išteklių potencialo naudojimas Lietuvoje"

attractive business in Lithuania. Thus abolishing quotas would lead to more renewable energy production. However, such policy would require high amount of public funding. Also, there is a technical limit on how much power can be supplied using existing power grids in Lithuania.

Strict requirements (such as minimum REN share of the fuel balance) which have to be met to be eligible for sliding feed–in premium, lack of long–term REN strategy and implementing legislation and uncertainty due to legislation changes are seen as other REN limiting factors[39]. These issues have to be solved at a national level.

Give an estimate of the trend in renewable energy production using values from –5– to +5 (where –5 is a strong reduction, 0 means neither growth nor reduction, +5 strong growth). Describe supporting factor as well as barriers.

3. The use of renewable energy production in Ignalina NPP is increasing. Here most energy is produced by the heat providers. As central heating companies in Ignalina and Zarasai are producing all their heat from renewable sources (mainly biomass) and Visaginas energija is increasing its use of biomass fuel (due to relatively low biomass price compared to imported fossil fuels), the share of REN is rising. Also, the use of solar energy is increasing in the region. The main barrier for wider REN production is the low potential for geothermal, wind or hydro energy in the region.

8.2. *Available natural resources in the region*

8.2.1. Biomass

How are forest areas used? For what purpose? What is the regional energy potential using existing forest areas? Please state whether it is a theoretical or technical potential and describe regulatory support systems as well as barriers.

Ignalina NPP region is relatively abundant in forests as they cover more than 106k ha or approximately 36% of the total territory. As a result, the region is rich in wood and peat resources. Forestry together with agriculture and hunting accounts for around 5% of economic activities in Ignalina and Zarasai district municipalities. Overall wood increment is around 636 thousands m^3 on the yearly basis in Ignalina NPP region. However, the economic activities are restricted in around 17 thousands ha of regional forests (e.g. they are reserve or recreational forests), thus, these forests cannot be included into the biomass production. The theoretical wood potential for biomass production is 536 thousands m^3 wood per year or the whole increment of wood in less protected forests. According to the National Forestry Development Program for 2012–2020, only 44% percent of the increment is actually used excluding branches, barks and stumps.

Currently, small private forest plots prevail, limiting the economies of scale. The forest owners could cooperate for cleaning and sanitary lumbering to increase the efficiency of forest management and use.

According to 2010 State Audit Report by State Audit Office of Republic of Lithuania, Lithuania takes the second place among EU countries based on the biomass usage potential per capita. Compared to other renewable energy sources potential, biomass sources are among the most important ones in Lithuania due to the amount of current reserves and its stability.

[39] Paulius Markovas (2013) "Atsinaujinančių energetikos išteklių teisinis reguliavimas"

Lithuania National Forestry Development Strategy states that collected amount of lumbering waste should be tripled by 2020. Then it would reach 500 thousands m^3 by 2020. Following the targets of Lithuania National Forestry Development Strategy, 38 186 m^3 of wood could be used for biomass production in Ignalina NPP region. As the thermal value of wood fuel is 2.4 MWh / ktm, 91 886 MWh of energy would be obtained each year. It accounts for 21% of yearly thermal energy consumption in the region. Thus, it is reasonable to promote lumbering waste collection.

Around 25% of natural wood increment is lost as dead wood. Only 25% of it is collected. Considering that every year there is around 134 thousands m^3 of dead wood in Ignalina NPP region, around 103 thousands m^3 of it is left to rot. Even though dead wood potential is used inefficiently, it would not be cost effective to increase dead wood collection, as it involves higher costs than collecting lumbering waste.

There are various support measures related to biomass energy production. Similarly to other sorts of renewable energy production, the biomass energy is eligible for sliding feed–in premium. National Commission for Energy Control and Prices sets tariff rates for RES plants with a generating capacity of up to 10 kW. RES plants with the installed capacity exceeding 10 kW acquire the guaranteed tariff rate by participating in tenders40. Also, biomass energy is exempt from excise duty and environmental pollution tax. Gas system operators have to inject biogas into the natural gas transmission and / or distribution system. The measures targeted specifically at biomass energy include the financial support for the farmers who produce energy corps as biofuel raw materials, companies which purchase and process them and the companies willing to invest into the installation of biomass plants.

What are main agricultural products at the moment? What is the regional energy potential from agricultural products? Please state whether it is a theoretical or technical potential and describe regulatory support systems as well as barriers.

The main agricultural products in Ignalina NPP region are rape (0.51 thousands t), rye (4.06 thousands t), wheat (8.79 thousands t), barley (9.54 thousands t), and oats (2.16 thousands t). Considering that 10% of overall produced amount of straw would be used for fuel and fuel thermal value is equal to 2.4MWh/t, straw fuel potential is equal to 6 010 MWh/year. Therefore, straw energetic potential is feasible and recommended in small centralized heating provision systems in Ignalina NPP region. Also, it would be reasonable to build 1–2 boilers in Ignalina or Zarasai town boiler–house next to the boilers heated using wood waste.

Industrial grass plantations in Lithuania are rather rare, but they could be established on the little fertile land in the future. Approximately 11 thousands ha of land is abandoned and uncultivated In Ignalina NPP region which could be used for growing energetic plants and provide 7t/ha average yield or 83 thousands t of dry biomass.

[40] Jurga Tallat–Kelpšaitė (2017) “Lithuania: Overall summary”

8.2.2. Hydro power (incl. tide and wave power)

Give an overview of hydro power sources used at the moment and describe the energy potential for the different technologies: run–of–river hydropower plants, reservoir hydropower plants, use of tide and wave power, if applicable. Differentiate between small and large hydro power. Describe the energy potential based on geographical and political frameworks.

The hydropower potential in the region is used up and it is assumed that in the future hydro power production will remain steady. It is limited by geographical conditions and strict environmental requirements.

8.2.3. Solar power

Solar irradiation (on optimally inclined plane) per year	1 000	kWh/m²

Source: Investicijų Partneris (2012) "Ignalinos AE regiono energetikos strategija 2012–2035"

Give an overview of both solar thermal and PV usage hydro power sources at the moment and describe the energy potential based on geographical and political frameworks.

The solar irradiation in Ignalina NNP region is approximately 1 000 kWh/m² a year. It is among the highest irradiation values in Lithuania (refer to Figure 10). It constitutes to the theoretical potential of 2 664 TWh[41] per year.

Solar thermal power

The solar irradiation in the region is sufficient to use solar energy for heating water for households. However, taking into an account the old age and poor condition of the roofs of the buildings in the Ignalina NPP region, very few buildings have technical possibilities to install solar thermal collectors. The potential of solar thermal collectors in Ignalina NPP region is even further restricted by the lack of financial resources. However, solar thermal collectors would enable saving 50–60% of costs used for heating water annually. The theoretical potential for solar thermal collectors is 185 GWh.

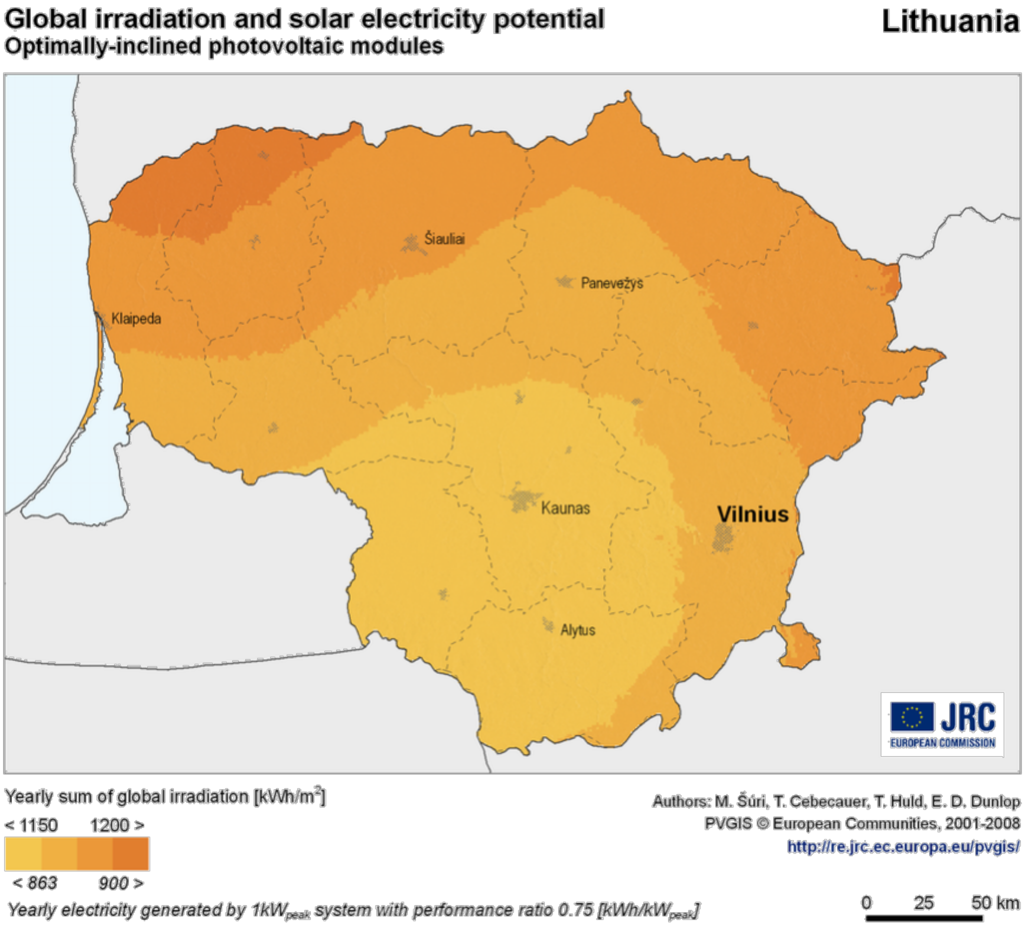
Solar PV

Solar PVs are used for electricity production using photo elements. This technology is considered highly environmentally friendly as it does not use fuel or water and do not emit any pollutants or sounds. Only limited amount of power can be connected to the existing power grid in Ignalina NPP region restricting the solar power potential to 190 MW.

Lithuanian government supports the development of solar energy in the country. Financial support is provided for the development of solar plants or solar PVs/collectors installed by households. Moreover, the households producing solar power are allowed to accumulate electricity in the grids of main electricity distributor Elektros skirstomieji tinklai. In Lithuanian solar PVs produce most of the energy during summer months. If their owners do not consume all the electricity provided by solar PV it is accumulated in the grid free of charge and they can use it during the winter days when solar PVs produce less electricity. Finally, solar power energy producers are eligible for the support mechanisms provided for all renewable energy producers (refer to section 8.1). Taking into account all the support mechanisms, the installation of solar PV pays of in 7–10 years.

[41] Based on the Dukšto MS solar exposure

Figure 10. The Lithuanian map for solar irradiation



Source: M. Šúri, T.A. Huld., E.D. Dunlop, H.A. Ossenbrink (2007) "Potential of solar electricity generation in the European Union member states and candidate countries"

8.2.4. Wind power

Average wind velocity	4.0	m/s
Full load hours	1 697	h/a

Source: Lithuanian Energy Institute, Energy Economics Group of Vienna University of Technology

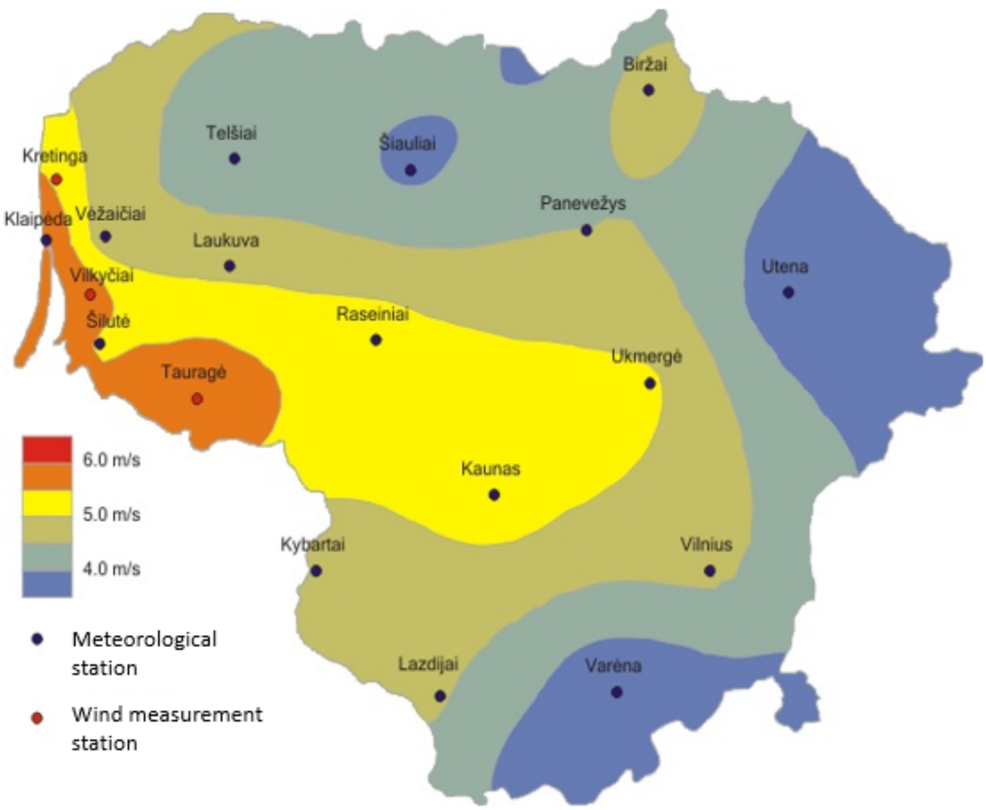
Give an overview of wind power use at the moment and describe the energy potential based on geographical and political frameworks. Differentiate between offshore and onshore potential

In the Ignalina NPP region, conditions for the development of wind power plants are not favourable (average wind velocity reaches 3.5−4 m/s; refer to Figure 11); however, wind energy would be possible in this region if advanced wind power plant production technologies were applied, the most suitable locations for plants were selected and the 100 metre-high or higher wind turbine towers were built. According to the wind plant power connection scheme, presented by JSC LITGRID, the Ignalina NPP has technical possibilities to connect plants generating up to 75 MW of power in each Zarasai, Visaginas and Ignalina municipality. Wind power plants having up to 225 MW power in total could be connected to the high-tension networks in the Ignalina NPP region, which determines the theoretical wind energy potential.

Technical wind energy potential was estimated following the assumption that the Ignalina NPP region could fully satisfy the electrical energy demand, i.e. 74 MW, using RES. In addition, the economically-based wind energy potential of the Ignalina NPP region could be estimated by carrying out a detailed theoretical and wind parameter research (which would require a lot of time and financial resources), involving the selection of appropriate construction sites for wind power plants. The fact that the construction of a very powerful wind power plant may not pay off in the Ignalina NPP region does not deny the possibilities to develop wind energy of smaller capacity (up to several tens or hundreds of kilowatts). The requirements for building special-construction wind power plants adjusted to operate under high turbulence, for example, in a city, are not so strict; thus, their construction and connection to low-tension networks are cheaper.

The support mechanisms provided for other renewable energy sources is applicable for wind power, the most important of which are feed–in tariffs. However, due to unfavourable environmental conditions, currently no wind power plants are established in the region.

Figure 11. The Lithuanian Wind power map



Source: Stasys Paulauskas (2010) "Vėjo energijos panaudojimo technologijos. Lietuvos situacija ir perspektyvos"

8.2.5. Geothermal energy

Give an overview of use of geothermal energy at the moment and describe the energy potential based on geographical and political frameworks.

There are two types of geothermal energy: shallow and deep.

Shallow geothermal energy

Ground heat may be exploited by using heat pumps: source – heat exchanger – heat pump – consumer. Heat pumps are used for heating separate houses of public objects (area of several hundred m^3). The dominant installations include heat source – ground (system with intermediate heat exchanger), heat source – water basin or air. To heat a 100 m^2 building an installation of about 7 kW heat generation is necessary. 1kW of electrical energy is necessary to produce 3–5 kW of thermal energy. The annual increase of heat pump installation in Lithuania is about 20%[42].

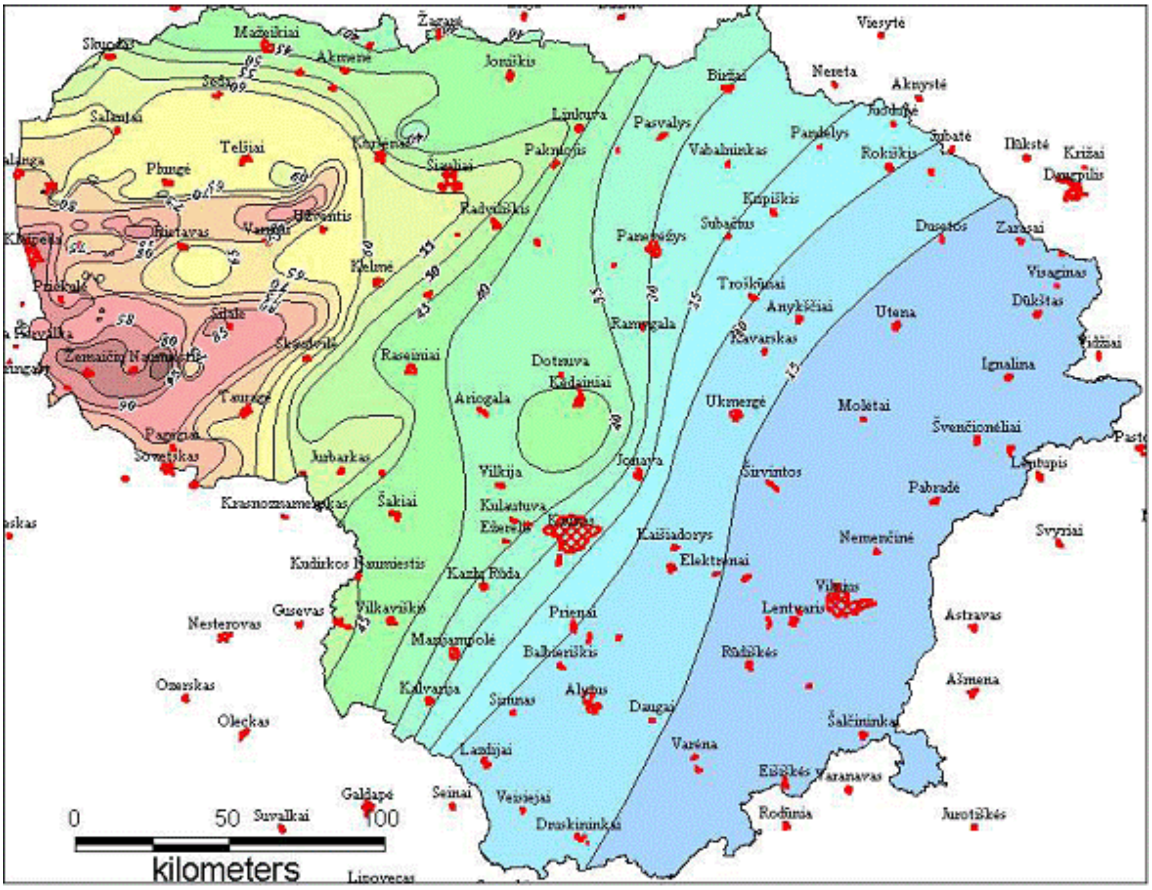
Theoretical possibilities of shallow geothermal energy use in the Ignalina NPP region require heat pumps of 135.8 MW capacity when the dwelling fund is 1340 thousand m^2.

Deep geothermal energy

As can be seen from the Figure 12, the heat flow in the western part of Lithuania is much more intensive than in the eastern part of Lithuania. The temperature of the Cambrian aquifer varies from 14 ^{0}C in the eastern part of Lithuania to 96 ^{0}C in Western Lithuania and only territories where the temperature of the Cambrian aquifer is above 30^{0}C are considered to have potential for deep geothermal energy. The western part of Lithuania also has the largest geothermal gradient (40–45 °C/km) compared to the geothermal gradient of 20–25 ^{o}C/km in the eastern part. Therefore, the conditions for deep geothermal power plant in Ignalina NPP region situated in the eastern part of Lithuania are unfavourable and geothermal energy is not economically viable.

[42] Lithuanian Energy Institute “Ignalinos AE regiono esamos padėties įvertinimo studija”

Figure 12. Temperatures of Cambrian aquifer in Lithuania



Source: Feliksas Zinevicius, Saulius Sliaupa (2010) "Lithuania – Geothermal Energy Country Update"

8.2.6. Waste

Describes overlaps between waste management and energy sector. Is municipal solid waste used for energy production? How is the energy from waste incineration plants used, e.g. electricity generation, district heating (cogeneration)?

Dumping grounds

Currently there are no waste incineration plants in Ignalina NPP region and the conditions for producing energy from waste are unfavourable.

The potential of household waste is calculated based on the number of citizens in each district. According to the data of the Ministry of Environment, on average around 300 kg of household waste falls on one citizen of a city, 220 kg — of a town and 70 kg — of a village a year. Such waste can be used for producing energy after it has been separated from other types of household waste and processed in biogas reactors. However, household waste is still not widely sorted, but instead most of it is taken to dumping grounds where it mixes with other non-hazardous waste, such as street and road sweeping, biologically degradable waste from food processing and catering institutions.

Waste managed by the municipalities amount to 25 thousands tons in the Ignalina NPP region. Theoretically, it would be possible to consider the adjustment of dumping grounds to the collection of gas, but in reality due to relatively small amounts of waste the closure of dumping grounds in order to install biogas collection equipment would be irrational. On the basis of the collected data on household waste, the Ignalina NPP region has no possibilities to use gas from dumping grounds for producing energy.

Water-supply waste

In 2007 the amount of cleaned sewage of the Ignalina NPP region reached 395 t, 299 t of which goes to Visaginas municipality. The estimation of formed sludge amount is based on the assumption, proposed by Kaunas Wastewater Treatment Division, stating that 60 t m^3 of sewage provides 10 t of dried sludge and 8 thousand m^3 of biogas when the degree of sewage pollution is 400 mg/l. Theoretical potential of biogas production from sewage sludge reaches 0.152 k toe of the total primary energy in the whole Ignalina NPP region.

Organic materials (animal manure and bedding, biologically degradable waste, biomass from parks)

In Lithuania the main source of raw materials for biogas production is animal manure. Currently pig farms which have the greatest biogas production potential are being modernised and expanded. Thus, large farms, using animal and bird keeping technologies with no bedding and having huge demand for thermal energy, have the greatest prospects to build biogas power plants. If in the Ignalina NPP region only raw materials were used for biogas power plants, theoretically this would have a great potential. The area of most farms of the region amounts to 20 ha, thus, it may be stated that building of biogas power plant and maintaining it by a single farm would be impossible. Since the farms are too small, only cooperation is possible, because rather vast amounts of raw materials and respective areas of land are necessary. The performed calculations suggest that in order to supply raw materials to a biogas power plant having 500 kW of electric power, 450–500 ha of land is required. In 2008 the annual amount of manure (of cattle, pigs, birds) available in large farms in the Ignalina NPP region amounted to 36 kt/annually.

8.2.7. Restriction through protected areas

Are there environmentally protected areas, which are not available for REN facilities or restrict the overall potential?

The region has a number of protected areas including national, regional parks and reserves where economic activities are restricted and where REN facilities could not be developed. The map of environmentally protected areas is provided in the Figure 13.

Figure 13. Map of restricted areas in Lithuania

Source: Education Development Centre

9. Energy efficiency – status and potential

What is the status of the implementation of the Energy Efficiency Directive?

The Energy Efficiency Directive is being implemented in Lithuania. It is ensured by legislations (such as the Law on Energy Efficiency, Law on Energy, Law on Heat Sector, Law on Electricity, Law on Natural Gas, Law on Public Procurement) and alternative measures. These measures include energy taxes on fuels, energy audits, agreements with energy suppliers on information campaigns and energy efficiency at final consumers, revised Multi–apartment Renovation Programme and Public Building Energy Efficiency Development Programme[43]. The implementation of Energy Efficiency Directive is administrated at the national level (the implementation is led by the Ministry of Energy with the support of Ministry of the Environment, Ministry of Economy and State Enterprise Energy Agency) rather than at the regional level.

The energy efficiency measures in Lithuania saved 567.1 GWh of energy in 2015[44]. However, the current savings do not seem to be sufficient to meet the goals of Energy Efficient Directive by 2020.

[43] The Concerted Action for the Energy Efficiency Directive (2016) "National Implementation Report 2016"
[44] The Ministry of Energy (2017) „2015 m. pažangos siekiant nacionalinių energijos vartojimo efektyvumo tikslų ataskaita"

Contrary to most EU countries, the energy consumption in Lithuania increased in the period 2005 – 2016[45].

What is the status of the implementation of the Energy Performance of Buildings Directive (e.g. data on low/zero energy buildings)?

The Energy Performance of Buildings Directive is being implemented in Lithuania. The Law on Construction and Construction technical regulations have been amended accordingly. Since 2016 energy level of the building cannot be lower than A. The minimum threshold will be raised to A+ and A++ in 2018 and 2021 respectively[46]. The renovated building has to reach at least C energy level since 2014. The goals set by the directive are measured and have to be met at the national level.

Also, financial support is provided for the refurbishment and modernization of multi–apartment buildings in Lithuania. As the programme is co–financed by the Lithuanian Government, Climate change and Ignalina programs, the owners of selected buildings in Ignalina NPP region have to pay only around 50 – 55% of the renovation costs[47] while the support in other regions is lower. The renovation programme is highly successful in Ignalina district municipality where 50% (or 80 out of 162) of apartment buildings have been renovated by August 2017[48]. Other municipalities in the region are by far less successful. Only 11 (4%) apartment buildings are renovated in Zarasai district and none in Visaginas municipalities, but they have plans to expand the renovation programmes[49].

The main achievements related to energy performance of buildings in 2015 in Lithuania include:

• 574 multi–apartment buildings renovated leading to the energy savings of 138 GWh (the savings increased by 4.5 times compared to energy savings of 25.3 GWh in 2014)

• 1280 measures related to informing and educating the society over the building efficiency led to energy savings of 6.45 GWh.

• 1.19 GWh of energy saved from the buildings belonging to municipalities[50].

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[45] European Commision (2017) "2016 assessment of the progress made by Member States in 2014 towards the national energy efficiency targets for 2020 and towards the implementation of the Energy Efficiency Directive 2012/27/EU as required by Article 24 (3) of the Energy Efficiency Directive 2012/27/EU"; Statistics Lithuania

[46] The Ministry of Environment (2016) „Pastatų energinio naudingumo reglamentavimas ir perspektyvos"

[47] "Zarasų būstas"

[48] Ignalina district municipality (2016) "Ignalinos rajono energinio efektyvumo didinimo daugiabučiuose namuose programa „Ignalinos Enervizija""; Housing Advisory Agency (2017) „Top 10 savivaldybių renovacijos lyderiai"

[49] Visaginas municipality (2017) "Strateginis veiklos planas 2017–2019", Zarasai district municipality (2017) "Zarasų rajono savivaldybės 2017–2019 metų strateginis veiklos planas", Aina Naujienos (2017) "Daugiabučių renovacija Zarasuose įgauna pagreitį", Vilnius Gediminas Technical University (2012) "Zarasų rajono savivaldybės daugiabučių gyvenamųjų namų energijos efektyvumo didinimo galimybių studija"

[50] The Ministry of Energy (2017) „2015 m. pažangos siekiant nacionalinių energijos vartojimo efektyvumo tikslų ataskaita"

Analyse the sectors:
Households: Are energy efficiency measures implemented in this sector? Are there awareness campaigns to highlight the potential? Is there support for the implementation (financial and non–financial)?

Yes. Most of the measures are related to the energy efficiency of the buildings and have been covered in the question above. Besides them, an agreement between the Ministry of Energy and energy distributors has been launched which obliges the energy distributors to supply information to the final user over measures to increase energy efficiency.

Service sector: Are energy efficiency measures implemented in this sector? Are there awareness campaigns to highlight the potential? Is there support for the implementation (financial and non–financial)?

No energy efficiency measures are designed for service sector. However, the measures related to energy performance of buildings, transportation and the agreement between the Ministry of Energy and energy distributors, obliging the energy distributors to supply information to the final user over measures to increase energy efficiency, apply. Despite the small number of energy efficiency measures targeted at service sector, its energy consumption was decreasing in 2004–2015[51]. One special subsector of services is supply and distribution of heat, gas and electricity. The energy related companies are offered financial support for modernization of heat and electricity grids. Also the operators of electricity and gas network controlled by the government or state owned company are obliged to agree with the Ministry of Energy over the energy savings.

Industry: Are energy efficiency measures implemented in this sector? Are there awareness campaigns to highlight the potential? Is there support for the implementation (financial and non–financial)?

The industry sector is moving towards the more energy efficient technologies. To facilitate this switch a number of support measures have been implemented, including: • Subsidies for energy audits in industrial companies • Financial support for the installation of renewable energy devices of a higher efficiency • Compensations for interest rates on loans for equipment and technologies meant to increase energy efficiency. Non–financial measures include minimum energy efficiency standard and requirements, special labelling and consultations to industry companies.

[51] European Commision (2017) “2016 assessment of the progress made by Member States in 2014 towards the national energy efficiency targets for 2020 and towards the implementation of the Energy Efficiency Directive 2012/27/EU as required by Article 24 (3) of the Energy Efficiency Directive 2012/27/EU”; The Ministry of Energy (2017) „2015 m. pažangos siekiant nacionalinių energijos vartojimo efektyvumo tikslų ataskaita“

Transportation: Are energy efficiency measures implemented in this sector? Are there awareness campaigns to highlight the potential? Is there support for the implementation (financial and non–financial)?

The consumption of final energy has increased by 37% from 2005 to 2016[52]. This increase is related to both increase in consumption and decrease in smuggling activities[53]. However not many measures have been taken to increase the energy efficiency in the sector. Most of transport related support measures are instead focused on the increase of use of renewable energy sources (biofuel, electricity).

One of the successful measures to increase energy consumption in transport sector was modernization of railway equipment in the country. Also, Lithuania uses excise duty on the fuels. Non–financial measures include minimum energy efficiency standard and requirements, special labelling related to vehicles and transportation equipment.

Give an estimate of the trend in energy efficiency development using values from –5– to +5 where (5 is a strong reduction, 0 means neither growth nor reduction, +5 strong growth).

2. Energy efficiency is increasing in Lithuania. The energy efficiency measures in Lithuania saved 567.1 GWh of energy in 2015[54]. In 2010 – 2015 both primary and final energy consumption has decreased by 15.7% and 21.4% respectively in the country. In Ignalina NPP region, the increase of energy efficiency is stimulated by the renovation of public and private buildings, modernisation of heat production facilities and supply networks as well as modernisation of street lighting systems among other means.

Demand side management, smart metering, storage

The main demand side management measures include smart metering systems and pricing models. All electricity consumers have smart metering and pay for electricity they actually consume. Moreover, the consumers are offered different pricing options. First of all, they can select price plan (Standard, Home, and Home plus) each having monthly subscription price on the top of fee per kWh. Additionally, users can select either single time tariff or dual time tariff. If dual time tariff is chosen, higher price is payed for daytime energy consumption than for electricity consumed at night or weekends. This way electricity consumers can select the optimal pricing plan minimizing their costs and are encouraged to save electricity during daytime.

[52] Statistics Lithuania

[53] The Ministry of Energy (2017) „2015 m. pažangos siekiant nacionalinių energijos vartojimo efektyvumo tikslų ataskaita“

[54] The Ministry of Energy (2017) „2015 m. pažangos siekiant nacionalinių energijos vartojimo efektyvumo tikslų ataskaita“

10.SWOT analysis

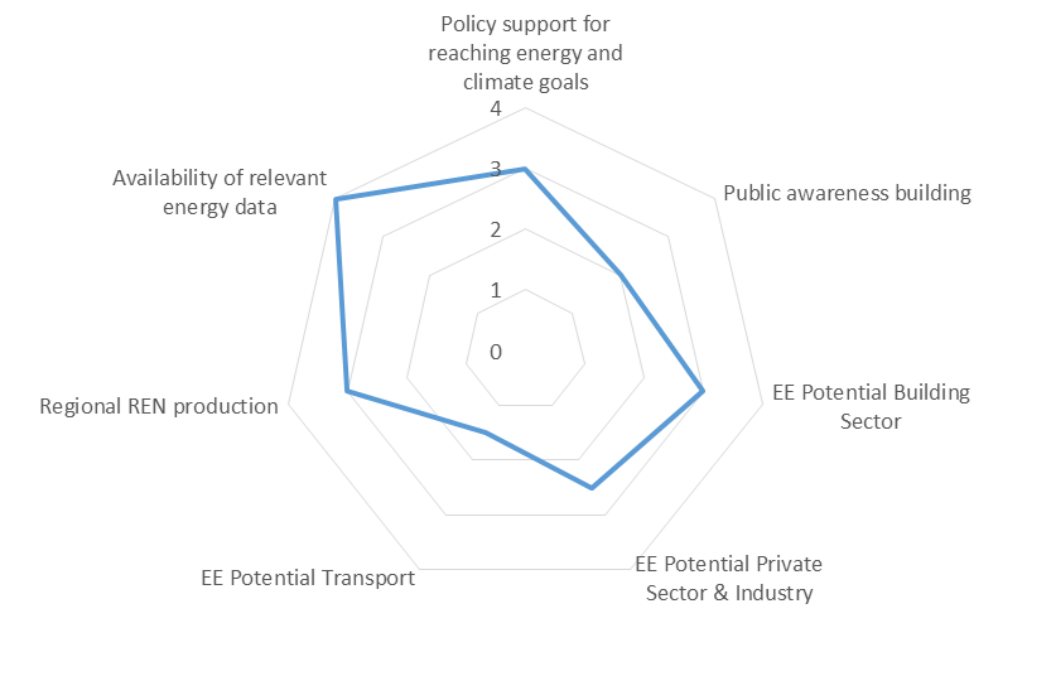
Please make a SWOT–analysis for the development of your region towards a low–carbon economy in 2050. Include stakeholders in the process.

Strengths	Weaknesses
• Extensive use of biomass in heating sector • High production of biomass in agricultural sector and forestry • Favorable conditions for solar energy • Availability of energy professionals • Recently refurbished energy production capacities • High share of renovated buildings In Ignalina district municipality	• Limited financial resources of municipalities • Poor condition of condition of heating and electricity networks (currently being renovated) • Low thermal resistance of old buildings (without renovation) • Low potential of geothermal, waste, wind or hydro energy • Low support for building renovation of residents of Zarasai district and Visaginas municipalities
Opportunities	**Threats**
• Integration into the European Union gives an opportunity to use financial and technical aids • Special attention and financial resources for Ignalina NPP region due to the shutdown of the nuclear power plant will enable higher financing for energy projects in the region • New technologies introduced in the market are of a higher energy efficiency • High prices of imported fossil fuels discourage from their use • Increasing use of alternative fuels in transportation sector • Increasing electricity price facilitating the interest in more energy–efficient devices	• Decreasing population making the investments in energy sector less attractive • Increasing motorization rate leading to higher energy consumption • Increasing environmental requirements rising the needed financial investment into energy projects • Lack of long term vision of energy sector as well as constant changes in energy–related legislations and support schemes create uncertainty for investors • Used–up feed–in tariff quotas limiting the financial benefit or renewable energy plants' development • Increasing price of biofuels that are extensively used in the region[55]

[55] BALTPOOL (2017) "Biokuro biržos prekybos apžvalga 2017 m. liepa"

Self–assessment:

Figure 14. Energy sector assessment[56]



[56] Points:
1 … no measures set/ potential unused
to
5 … fully developed/ potential fully used

11. Annex: List of sources /bibliography /List of relevant stakeholders/institutions in the region

1. Action Plans for Implementation of Ignalina NPP Region Energy Strategy for Ignalina District Municipality, Zarasai District Municipality and Visaginas Municipality
2. Aina Naujienos (2017) “Daugiabučių renovacija Zarasuose įgauna pagreitį“
3. Amber Grid (2017) “Gas Transmission System in Lithuania“
4. Autoplius.lt (2017) “Ketvirtinė automobilių rinkos apžvalga 2017 m. 2 ketvirtis”
5. Autoplius.lt (2017) “Ketvirtinė automobilių rinkos apžvalga, 2017 m. 1 ketvirtis”
6. BALTPOOL (2017) “Biokuro biržos prekybos apžvalga 2017 m. liepa”
7. Development Plan for Utena Region for 2014–2020
8. Didžiasalio komunalinės paslaugos (2016) “Heat analysis”
9. Energy Agency "Energy resources map"
10. Energy Efficiency Action Plan
11. Energijos skirstymo operatorius (2017) “Electricity rates 2017”
12. Energijos skirstymo operatorius (2017) “Natural gas distribution service rates”
13. European Commission (2017) “2016 assessment of the progress made by Member States in 2014 towards the national energy efficiency targets for 2020 and towards the implementation of the Energy Efficiency Directive 2012/27/EU as required by Article 24 (3) of the Energy Efficiency Directive 2012/27/EU”
14. Environmental Protection Agency (2017) “2016 m. ŠESD suvestinė”
15. Data provided by “Energijos skirstymo operatorius” and “Panevežio energija”
16. Feliksas Zinevicius, Saulius Sliaupa (2010) “Lithuania – Geothermal Energy Country Update”
17. Housing Advisory Agency (2017) “Top 10 savivaldybių renovacijos lyderiai“
18. Ignalina district municipality (2016) “Ignalinos rajono energinio efektyvumo didinimo daugiabučiuose namuose programa “Ignalinos Enervizija““
19. Ignalina NPP Region Energy Strategy for 2012–2035
20. Ignalina Nuclear Power plant (2011) “Valstybės įmonės Ignalinos atominės elektrinės veiklos ataskaita už 2010 m.“
21. Investicijų Partneris (2012) "Ignalinos AE regiono energetikos strategija 2012–2035“
22. Jurga Tallat–Kelpšaitė (2017) “Lithuania: Overall summary”
23. Lietuvos energija (2015) “Electricity Generation”
24. Lithuanian Energy Institute “Ignalinos AE regiono esamos padėties įvertinimo studija”
25. "Lithuanian Power Market Development Plan”
26. Lithuanian Road Administration under the Ministry of Transport and Communications (2017) “Annual average daily traffic (AADT) in 2016”
27. M. Šúri, T.A. Huld., E.D. Dunlop, H.A. Ossenbrink (2007) “Potential of solar electricity generation in the European Union member states and candidate countries”

28. Ministry of Energy of the Republic of Lithuania (2015) “Atsinaujinančių energijos išteklių naudojimas Lietuvos transporto sektoriuje”
29. Ministry of Energy of the Republic of Lithuania (2017) “Atsinaujinantys energijos ištekliai”
30. National Audit Office of the Republic of Lithuania (2010) “Valstybinio audito ataskaita atsinaujinančių energijos išteklių potencialo naudojimas Lietuvoje”
31. National Commission for Energy Control and Prices (2016) “Elektros energijos gamyba”
32. National Commission for Energy Control and Prices (2016) “Gamtinių dujų skirstymo sistema”
33. National Commission for Energy Control and Prices (2017) “Šilumos žemėlapis”
34. Paulius Markovas (2013) “Atsinaujinančių energetikos išteklių teisinis reguliavimas“
35. Registrų centras "Regia Map"
36. Stasys Paulauskas (2010) “Vėjo energijos panaudojimo technologijos. Lietuvos situacija ir perspektyvos”
37. Statistics Lithuania “Official Statistics portal”
38. The Concerted Action for the Energy Efficiency Directive (2016) “National Implementation Report 2016”
39. The Law on Heat sector
40. The Law on Renewable Energy sources
41. The Lithuanian District Heating Association (2017) “Šilumos tiekimo bendrovių 2016 metų ūkinės veiklos apžvalga“
42. The Ministry of Energy (2016) “Rekomendacijos dėl pagrindinių Lietuvos Respublikos energetikos strategijos krypčių“
43. The Ministry of Energy (2017) “2015 m. pažangos siekiant nacionalinių energijos vartojimo efektyvumo tikslų ataskaita“
44. The Ministry of Environment (2016) “Pastatų energinio naudingumo reglamentavimas ir perspektyvos“
45. The Ministry of Finance (2016) “Lietuvos ūkio 2016–2019 m. perspektyvos”
46. The National Energy Independence Strategy
47. The National Programme Heat Sector Development in 2015 – 2021
48. The National Strategy for Climate Change Management Policy
49. The National Strategy for Sustainable Development
50. The National Strategy for the Development of Renewable Energy Sources
51. Vilnius Gediminas Technical University (2012) “Zarasų rajono savivaldybės daugiabučių gyvenamųjų namų energijos efektyvumo didinimo galimybių studija“
52. Visaginas City Local Action Group (2016) “Visagino miesto vietos plėtros strategija 2016 – 2022 m.“
53. Visaginas municipality (2016) “Visagino savivaldybės 2016 – 2022 m. strateginis plėtros planas“
54. Visaginas municipality (2017) “Strateginis veiklos planas 2017 – 2019“

55. Visagino energija (2017) “Valstybės įmonės “Visagino energija“ veiklos strategija 2017 – 2020 m.”
56. Zarasai district municipality (2017) “Zarasų rajono savivaldybės 2017 – 2019 metų strateginis veiklos planas“
57. Zarasai municipality (2015) “Zarasų rajono savivaldybės 2015 – 2021 m. strateginis plėtros planas”

REGIONAL ENERGY PROFILE

Region: Vidzeme planning region, Latvia

PANEL 2050 – Partnership for New Energy Leadership 2050
Deliverable 3.1

By: <name and logo>

Date: XX.XX.20XX

Table of Content

1. Methodology

The PANEL 2050 project has the aim to create durable and replicable sustainable energy networks at local (municipality/community) level, where relevant local stakeholders collaborate for the creation of a local energy visions, strategies and action plans. The aim of these networks is to contribute to and actively work for the transition towards low carbon communities in 2050.

The PANEL 2050 partnership will provide support for the creation of first successful local energy networks in the CEE countries. In the course of the project, organisations from 10 CEE countries will collaborate on creating regional energy strategies and action plans.

The present Regional Energy Profile was prepared in order to get a better understanding of the energy-related status quo in the region of XXXX, analysing strengths and challenges with regard to the transition towards a low carbon community.
This energy profile constitutes the groundwork for the preparation of a Regional Energy Roadmap and related Action Plans and will be essential for the communication with regional stakeholders.

For completing this Regional Energy Profile the following sources were used:

- Data bases of the Central Statistical Bureau of Latvia (http://www.csb.gov.lv/en/about-us);
- Ministry of Economics of the Republic of Latvia;
- Ministry of Environmental Protection and Regional Development of the Republic of Latvia;
- Interviews and meetings with representatives from municipalities from Vidzeme planning region.

Please provide a summary of main source of information (a full list can be added in the Annex), stakeholder events contributing to the results, etc.

2. General introduction of the region

max 2 pgs

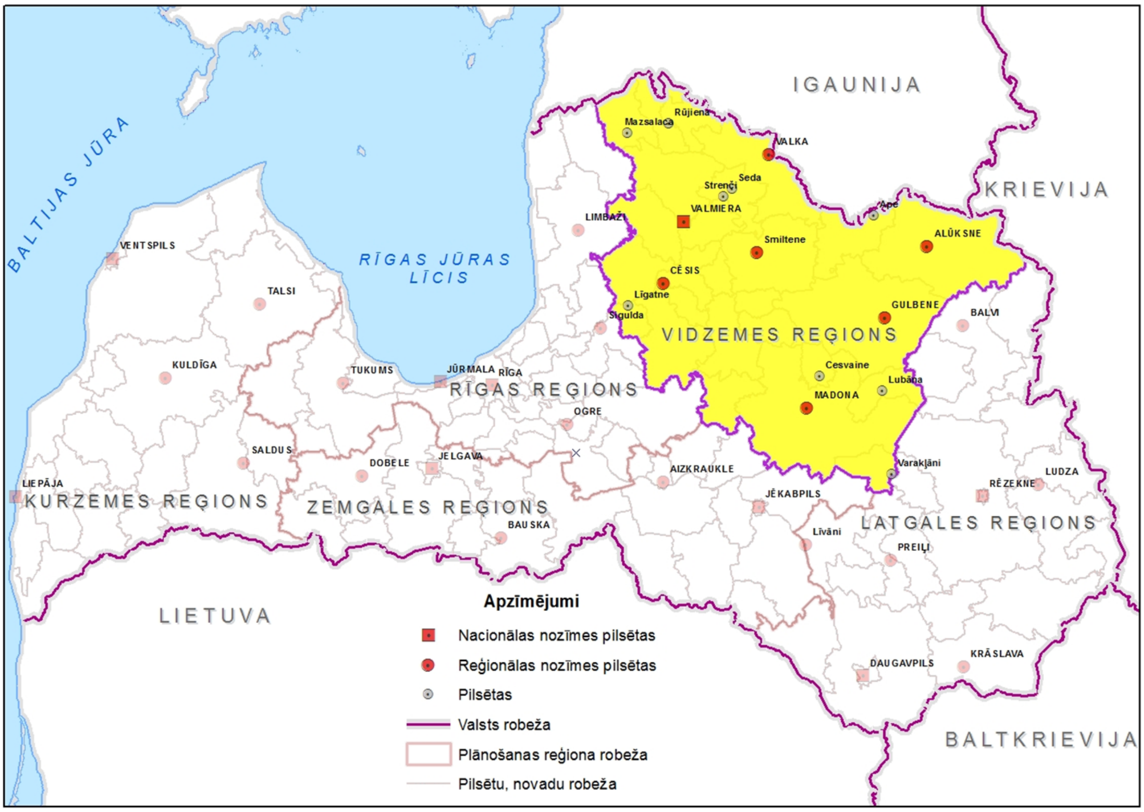
Name of the region and NUTS identification

Vidzeme Planning Region is at NUTS 3

Geography and policy:

Describe the location of the region + provide also a political map showing location of the region in your country

Vidzeme is the territorially largest of the five planning regions in Latvia, occupying 23.6 % of the country's territory. Vidzeme is a border region of the European Union, which is crossed by several major international transport corridors, ensuring Vidzeme a direct contact with major regional centres of the neighbouring countries – Tartu and Tallinn in Estonia, Pskov, Novgorod and St. Petersburg in Russia. Around these corridors, the development zones significant to the strategic development of the Baltic Sea region are formed, such as the VHB Zone Hanseatica Development Corridor, the South Baltic Rim development corridor, as well as Via Baltica.



Geography of the region, including morphology, geology, climate, hydrology, flora and fauna related to energy (text description)

The leading energy resources available in Latvia and Vidzeme are biomass, hydropower, solar energy wind energy and geothermal energy. In Latvia, more than 150 small hydro power plants (HPP) are operating, which provide a total electricity production of more than 50 MWh per year. On the rivers of the Vidzeme region, 50 small hydroelectric power stations (9 on the river Gauja, 5 on the river Abuls) have been built. Their hydroelectric energetic potential is rather small.

The solar radiation on a horizontal surface ranges between 900 and 1100 kWh/m2 in the Baltic region. Majority of the radiation is obtained during the summer period. The Solar radian energy in Vidzeme can be used for an average of 1700 hours per year. Use of solar collectors in Vidzeme provides good results. The global solar radiation in our latitudes varies according to the time season - from May to September from 1 m^2 of the solar collector approx. 700-740 kWh/ m^2 can be obtained, from October to April – 200-240 kWh/ m^2, while from November to February – 40-50 kWh/ m^2. The total Baltic wind energy potential is rated from 4.5 to 7 TWh per year (in Estonia – 4 TWh, in Latvia up to 1.5 TWh, in Lithuania – 1.5 TWh). The best conditions for constructing WPS are in Latvia, on the coast of Kurzeme, a little worse – in Vidzeme, near to the Estonian border. The Ainaži WPS (1.2 MW, year 1996) was the first wind power station in the Baltics, while ''Vēja parks, Ltd." in Grobiņa (19.8 MW, year 2002) – the first large wind farm in the Baltics. Currently, there are wind turbine with a total capacity of 30 MW installed in Latvia, mainly in Kurzeme. Energy production in the Vidzeme planning region using wind energy is potentially possible in the Vidzeme highlands, where there is a sufficient wind intensity.

The favourable conditions for peat formation processes provides the region with peat resources and peat exports to foreign countries. The largest peat bog areas are located in lowlands. Overall, on 1 January, 2012, the explored amount of peat is 25 702 thousand tons with the humidity of 40%. In terms of peat stocks, the Vidzeme region is followed by surrounding areas of Riga and the Latgale region, where the peat stock is greater. In the recent decades, extraction and use of peat as organic fuel has decreased substantially, but, depending on the specifics of the region, the peat extraction potential can be assessed. In Vidzeme, considerable peat resources are available, but their use in energy production is negligible.

Vidzeme is the region in Latvia richest in forests – they occupy 55.8% of the region's territory. Compared to 2007, the share of forests has increased by 7.2% which is 108.7 thousand ha, mostly on the expense of overgrown farmland. 54.9% of the forest area is covered by deciduous trees. Due to the large forest areas, the most affordable renewable source of energy in Vidzeme is biomass, made up from forestry and woodworking residues, used wood, shrubs, fuelwood plantations, agricultural residues and various types of organic waste.

Brief history overview of the region – state the most important milestones related to the industrial / regional development (e.g. significant energy projects, power plants, etc.), ideally related to energy

In the 18th century, weaving of flax cloth for the market, as well as woodworking manufactories and papermills developed in the territory of Latvia. In the second decade of the 19th century, a paper mill was developed in Līgatne, which operating until 2015. In October 2003, Līgatne paper mill started the production of recycled paper.

According to the value and amount of production, the dominant industries of the early 19th century were manufacturing of spirits and textile. In the 2nd half of the 19th century, Vidzeme and Kurzeme were two of the Russian provides where mechanical engineering was the most advanced industry – rail cars, ships, turbines, motors, steam machines, boilers, equipment for sawmills, as well as leather, paper and food manufacturing was produced there. Up to the First World War, the industrial development, which was characterized by concentration of production, merging companies into syndicate, etc., did not change the industrial location and specialization, which had developed in the 1990s, but intensified the diversity of the industrialisation and distinct development of Latvian coastal areas and inland areas even more.

Nowadays, the main industrial centre of Vidzeme, is Valmiera. It is the town where such major manufacturing and trading companies of the Vidzeme region as JSC "Valmiera Glass", agricultural co-

operative "Vidzeme agroeconomic cooperative society", JSC "Valmiera Milk", Limited liability company "Vidzemes agroceltnieks", "Valpro" Ltd. and others are located.
In turn, the largest company by turnover located in Cēsis, is "Cēsu Alus", which operates in the food production sector.
In Smiltene, companies with the largest turnover are operating in logging and production of wood products ("Stora Enso Latvija" JSC, "Graanul Invest" Ltd., "GraanulPellets" Ltd.), as well as in retail ("Madara 89"), road construction ("8 CBR" Ltd.) and food production ("Smiltene Milk"). In the Gulbene district, the only distribution and servicing dealers of agricultural machinery produced in Belarus and the Russian Federation "M.T.Z. serviss" Ltd. and "Kombainserviss" Ltd., as well as the wood processing company „Avoti SWF" Ltd. – an IKEA furniture factory – are located.
Several companies in Vidzeme also are keen about using RES. "KRK Vidzeme" Ltd. is the largest charcoal manufacturing company in the Baltics with more than ten years of experience. Every year the company produces about 3,500 tons of high quality charcoal. Within the production process, alder wood, bought from local suppliers, is used. The brewery "Cēsu alus" demonstrates an economically efficient use of energy, by leavening sludge collected in wastewater pre-treatment and producing biogas, and by further using it for heat supply.
"Biodegviela" Ltd. illustrates alternative means of using agricultural products, by using grain to create "green energy". A company in the Madona district produces agricultural ethyl alcohol. The raw material used for producing ethyl alcohol are grains, mainly rye, wheat, triticale. During the technological process, bioethanol, which is a fuel component and is mainly used in vehicles, is derived. Also, Vidzeme region has 5 biogas plants that produce biogas from manure and green fodder. Ltd. Biodegviela uses distillery refuse as a raw material for the production of alcohol. Two biogas plants use domestic waste (CA landfill "Daibe"), and food industry waste (farm "Zemturi") as raw materials. The Vidzeme region holds the first place among other Latvian planning regions in terms of number of biogas production stations.

Public administration procedure – brief profile of current energy planning process in your region starting from the national level down to the region (see also your desk research within WP3.1)

In Latvia, the overall development planning procedures, including in the energy field are governed by the Development Planning Act and the Law on Development Planning System. The Sustainable Development Strategy 2030 (Latvia 2030), describing the current situation in Latvian, points out that despite the fact that the overall energy intensity or energy consumption of the Latvian economy per one unit of GDP produced has gradually decreased in recent years, it is still nearly two times higher than the EU average. Therefore it is necessary to significantly improve the performance levels in both energy end-user groups, as well as energy generation and transmission, setting a specific goal: "To ensure national energy independence, by increasing energy self-sufficiency and integration into the EU energy networks". The mid-level planning document „The Latvian National Development plan 2014-2020 (NDP2020)" in the course of action „Energy efficiency and energy production" emphasizes the increasing the use of RES, raising of energy efficiency in the production sector and need of increasing energy efficiency of public and residential buildings. The Energy Development Guidelines 2016-2020 (the Guidelines) is a policy planning document that sets out basic principles, goals and lines of action in energetics of the Latvian government for the period from 2016 to 2020. The Ministry of Economics is responsible for the implementation of guidelines. In a regional level, goals of energy are determined by the Sustainable Energy Action Plan, while in municipalities the energy sphere is included in the municipal development strategies and the Energy plan, if such a plan has been developed in the municipality.

Highlight significant characteristics differentiating region from others and give short (!) introduction of energy targets and challenges in the region

The Vidzeme Planning Region is the „greenest" region in Latvia, if the main criteria is the use of the renewable energy resources in the production of heat and electricity. In Vidzeme in incineration facilities (boiler houses, industry and other sectors) 75% of wood is used. In most cases it is firewood, chip, pellets and wood processing waste. The great proportion of the renewable energy resources (RER) in the VPR can be explained by the fact that 52% of the region is covered by forests and there care enough raw materials for wood. In turn, the most advanced waste management practice in Latvia is implemented in Northern Vidzeme. Biodegradable waste management is one of the areas of the bio-economy where VPR has development opportunities. Up to now, the need of organic waste treatment has been identified, compositing sites have been developed and are operating, biogas stations, where municipal waste is used for producing biogas, are operating.
Taking into account the needs, resources and potential of the Vidzeme inhabitants, VPR has set a goal in the Development programme 2015-2030 to improve the management of energy issues as well as to increase energy efficiency and use of renewable energy by 2020.

3. Basic demographic data and figures *max 1 pg*

Regional demographic indicators:

Population of region	195998	cap
Area of region	15245	km²
Population density	13	cap/km²
Number of individual municipalities	26	mun.

Data from 2015

Basic demographic data

Population growth, age distribution in last 20 year – text description

A population decrease has been observed in all the Vidzeme planning region counties and development centres. According to the data of the Central Statistical Bureau in 2016.

Socio-economic development of past 3-5 years

Unemployment rate	9,2(8,4 in Latvia)	%
Average annual income per capita (gross)	8016.00(9997.44 in Latvia)	EUR

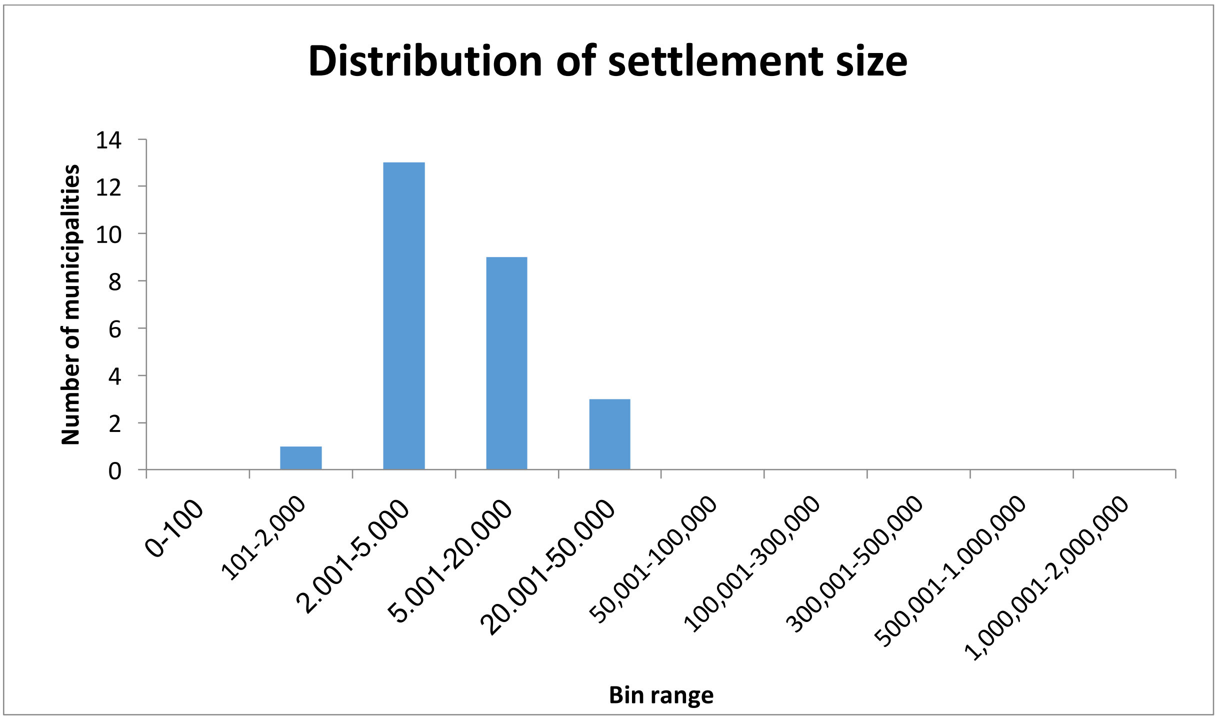
difference from the EU average (34.500 EUR gross annual earning) – EU average gross earning on 2015 is 23,335.88 according Eurostat	76,76 65,65	%
Share of employees in		
agriculture	8	%
industry	15.6	%
services	76,4	%
Share of population with tertiary education	27	%

Text description for figures above

In 2015 and 2016, in a national level the lowest level of vacancies was in the agricultural sector (1161, or 2% of the total number of vacancies), followed by the manufacturing sector (8223, or 14% of the total number) and the service sector. In the Vidzeme planning region, the unemployment rate is slightly higher than the average index in Latvia – 9.2% (in 2010 – 16.2%), but by assessing their separate regions, only in Riga and the Zemgale planning region the employment rate is higher. Compared with other regions, most of the inhabitants of Vidzeme are employed in trade (7.85%), food processing (6.89%), education (6.23%), wood processing, crafts, industrial equipment maintenance, construction, agriculture, forestry and fisheries, as well as health care. In Vidzeme the most of information and communication technology (ICT) professionals (0.33%) are to be found. The number of people with higher education increases every year.

The spatial distribution of the population, level of urbanisation

In terms of population, the largest development centre is Valmiera with 24.2 thousand inhabitants, which is followed by Cēsis (16.9 thousand inhabitants). More than 8 thousand people live in three other development centres – Madona, Gulbene and Alūksne. There are 5.5 thousand inhabitants in Valka and Smiltene.



Insert histogram – use attached xls template to generate it

4. Regional economy and economic trends

max 2 pgs

Regional economic indicators:

GDP, total	24,34	million EUR
GDP per capita	12 314	EUR/cap
HDI	0.819	

Data from 2015

GDP per economic sectors:		
Agriculture	3,3	% of total GDP
Industry	21,2	%
Services	75,5	%

Data from 2015

Regional economy

Please provide information about the regional economy, past development and trends using GDP and other indicators. If available, include graphs about GDP / HDI development of last 10-20 years.

Detailed statistics per region are available only for the year 2012. There, as we have seen, the VPR GDP share figure is lower than in other regions and almost 10 times lower than in Riga.

number of operating entrepreneurs (SMEs, large and individual)	**5551**	
→ share of SMEs	99,9	% of total number of operating businesses
number of operating nonprofit organisations	1 133	
Amount of EU funds (2007-13)	4 530 447 634	EUR

What are the main contributors/contributing sectors to the regional GDP? How stable are these sectors (qualitative assessment)?

In competition with the Latvian regions, Vidzeme has the lowest added value – in 2013 it was 1.235 billion euro, which is only 6.8% of the production's added value. This indicator is influenced by the uneven distribution of population in the regions of Latvia. When speaking of regions, Vidzeme has the highest rate of primary sectors (agriculture, forestry, fisheries) of the regional economic structure (15.8%), so the region's economy is dominated by sectors, in which an increase of productivity means a reduced need of labour. In Vidzeme, the share of services is the second lowest (59.4%) in the economic structure, which points out the growth potential of developing business in fields that create a high added value per one employee.
By type of activity (NACE 2nd red.) most of the economically active units of the Vidzeme region in 2012 worked in forestry and logging; plant and livestock production, hunting and related ancillary activities; wood, wooden and cork production and accommodation. In these sectors, traditionally

most of the region's businesses are operating, and businesses of this field in Vidzeme have the highest comparative advantage in comparison with the overall situation in Latvia. The comparative advantages indicate the ratio between the share of enterprises of the respective sector in the region and the share of enterprises of the respective sector in Latvia in total. Comparing the industries of economically active enterprises in 2013, it can be seen that the number of self-employed persons has increased by 1.066, 476 new commercial companies have been created while the number of farms and fisheries, and individual merchants has decreased by 274 and 12 units respectively.
When speaking of the sector, the highest added value in Vidzeme in 2011 was created by the manufacturing industry, agriculture, forestry and fishing, wholesale and retail trade; repair of cars and motorcycles, real estate operations, public administration and defence; compulsory social security; construction and education. The added value of the processing industry, agriculture, forestry and fishery is higher than the added value share on average in Latvia.

Describe the regional job market, employment/unemployment rates per sectors – agriculture and forestry, industry, services

See description under chapter - Socio-economic development of past 3-5 years

Importance of trade; Import/ export balance, if available

N/A

5. National and local energy strategies *(task WP 3.1) max 1 pg*

List of relevant and most influencing strategies / roadmaps / measures to local energy situation or development – already provided in task WP 3.1

Region	Brief description of current …	legal requirement OR voluntary initiative	National/ regional/ local level	Original title + link (if possible)	English title + brief description	Organisation in charge	Type (EE,EPB,RES, etc. or combination...)
Latvia	The NDP of Latvia 2014-2020 states 4 key energy targets (1) The proportion of energy produced from RES in the total gross energy consumption – at least 40% in 2020 (2) Energy consumption towards generating the GDP (in kg of toe equivalent per EUR 1000 of GDP) – 280 (in 2020) and < 150 (in 2030), baseline 373 (2010) (3) Energy dependence: net energy resource imports/gross domestic energy consumption, plus bunkering (%) – 44.1 (in 2020) and <50 (in 2030), baseline 41.6 (2010)(4) Intensity of GHG emissions in the economy (tones of CO2 eq. per EUR 1000 of GDP) – 0.794 (in 2020) and 0.752 (in 2030), baseline 1.188.	legal requirement	National	Latvijas Nacionālais attīstības plāns 2014-2020.gadam http://likumi.lv/doc.php?id=253919	National Development Plan for Latvia 2014-2020, material and resource efficiency and sustainable management of natural and cultural capital	Latvian Inter-Ministerial Coordination Center	EE, RES
Latvia	**Energy savings according 2012/27/EU Directive Aricle 3. in: primary energy consumption – 0.670 Mtoe (28 PJ), finaly energy consumption – 0.457 Mtoe (19 PJ)**	legal requirement	National	Enerģētikas attīstības pamatnostādnes 2016-2020.gadam http://likumi.lv/ta/id/280236-par-energetikas-attistibas-pamatnostadnem-2016-2020-gadam	**National Energy Development Guidelines for 2014-2020** declines energy efficiency objectives	Ministy of Economics	EE
Latvia		legal requirement	National	Latvijas Enerģētikas ilgtermiņa stratēģija 2030 –	**"Latvia's Long-term Energy Strategy 2030 – Competitive Energy for Society**" -long-term	Ministry of Economics	EE,RES

				konkurētspējīga enerģētika sabiedrībai https://www.em.gov.lv/lv/nozares_politika/atjaunojama_energija_un_kogeneracija/normativie_akti_un_politikas_planosanas_dokumenti_/	targets for security of energy supply, competitiveness, EE and the use of RES.		
Latvia		legal requirement	National	Vides politikas pamatnostādnes 2014.-2020. gadam http://likumi.lv/doc.php?id=265262	**Environmental Policy Guidelines for 2014-2020**-(1) foster resource efficiency through (green) innovation that would allow diverting secondary material from waste streams, promote material reuse, waste recycling and recovery, (2) enhance the rational use of resources and new technologies to decrease emissions from industry, transport and households	Ministy of Environmental Protection and Regional Development	RES
Latvia		legal requirement	National	Lauku attīstības programma 2014.-2020. gadam http://www.vmd.	**Rural Development Programme 2014-2020** - promotion of resource efficiency through low-carbon economy in the	Ministry of Agriculture	**EE**

				gov.lv/lauku-attistiba/statiskas-lapas/latvijas-lauku-attistibas-programma-2014-2020-gadam-?id=3089#jump	agriculture, food and forestry sectors		
Latvia		legal requirement	National	Enerģētikas likums http://likumi.lv/doc.php?id=49833	**Energy Law** defines the general framework of energy policy in Latvia. English translation available.	Ministry of Economics	EE
Latvia		legal requirement	National	Energoefektivitātes likums http://likumi.lv/doc.php?id=280932	**Law on Energy Efficiency**.In force since 29March 2016. The aim - rationalisation and management of energy recources. Defines obligation to make internal energy audits and to develop and implement energy management system in largest enterprises and municipalities	Ministry of Economics	EE
		legal requirement	National	Ēku energoefektivitātes likums http://likumi.lv/doc.php?id=253635 likums	**Law on the Energy performance of Buildings**, the requirements of the Directive 2010/31/EC on Energy Performance of	Ministry of Economics	EPB

					Buildings. English translation available.		
Latvia		legal requirement	National	Dzīvokļa īpašuma likums http://likumi.lv/doc.php?id=221382	**Law On Residential Properties**, states the provision of minimum EE requirements as one of obligated functions of the building management.	Ministry of Economics	EPB
Latvia		legal requirement	National	Uzņēmumu energoaudita noteikumi MK noteikumi Nr. 487, 26/07/2016 http://likumi.lv/ta/id/283807-uznemumu-energoaudita-noteikumi	Regulation - **The Methodology of Energy Audit in Enterprises**	Cabinet of Ministers of Latvia	EE
Latvia		voluntary initiative	National	Ieteikumi un rokasgrāmata enerģijas sektora plānošanai pašvaldībās https://www.em.gov.lv/lv/nozares_politika/energoefektivitate_un_siltumapgade/energoefektivitate/pasvaldibu_energoplani/	**Recomendations and Handbook for Energy Planning and Management in Municiplaities**	Ministry of Economics	EE

Latvia	Dissemination action	voluntary initiative	National	Energoefektīvākā ēka Latvijā http://www.energoefektivakaeka.lv/index.php	**Annual competition - the most energoefficient building in Latvia**. Organised by Ministry of Economics, Ministry of Environmental Protection and Regional Development since 2010	Ministry of Economics, Ministry of Environmental Protection and Regional Development	EPB
Latvia	Related projects	voluntary initiative	Regional	Jaunu metožu lietojums apmācībās par pielāgošanos klimata pārmaiņām un to mazināšanu http://www.energoplanosana.lv/about-us/project/en	EU Project - The project **'Training on climate and energy management issues for municipalities and different industries'** aims at finding solutions for introducing sustainable environment and energy management ideas in daily life practice, as well as increasing public awareness and participation in climate change mitigation. Goals of the project:To promote knowledge transfer between municipalities about greenhouse gas emission reduction solutions, and;To increase overall awareness and	Ekodoma Ltd., Salaspils Municipality, Saldus Municipality, Jurmala Municipality, Liepaja Municipality	EE

					knowledge about climate change through a multi-sectoral approach.		
Latvia	Related projects	voluntary initiative	Regional	RES H/C Spread http://www.res-hc-spread.eu/en_GB/lv/	EU Project- RES H/C SPREAD project. Running from 2014 to 2017, the RES H/C SPREAD project has developed six regional pilot plans in the field of heating and cooling with renewable energies, in order to harmonize baselines and therefore allow better policy planning. The project involves six pilot regions (Castilla y Leon in Spain, Emilia Romagna in Italy, Salzburg in Austria, Riga in Latvia, Western Macedonia in Greece and Rhodope in Bulgaria) representing the main climatic zones in Europe	Ekodoma Ltd., Riga Municipality	EE
Latvia	Related projects	voluntary initiative	National	BUILD UPON http://buildupon.eu/	EU Project - **BUILD UPON**. Deep building renovation represents one of the single most critical tools to massively lower Europe's CO2	Liepaja Municipality	EPB

					emissions, create jobs in the construction sector and improve the quality of the existing built environment for the good of European citizens. This Horizon 2020 project, aimed at helping European countries design and implement strong, long-term national strategies for the renovation of their existing buildings		
Latvia	Related projects	voluntary initiative	Regional	Koksnes enerģija un ekoloģiski tīras tehnoloģijas http://www.vidzeme.lv/lv/projekti/koksnes_energija_un_ekologiski_tiras_tehnologijas_woodenergy	**The Wood Energy and Cleantech** This EU project promotes wood as an energy source and improves knowledge about wood energy, eco-friendly techniques and clean technology. Knowledge regarding wood energy, clean technology (cleantech) and its applications are not sufficiently distributed to the stakeholders of energy production in all regions of the Central Baltic region.The project	Vidzeme Planning Region, Latvian Rural Advisory and Training Centre/Forest Advisory Service Centre, Amata Municipality	EE

					develops regional action plans and strategies on how to promote the effectiveness of wood energy.		
Latvia		voluntary initiative	National	Latvijas energoefektīvas būvniecības attīstības stratēģija BUILD UP Skills http://www.vidzeme.lv/lv/projekti/latvijas_energoefektivas_buvniecibas_attistibas_strategija_build_up_skills/info/	Programme Intelligent Energy Europa, **Project BUILD UP Skills Initiative.** Main aim of the project was to define National 2020 targets on energy savings and renewable energy contributions by the building sector in Latvia.	Riga Planning Region, Kurzeme Planning Region, Latgale Planning Region, Zemgale Planning Region, Vidzeme Planning Region, Latvia Association of Civil Engineers, Association of Heat, Gas and Water Technology Engineers of Latvia, Latvia Environmental Investment Fund, The Latvian Builders Association	EPB

Latvia		voluntary initiative	Regional	BioRegions http://www.bioregions.eu/en_GB/project	**BioRegion**s. The project brought the development of bioenergy regions on a European level by building on the work of the most advanced areas.	Ekodoma Ltd., Limbaži Municipality	EE
Latvia		voluntary initiative	Regional	Ilgtspējīgas enerģētikas attīstības Rīgas plānošanas reģionā 2014.-2020.gadā Rīcības plāns http://www.rpr.gov.lv/uploads/filedir/Projekti/Global%20Vision/R%C4%ABc%C4%ABbs%20pl%C4%81ns_RPR_energoplanosanas_vadlinijas.pdf	**Long Term Energy Action Plan of Riga Planning Region 2014-2020**	Riga Planning Region	EE
Latvia		voluntary initiative	Regional	Pilsētas mēru pakts enerģētikas un klimata jomā http://www.pilsetumerupakts.eu/about/covenant-of-mayors_lv.html	**Convenant of Mayors for Climate Energy.** Pilsētu mēru pakta iniciatīvas ietvaros 19 Latvijas pašvaldības ir uzņēmušās CO2 samazinājuma mērķus līdz 2020.gadam (20-	Balvi, Cēsis, Ikšķile, Jēkabpils, Jelgava, Jūrmala, Kārsava, Ķegums, Lielvārde,	EE

					55%)	Liepāja, Limbaži, Līvāni, Ludza, Ogre, Rīga, Salaspils, Saldus, Tukums, Valka, Viļāni	
Latvia		voluntary initiative	Regional	Energoplānošanas vadlīnijas www.vidzeme.lv/upload/lv/Regionalie_petijumi/Energoplanosanas_vadlinijas.do	**Guidlines for Energoplanning in Vidzeme planin region.** Deliverable of the Project Wood Energy and Cleantech Prepared by external experts.	Vidzeme Planning Region	EE
Latvia		voluntary initiative	Regional	Survey of Management of Energy Planning Procedures in Vidzeme Planning Region http://www.vidzeme.lv/lv/regionalie_petijumi/50/128240/	**Survey of Management of Energy Planning Procedures in Vidzeme Planning Region.** Deliverable of the Project Wood Energy and Cleantech Prepared by external experts.	Vidzeme Planning Region	EE

6. Energy Production

6.1. *Conventional energy production capacities (fossil fuels and nuclear power)*

Give an overview of energy production by fossil fuels and nuclear power plants – concentrate on the most significant 3 to 5 power plants.

Name & Location (city, town)	Owner	Year of commis-sioning (refur-bishment)	Type of plant & fuel	Capacity in MW	Annual energy production in MWh	Annual CO_2-emissions in t	Utilization rate (qualitative assessment)
	[choose: Public / private SME / private large enterprise]			[state: electr. and/or heat]			[choose: Constantly used / sometimes / seldom / to be decommissioned]
Valmiera	Private SME	2015	CHP & Natural gas	2 x 1,99 MW_{el}; 63,3 MW_{th}	224 040 MWh		Constantly used
Cēsis	Private SME	2015	CHP & Natural gas, biomass	38,2 MW_{th}, 1,27 MW_{el}	40000		Constantly used

Add additional details to describe the conventional energy production capacities in the region. What are current trends? What influence have age, regional economy, fuel imports, and fuel prices on the on the current status?

There is trend in district heating systems to exchange natural gas boilers with renewable energy, particularly biomass boilers. It is initiated by several support programs for district heating systems to increase use of renewable energy, support energy security and improve energy efficiency of district heating systems.

6.2. *Renewable energy production*

Energy production capacities

Give an overview of energy production by renewable energy capacities (e.g. small/large hydro, solar PV, solarthermal, biomass, geothermal & other production capacities – concentrate on the most significant 3 to 5 power plants or aggregation of production facilities.

Name & Location (city, town)	Owner	Year of commis-sioning (refur-bishment)	Type of plant & fuel	Capacity in MW	Annual energy production in MWh	Annual CO_2-emissions in t	Utilization rate (qualitative assessment)
	[choose:			[state:			[choose:

	Public / private SME / private large enterprise]			electr. and/or heat]			Constantly used / sometimes / seldom / to be decommissioned]
Valmiera	Private SME	2015	CHP & Natural gas	2 x 1,99 MW_{el}; 63,3 MW_{th}	224 040 MWh		Constantly used
Cēsis	Private SME	2015	CHP & Natural gas, biomass	38,2 MW_{th}, 1,27 MW_{el}	40000		Constantly used

Add additional details to describe the renewable energy production capacities in the region. What are current trends? What influence have age, regional economy, fuel availability or renewable energy potential, and subsidy systems on the current status?

There are only biomass technologies used in large scale (heat capacity > 0,5-1 MW), particularly in district heating. Other relevant renewable energy technologies (e.g. hydro, wind and solar) are installed relatively in small scale for local purposes, e.g. kindergartens.

6.3. *Transmission and distributions*

What kind of facilities constitute the electric transmission and distribution system? Who are the owners? Who are the operators? Please add relevant map if available.

Electricity supply system consists of: i) electricity producers; ii) high-voltage grids and iii) distribution grids. Since 2015 there is open electricity market and there is option to buy electricity from different suppliers (>40).
Distribution grid is operated by Joint-stock company "Sadales tīkls" (www.sadalestikls.lv).
For small scale solar PV systems and wind turbines (not exceeding 11 kW) there is option via smart meter release surplus electricity to public grid on monthly bases.

Give an overview of other centralised or decentralised energy distribution systems (e.g. natural gas pipelines, heat grids, etc.).

District heating systems is very wide spread in Vidzeme planning region. Large scale (>1-5 MW) District heating systems are in cities, smaller district systems (e.g. several multifamily buildings and some public buildings) are very typical in small towns.

Give an overview on interconnections of regional energy production with the rest of the country. Are there large production facilities in the region on which the rest of the country's energy supply might depend?

There are several combined heat and power plants (cogeneration stations) in the Vidzeme planning region what are distributing produced electricity to public electricity grid.

6.4. *Jobs in the energy sector*

Give an overview about the status of the energy sector in the regional economy. How many jobs are there at the moment in the energy sector. How important are new "green job" for regional economy development. If possible, quantify investments in the energy sector.

Mostly jobs are related to small scale local biomass boiler houses operated manually. Other jobs are related to preparation, gathering and delivering of raw biomass, particularly, firewood. Next part of jobs related to production of wood chips and pellets. Up to date the share of the biomass in district heating in Latvia is approx. 20% (Vidzeme region approx. 50%). There are wood resources available in Latvia and especially in Vidzeme region what gives great opportunity to increase proportion of biomass share in DH and to create new "green jobs" for development of regional economy.

Are coal and lignite mining undertaken in the region? What role does fossil fuel mining play for the regional economy and for regional energy security?

There is no coal and lignite mining undertaken nor in the region, neither in the country.

7. Final energy consumption

***Final energy** is a form, which might already been subject to conversion from the raw fuel. It is the energy made available to the user.*

For the sectoral analysis please use regional statistics as far as they are available to you and quote your sources.
If no regional data is available please use the Excel tool, which will give you a suggestion to estimate the needed indictors using national statistics.

Please always use kWh, MWh, GWh, etc. You can find a good conversion tool here:
https://www.iea.org/statistics/resources/unitconverter/

7.1. *Households*

Regional final energy consumption of household sector	1060	GWh

Heat consumption

Total heat energy consumption of households sector (heating and hot water consumption)	893	GWh
Average heat energy consumption per household	140	kWh/hh

Describe the average building standard. What is their average age of existing building stock? Are energy efficient renovations in progress?

Around 60% of all housing stock was built in period of 1960-1990. From those buildings around 80 % do not correspond to minimal energy performance requirements of building code.
There is relatively slow renovation process in place due to high upfront costs, relatively low income level of owners and very long payback time.

Electricity

Electricity consumption of households	161	GWh
Average electricity consumption per household	2182	kWh/hh

Describe if there are any national or regional programmes for reducing household electricity consumption (e.g. washing machine or refrigerator replacement programme). If yes, please elaborate it briefly.

There are no mandatory requirements for reduction of electricity consumption and use of domestic appliances with higher energy efficiency class.

Cooking

Gas consumption for cooking appliances of households	67	GWh

Describe if gas is a significant energy source for cooking in the household sector.

Gas use for cooking is very common in the household sector.

General information

Household electricity price	0.165	EUR/kWh (incl. taxes)
Household natural gas price	458	EUR/1000 m3 (incl. taxes)
Household district heating price	0.0493	EUR/kWh (incl. taxes)
Household price: other energy sources – specify:		EUR/kWh (incl. taxes)
Energy expenditure by household	13.2	% of income

Is there any element of Demand Side Management of electricity on household level in place? If yes, please describe it (e.g. peak price, smart metering)

There are no mandatory Demand Side Management activities in place. There is possible to install smart meters instead of existing electricity meters. As well as to use specific appliances to measure and control electrical and electronical equipment in the households.

Is energy poverty an issue in the region? If yes, please describe how many people are affected, in what extent?

There are no specific provisions regarding vulnerable consumers in energy law; instead this issue is dealt with in social legislation. *Approx 50% of citizens occasionally suffer from energy poverty in Latvia. On 2014 19,1% or 157 000 households (approx. 377 000 persons) cannot afford to keep the proper heating in house or flat. More than 10 % of income is used to cover energy consumption (heat and electricity).(Latvia Green movement in cooperation with CEE Bankwatch Network " Energy poverty in Latvia: implementation of energy efficiency activities and supporting mechanisms")*

Give an estimate of the trend in final energy consumption in the household sector using values from -5- to +5 where (-5 is a strong reduction, 0 means neither growth nor reduction, +5 strong growth).

+1 to +2

7.2. *Service Sector*

Regional final energy consumption of service sector	36	GWh

What are the main sub-sectors driving energy consumption in the in the service sector (building standard, number of businesses, …)? How important is service sector for the regional economy?

The main sub-sectors driving energy consumption in the service sector are buildings.

Give an estimate of the trend in final energy consumption in the service sector using values from -5- to +5 where (-5 is a strong reduction, 0 means neither growth nor reduction, +5 strong growth).

0 to -1

7.3. *Industry*

Total energy consumption of the industrial sector	633	GWh
Industry electricity price		EUR/kWh (incl. taxes)
Industry natural gas price		EUR/kWh (incl. taxes)
District heating price		EUR/kWh (incl. taxes)
Household price: other energy sources – specify:		EUR/kWh (incl. taxes)

What are the main sub-sectors driving energy consumption in the in the industrial sector? How important is industry for the regional economy?

The main sub-sectors driving energy consumption in the in the industrial sector are Wood and wood products, Non-metallic minerals and Food production.

7.4. *Transport*

Regional final energy consumption of transport sector	1044.04	GWh

Describe the main characteristics of the transport sector: transport infrastructure, motorisation rate, availability of public transport and differences between urban and rural environments.

On 2016 in traffic intensity monitoring stations of Vidzeme Planning Region, average traffic intensity was 3838 vehicles in twenty-four hours, in all monitoring stations together are registered 26866 vehicles (16% trucks) in twenty-four hours. Motorisation rate in Vidzeme Planning Region on 2014 was 338 (331 in Latvia) on 2015 it was 355 (345 in Latvia) and on 2016 it was 345.

Passenger transport

Motorisation rate - number of passenger cars/1 000 inhabitants	367	
Regional energy consumption of passenger transport in the region	616	GWh

Freight transport

Regional energy consumption of road freight transport	346	GWh

If the rail, or transport by pipeline is a significant way of the freight transport, please describe their main characteristics.

Use of alternative fuels

Describe the market development for alternative fuel vehicles (natural gas, biogas, electric cars). What supporting mechanisms for alternative fuel are available on national and regional level? Describe challenges and barriers, e.g. infrastructure, technological, supply, financial barriers, etc..

There is common practice to use LPG for cars with gasoline engines. As well as there should be small additive of biofuel to existing fuels.
According to the governmental policy to provide Latvia's contribution to the global climate change (GHG emissions) mitigation, in 2014, the Cabinet of Ministers approved and the Ministry of Environmental Protection and Regional Development implemented an open tender for the Climate Change financial instrument's support for the purchase of electric cars and setting up of fast recharging stations. Several Vidzeme municipalities used this opportunity to receive this co-financing. According to experience of car users there is limitation in every day long distance usage of electric cars due to the lack of recharging stations in the region.

Give an estimate of the trend in final energy consumption in the transport sector using values from -5- to +5 where (-5 is a strong reduction, 0 means neither growth nor reduction, +5 strong growth).

+2 to +3

Other relevant sectors (delete if not relevant)

Regional final energy consumption of other sectors	1896	GWh

P*lease give a summary of large energy-consumers, which were not covered in the chapters above.*

Great number of final energy consumption is related to agriculture because it is well developed in Vidzeme planning region.

7.5. *Summary*

7.5.1. *Final energy indicators*

General indicators for the region

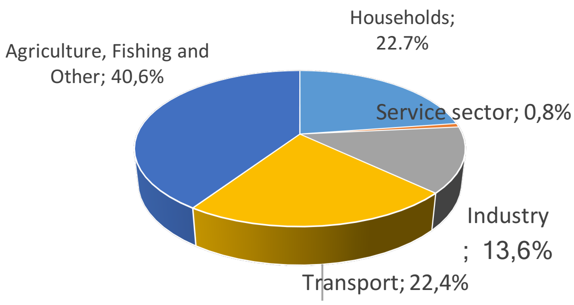
Use the Excel tool to fill the following tables and generate graphs.

If regional data is available, use this information and quote your sources.

Total final energy consumption	4669.07	GWh
Final energy consumption per capita	24102.9	kWh/cap
Electricity consumption per capita	1806.2	kWh/cap
Heat consumption per capita	14088.1	kWh/cap
% of total country consumption	10	%

Final energy consumption per sector

Year: 2015			%
Households	49.78	GWh	22.7%
Service sector	1334.26	GWh	0.8%
Industry	1170.15	GWh	13.6%
Transport	1590.12	GWh	22.4%
Agriculture, Fishing and Other	349.88	GWh	40.6%
Sum	4669.07	**GWh**	**100,0%**



Give an estimate of the trend in final energy consumption using values from -5- to +5 (where -5 is a strong reduction, 0 means neither growth nor reduction, +5 strong growth).

+1

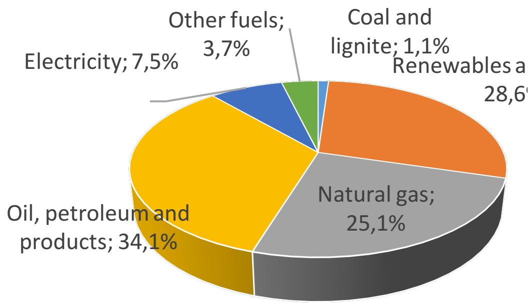
7.5.2. *Final energy consumption by fuel*

Use the Excel tool to fill the following tables and generate graphs.

If regional data is available, use this information and quote your sources.

Total final energy consumption by fuel

Year: 2015			%
Coal and lignite	49.78	GWh	1.1%
Renewables and waste*	1334.26	GWh	28.6%
Natural gas	1170.15	GWh	25.1%
Oil, petroleum and products	1590.12	GWh	34.1%
Electricity	349.88	GWh	7.5%
Other fuels	174.88	GWh	3.7%
Sum	4669.07	**GWh**	**100,0%**



*Hydro, wind, solar, tide/wave, biomass and waste, geothermal

7.5.3. *Primary energy equivalent*

Primary energy *is an energy form found in nature that has not been subjected to any conversion or transformation process. It is energy contained in raw fuels.*

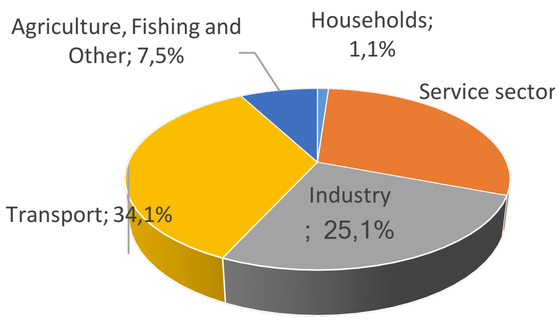
If regional data is not available for these indicators, use specific national indicators to break energy supply down to regional level. Refer to Excel tool for suggestions on calculation methodologies. Quote your sources and assumptions

Total Primary Energy Consumption	5980.3	GWh
Primary energy consumption per capita	30871.8	kWh/cap
Primary energy factor of electricity	2.5	-
Energy intensity	$3.85*10^{-6}$	TPES/GDP

Give an overview of the regional primary energy supply by fuel.
Use the Excel conversion tool using primary energy coefficients suitable for your region.

Primary energy equivalent by sector
Use the Excel tool to fill the following tables and generate graphs.
If regional data is available, use this information and quote your sources.

Year: 2015			%
Households	1609.01	GWh	26.9%
Service sector	56.47	GWh	0.9%
Industry	1080.64	GWh	18.1%
Transport	1148.44	GWh	19.2%
Agriculture, Fishing and Other	2085.72	GWh	34.9%
Sum	**5980.29**	**GWh**	**100,0%**



What is the level of primary energy supply dependencies: Which fuels need to be imported form the rest of the country and internationally.

Dependency on fuel imports: very high / high / average / low / very low Between average and high.

7.5.4. Regional CO_2-emissions associated with energy consumption

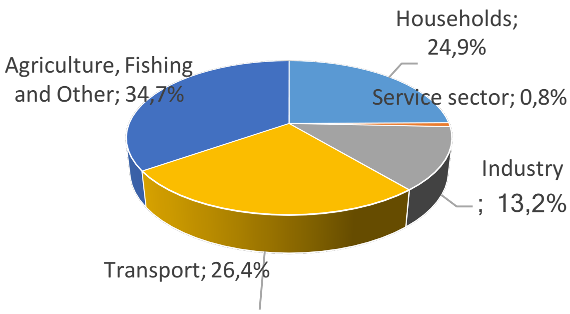
Use the Excel tool to fill the following tables and generate graphs.
If regional data is available, use this information and quote your sources.

Total CO_2-emission associated with energy sector	1.02	Mio t
CO_2-emissions per capita	5.26	t/cap
CO_2-emissions per GDP	0.0007	t/€ GDP

Give an overview of the regional primary energy supply by fuel.
Use the Excel conversion tool using CO_2-emission coefficients suitable for your region.

Energy-related CO_2-emissions by sector

Year: 2015			%
Households	1609.01	GWh	24.9%
Service sector	56.47	GWh	0.8%
Industry	1080.64	GWh	13.2%
Transport	1148.44	GWh	26.4%
Agriculture, Fishing and Other	2085.72	GWh	34.7%
Sum	**5980.29**	**GWh**	**100,0%**



8. Renewable energy sources – status and potential

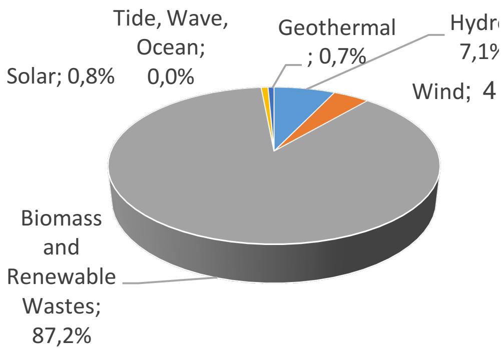
8.1. *General information*

Use the Excel tool to fill the following tables and generate graphs.
If regional data is available, use this information and quote your sources.

Renewable Energy Targets:		
2020 RES share in gross final energy consumption	40	%
2030 RES share in gross final energy consumption	50	%
Current RES share (2015)	36.7	%
thereof RES out of the region	36.7	%

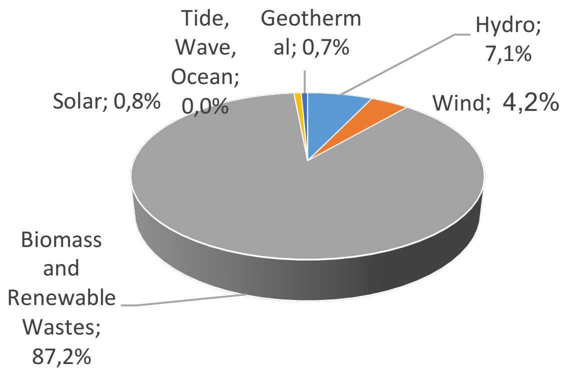
Share of final energy consumption produced by renewable fuels

Year: 2015			%
Hydro	120.75	GWh	7.1%
Wind	71.43	GWh	4.2%
Biomass, biofuels and renewable wastes	1483.11	GWh	87.2%
Solar	13.60	GWh	0.8%
Geothermal	11.90	GWh	0.7%
Tide, Wave, Ocean	0	GWh	0.0%
Sum	**1700.81**	**GWh**	**100,0%**



Share of total electric demand covered by renewable fuels

Year: 2015			%
Hydro	167.7	GWh	81.6%
Wind	13.2	GWh	6.5%
Biomass, biofuels and renewable wastes	24.3	GWh	11.8%
Solar	0.18	GWh	0.1%
Geothermal	0	GWh	0.0%
Tide, Wave, Ocean	0	GWh	0.0%
Sum	**205.5**	**GWh**	**100,0%**



Describe if and how renewable energy sources are integrated in the transport sector, e.g. biofuels, electric vehicles.

There should be small additive of biofuel to common fuels. This share is increased time by time, e.g. from 3% to 5%.

Describe the status of REN production in the region. % of total energy and electricity demand covered by REN. If available give a historic overview of the REN production capacities for the last 5 to 10 years.

Historically Vidzeme planning region was not fully installed with gas (gasified) therefore e.g. natural gas for energy were used only in some parts of region. Biomass is leading renewable technology. In last 5 years increased number of solar thermal, solar PV and heat pumps systems.

Describe if there are incentive programmes/schemes (financial and non-financial) in place to support REN-development. Are these programmes on national, regional or local level?

The main governmental financial support programme was Climate change financial instrument for public and private sectors with aim to increase energy efficiency and use of renewable energy.

Describe the top 5 regulatory barriers slowing down current and future REN-development. Should these barriers be addressed at national, regional or local level?

There is still large dependence on fossil fuels in energy sector (~60 %) on the state level. Law of Renewable energy is not developed yet. Existing support mechanism for electricity from renewable energy (bio-gas, biomass co-generation, wind, solar) are not well developed and mostly supporting gas driven power plants. Largest part of support component in electricity price are dedicated to gas driven cogeneration for installed capacity and generated electricity, e.g. in 2017 total support component in electricity price is around 35 EUR/MWhel., from it 23 EUR/MWh is for gas driven power plants. Decision on the state level not to develop new supporting mechanisms (feed-in tariff, grants or subsidies etc.) for renewable energy till 2020.

Give an estimate of the trend in renewable energy production using values from -5- to +5 (where -5 is a strong reduction, 0 means neither growth nor reduction, +5 strong growth). Describe supporting factor as well as barriers.

+1

8.2. *Available natural resources in the region*

8.2.1. Biomass

How are forest areas used? For what purpose? What is the regional energy potential using existing forest areas? Please state whether it is a theoretical or technical potential and describe regulatory support systems as well as barriers.

The forestry sector, including wood processing, is one of the most important fields for the economic development in Latvia, therefore, the objectives of VPR and the national policy are equal. They focus on the sustainable management of forests, increase of products with a high added value, thus ensuring competitiveness of Latvia. The issue of an efficient use of wood is still topical. It needs a complex solution. A lot of bushes grow along ditches and deserted fields and they could become a very good raw material for energy wood. It often happens that before incineration wood is not dried till its moisture content reduces up to 25-30%.

It is essential to elaborate a concept of using wood with a maximum added value. On the regional level, the added value can be generated by such activities as instalment of modern wood processing technologies and establishment of new factories that would allow using by-products as a high quality energy wood. The economic development of the region can also be promoted by creating an investor-friendly environment and enhancing education of the society and positive attitude.
Another solution that still needs a feasibility study is the establishment of an energy wood stock exchange with co-ordinated transport logistics and a fuel storehouse, if necessary.
The municipalities where forests cover the largest part of their territories, could promote their development with the help of the following activities:

- Co-operation with private forest owners to ensure the sustainable development;
- The Latvian State Forests (LSF) sell energy wood up to 50 metres from the road, i.e., they sell only the wood that is located up to 50 m from the road. The municipalities could make an agreement with LSF to find economically better solutions and go further inside.

What are main agricultural products at the moment? What is the regional energy potential from agricultural products? Please state whether it is a theoretical or technical potential and describe regulatory support systems as well as barriers.

State Priekuli Plant Breeding Institute located in Vidzeme Planning Region is one of the most experienced agricultural research institutions in the Baltic Sea region. Agricultural crops researched by SPPBI are: cereal (barley, rye, and triticale), potato, legumes and annual and perennial grasses. The main research areas: plant breeding, maintenance and preservation of plant genetic resources seed production, crop management for environmentally friendly, especially organic, farming systems. The Institute provides fundamental and applied research, promotes and carries postgraduate studies, and provides advising and consultancy on products (crop varieties, seeds) and technologies for organic, integrated and conventional agricultural holdings (large, medium and small enterprises). Research for environmentally friendly, especially organic, farming systems was intensified and extended at the beginning of the 21st century, when the Institute concentrated efforts on creation of new field crop varieties and seed production and on development of breeding and growing technologies for environmentally friendly, especially organic, production systems.

Provide a land use map or map indicating biomass energy potential of the region, if available.

Please see information in the Corine Land Cover 2012 database: *http://land.copernicus.eu/pan-european/corine-land-cover/clc-2012/view*

8.2.2. Hydro power (incl. tide and wave power)

Give an overview of hydro power sources used at the moment and describe the energy potential for the different technologies: run-of-river hydropower plants, reservoir hydropower plants, use of tide and wave power, if applicable. Differentiate between small and large hydro power. Describe the energy potential based on geographical and political frameworks.

On 2015 there was 146 small run-of-river hydropower plants actively operating in Latvia. Total share of electricity produced by hydropower plants from 2005-2014. was 0,9%. There are 43 small run-of-river hydropower plants located on different rivers in Vidzeme region. Gauja is the largest river in Vidzeme. There are 9 hydropower plants located on Gauja river. On the larger scale the largest hydro power stations in Latvia are located on Daugava river the total power produced amounts to 1.487 MW. According preliminary calculations Daugava river still has 130MW unused power capacity.

8.2.3. Solar energy

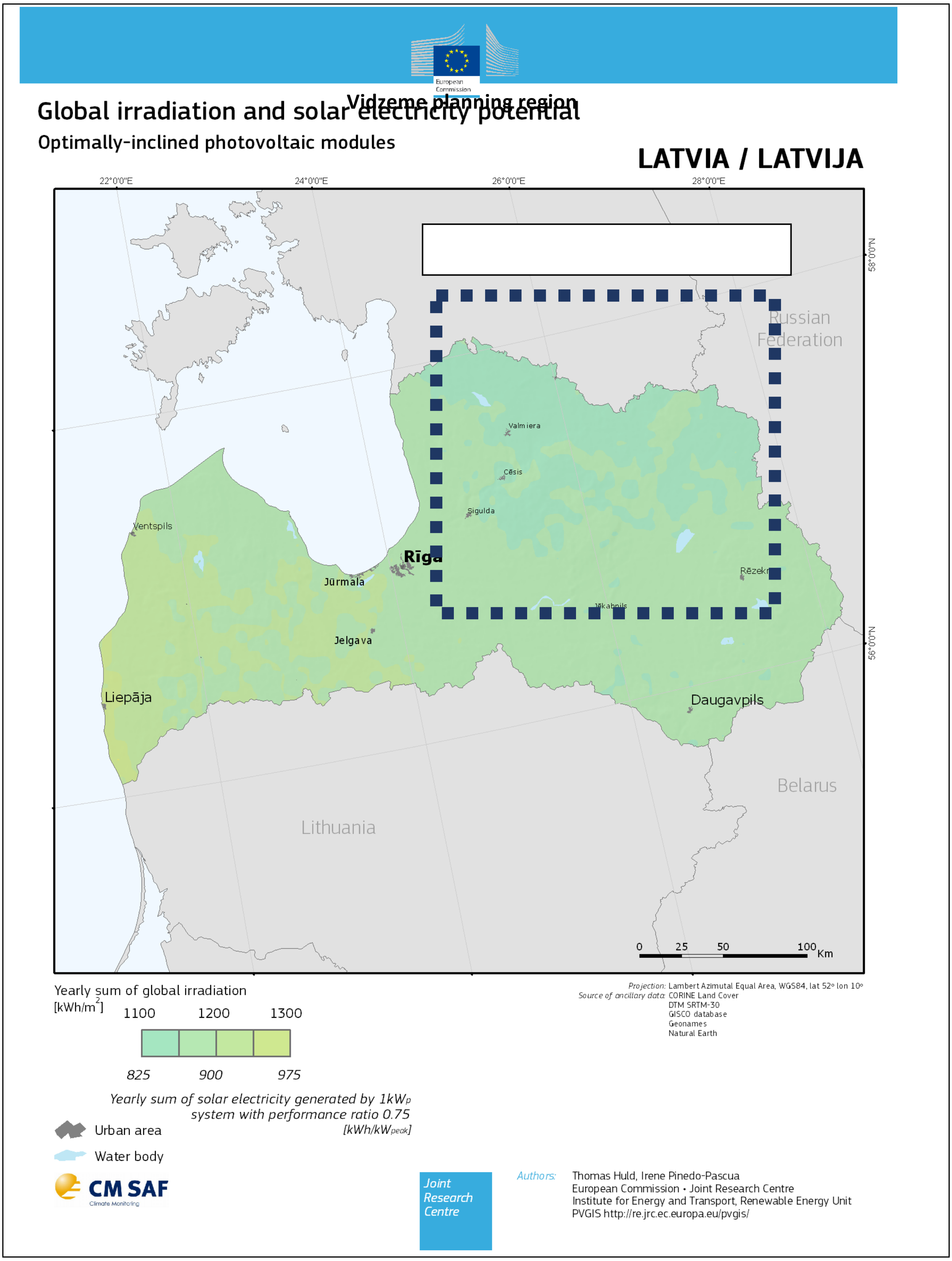
Solar irradiation (on optimally inclined plane) per year	from 1100 to 1200	kWh/m²

Give an overview of both solar thermal and PV usage at the moment and describe the energy potential based on geographical and political frameworks.

Solar energy in Latvia have untapped potential, but still there is lack of awareness and trust to solar energy technologies.
In last 10 years there increase number of installed solar thermal and solar PV systems mainly due to support for renewable energy technologies, e.g. Green Investment scheme.

Provide a map indicating solar irradiation in the region, if available.

You can use e.g. the interactive map or posters provided by EU JRC PV database: Photovoltaic Geographical Information System (PVGIS), http://re.jrc.ec.europa.eu/pvgis/



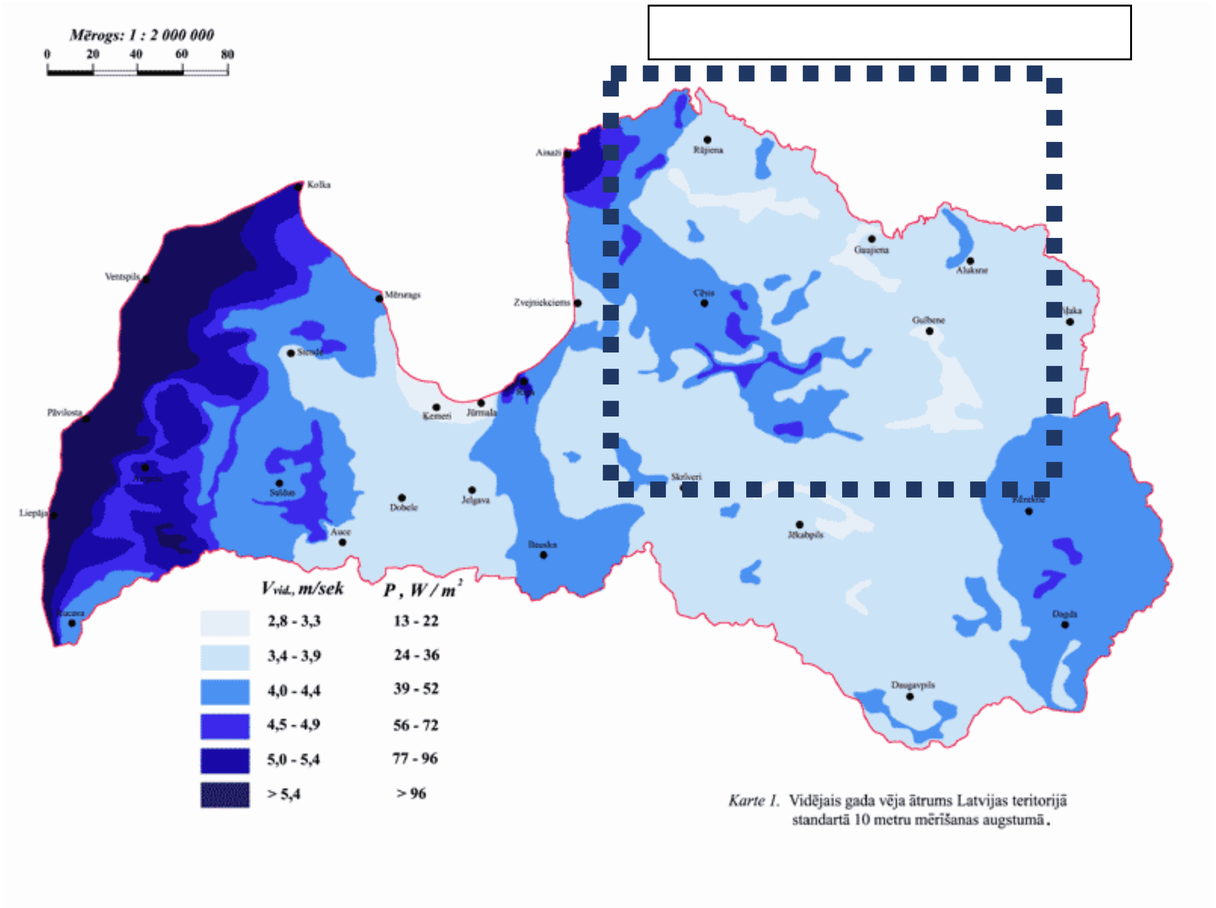
8.2.4. Wind power

Average wind velocity on 10m height	from 2 to 6	m/s
Full load hours		h/a

Give an overview of wind power use at the moment and describe the energy potential based on geographical and political frameworks. Differentiate between offshore and onshore potential

Use regional/national studies but if not available, you can refer to the EEA study for approximation of wind speed or full load hours: http://www.eea.europa.eu/publications/europes-onshore-and-offshore-wind-energy-potential/at_download/file

Provide a wind map for the region, if available



Karte 1. Vidējais gada vēja ātrums Latvijas teritorijā standartā 10 metru mērīšanas augstumā.

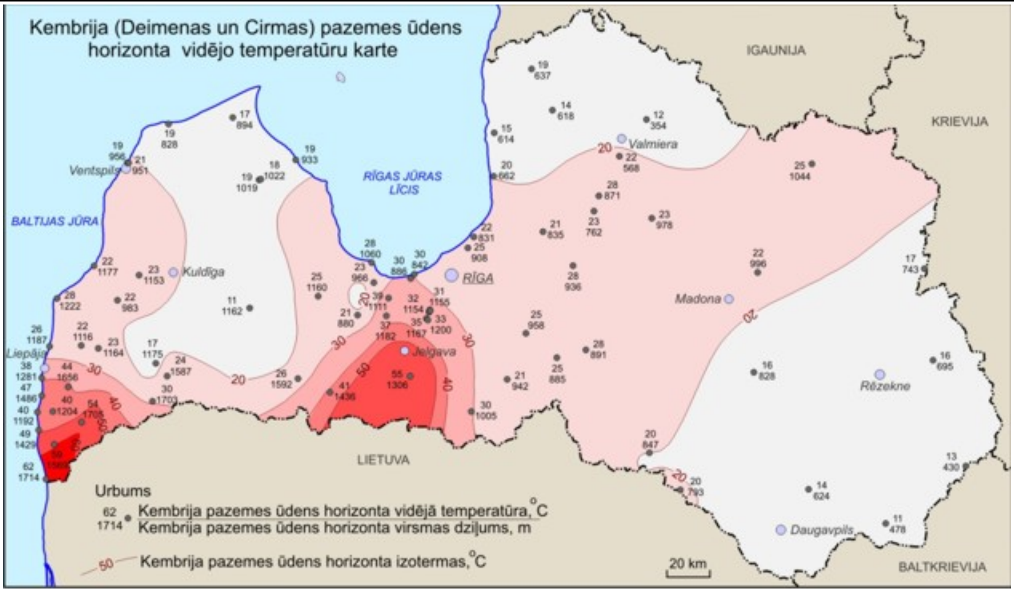
http://www.windenergy.lv/uploads/img/posts/karte03_1618218539.gif

8.2.5. Geothermal energy

Give an overview of use of geothermal energy at the moment and describe the energy potential based on geographical and political frameworks.

Potential geo-thermal aquifers lie in a depth of 300 – 2000 m (from 7 °C up to 65 °C) therefore geothermal energy is not used at the moment due to high initial investments and availability of other local and renewable energy resources, e.g. biomass.

Provide a geothermal map for the region, if available



https://www.meteo.lv/fs/CKFinderJava/userfiles/images/geologija/kembrijs%20geoterma.jpg

8.2.6. Waste

Describes overlaps between waste management and energy sector. Is municipal solid waste used for energy production? How is the energy from waste incineration plants used, e.g. electricity generation, district heating (cogeneration)?

Waste management is organised on the regional level. The landfill "Daibe" owned by municipalities has provided a gas collection system in the first disposal cell – gas collection pipes almost 3 km long, a gas regulation station and a pumping station. The collected gas is currently used for generation of electricity and heating in the co-generation network – for landfill infrastructure.

8.2.7. Other natural resources

Provide information about any other natural/renewable resources usable for energy production.

n/a

8.2.8. Restriction through protected areas

Are there environmentally protected areas, which are not available for REN facilities or restrict the overall potential?

There is, so called, NATURA 2000 area.

9. Energy efficiency – status and potential

What is the status of the implementation of the Energy Efficiency Directive?

There is delay in state level of implementation of EED.

What is the status of the implementation of the Energy Performance of Buildings Directive (e.g. data on low/zero energy buildings)?

Building codes from 2014 are tighter and overall energy performance of buildings (new built and renovated) is increased.

Analyse the sectors:
Households: Are energy efficiency measures implemented in this sector? Are there awareness campaigns to highlight the potential? Is there support for the implementation (financial and non-financial)?

There is more energy efficiency measures (e.g. renovations of multifamily buildings) implemented in cities/towns not in country side.

Service sector: Are energy efficiency measures implemented in this sector? Are there awareness campaigns to highlight the potential? Is there support for the implementation (financial and non-financial)?

There is relatively high number of energy efficiency measures (renovations, renewable energy etc.) implemented in service sector, particularly in buildings.

Industry: Are energy efficiency measures implemented in this sector? Are there awareness campaigns to highlight the potential? Is there support for the implementation (financial and non-financial)?

There is no significant number of efficiency measures implemented in industry. As well as there is no data on them.

Transportation: Are energy efficiency measures implemented in this sector? Are there awareness campaigns to highlight the potential? Is there support for the implementation (financial and non-financial)?

Sector with lowest rate of energy efficiency measures implemented.

Give an estimate of the trend in energy efficiency development using values from -5- to +5 where (-5 is a strong reduction, 0 means neither growth nor reduction, +5 strong growth).

+1

Demand side management, smart metering, storage

0 to +1

10. SWOT analysis

Please make a SWOT-analysis for the development of your region towards a low-carbon economy in 2050. Include stakeholders in the process.

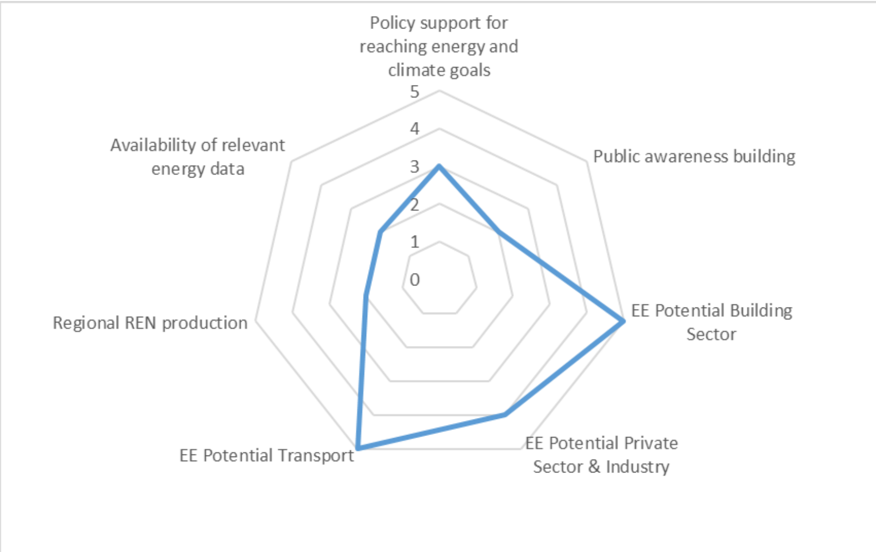
Strengths	Weaknesses
• A great potential of the renewable energy resources in VPR • Lack of the natural gas pipelines in the largest part of the VPR territory • Possibility to involve the local labour force • Sustainable forest management • Low costs of wood energy resources in comparison with the natural gas	• Lack of sustainable national policy • Lack of responsibility for the achievement of the objectives of the renewable energy resources and the energy efficiency • Shortage of professional knowledge how to prepare and use the energy wood • Lack of motivation to improve the local energy systems • Shortage of skills of an efficient use of the renewable energy resources in heat supply systems • Underdeveloped local market of biomass that can develop only then when there will be an unchangeable demand • Reliable data of the fuel consumption, produced energy and the consumption of energy in the VPR municipalities • Most of the small wood processing enterprises are not modernised and their products have a low added value • Inadequately great influence of the fossil fuel supplier, especially, the natural gas, on the use of the national policy instruments • Few possibilities to installation CHPs in the region due to lack of heat consumers • Low sensitiveness to energy saving
Opportunities	**Threats**
• Possibilities of the Latvian and Baltic „green" region – promotion of economics and wellbeing • Existence of many wood processing companies for efficient use of wood residues etc. • Many small decentralised wood log boiler houses where use of biomass can be improved • Existence of applicable funds to invest in energy system development • Need for efficient locally produced technology	• Decrease of biodiversity • Risk of energy resources price increase • Risk of state policy shift in favour of fossil fuels

Assess the following trends:

- Policy Support for reaching energy and climate goals
- Public awareness building
- EE Potential Households
- EE Potential Private Sector & Industry
- EE Potential Transport
- Regional REN production
- Availability of relevant energy data

Self-assessment:
See Excel template or modify the graph provided here (right-click).

Points:
1 … no measures set/ potential unused
to
5 … fully developed/ potential fully used



11. Annex: List of sources /bibliography /List of relevant stakeholders/institutions in the region

Please include your sources/bibliography, a list of identified stakeholders, etc

Bibliography

1. Analysis of Vidzeme Planning Region strengths and weaknesses, Ekodoma Ltd, 2011
2. Latvia Green movement in cooperation with CEE Bankwatch Network “Energy poverty in Latvia: implementation of energy efficiency activities and supporting mechanisms”
3. Data bases of the Central Statistical Bureau of Latvia (http://www.csb.gov.lv/en/about-us);
4. Ministry of Economics of the Republic of Latvia www.em.gov.lv.
5. Ministry of Environmental Protection and Regional Development of the Republic of Latvia www.varam.gov.lv.
6. www.Tentacle.eu

List of identified stakeholders

Municipality of Cēsis

Municipality of Pārgauja

Municipality of Valka

Municipality of Rūjiena

Municipality of Smiltene

Municipality of Rauna

Municipality of Strenči

Municipality of Beverīna

Municipality of Valmiera

Vidzeme Hospital/ Valmiera

Municipality of Ape

Municipality of Alūksne

Municipality of Gulbene

Municipality of Jaunpiebalga

Municipality of Amata

Municipality of Burtnieki

Municipality of Kocēni

Municipality of Cesvaine

Municipality of Lubāna

REGIONAL ENERGY PROFILE

Region: North East Planning Region, Republic of Macedonia

CENTRAL EASTERN EUROPEAN SUSTAINABLE ENERGY NETWORK

PANEL 2050 – Partnership for New Energy Leadership 2050
Deliverable 3.1

By: Balkan Development Solutions BDS Ltd.

Date: September 2017

European Commission
Horizon 2020
European Union funding
for Research & Innovation

Table of Content

1. Methodology

The PANEL 2050 project has the aim to create durable and replicable sustainable energy networks at local (municipality/community) level, where relevant local stakeholders collaborate for the creation of a local energy visions, strategies and action plans. The aim of these networks is to contribute to and actively work for the transition towards low carbon communities in 2050.

The PANEL 2050 partnership will provide support for the creation of first successful local energy networks in the CEE countries. In the course of the project, organisations from 10 CEE countries will collaborate on creating regional energy strategies and action plans.

The present Regional Energy Profile was prepared in order to get a better understanding of the energy-related status quo in the North East Planning Region (NEPR), Republic of Macedonia, analysing strengths and challenges with regard to the transition towards a low carbon community.
This energy profile constitutes the groundwork for the preparation of a Regional Energy Roadmap and related Action Plans and will be essential for the communication with regional stakeholders.

Majority of information used in this document come from regular statistics and publication by State Statistical Office of the Republic of Macedonia and its MakStat database, furthermore from publications of Ministry of economy, Energy Regulatory Commission, Center for Development of NEPR, etc.

2. General introduction of the region *max 2 pgs*

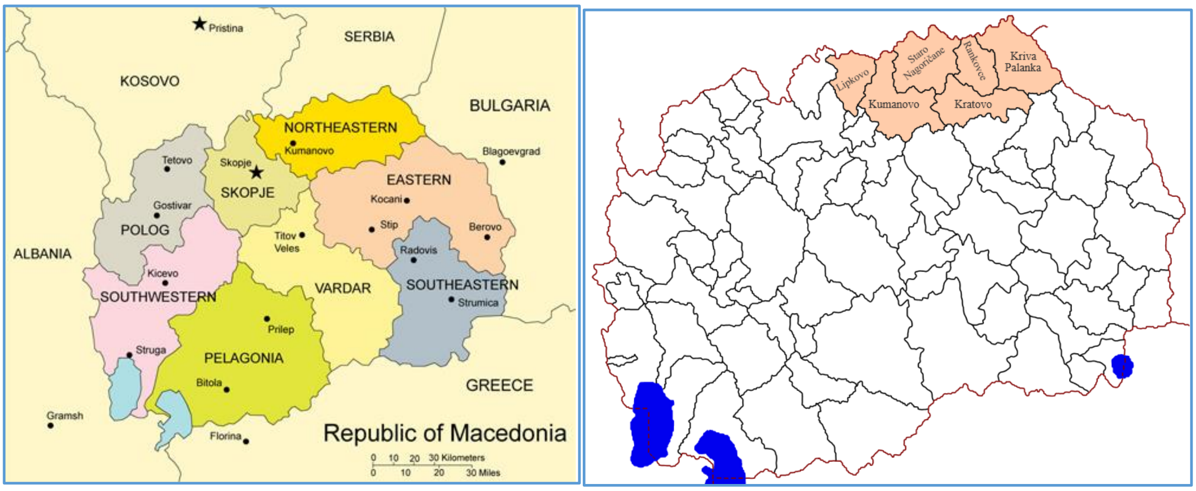
Name of the region and NUTS identification

North East Planning Region - MK007

Geography and policy:

The Northeast Planning Region (NEPR) consists of the municipalities in the far Northeastern part of the Republic of Macedonia and spreads along the rivers Pchinja and Kriva Reka and the borders with Kosovo, Serbia and Bulgaria. This planning region consists of 6 municipalities: Kratovo, Kriva Palanka, Kumanovo, Lipkovo. Rankovce and Staro Nagorichane with 192 settlements (189 are rural). The total area of the region is 2.310 km2, i.e. 9% of the total territory of the country.

Figure 1: Location of the North East Planning Region (NEPR)



Source: https://en.wikipedia.org/wiki/Northeastern_Statistical_Region

Geography of the region, including morphology, geology, climate, hydrology, flora and fauna related to energy

In the lowland part of the NEPR there is moderated continental climate, and in the higher part there is a mountain climate. Average annual temperature is 10-11°C, with differences of app.20°C. Average annual atmospheric precipitations are 500-750mm. In the areas with higher ASL atmospheric precipitations are higher. Average annual velocity of the winds is 2-3m/sec. (maximum 19,0m/sec), and with very big number of days with silence (over 200). Fog is very rare, which impacts on having a lot of sunny days during the year. The Osogovo mountain massif is one of the most important mining areas in the Republic of Macedonia, with mineral deposits of copper, lead, chrome, arsenic, antimony and zinc. The Toranica mine (Kriva Palanka) is a rich geological site, with ore reserves (lead, zinc, copper and silver) estimated at 50 years of normal exploitation, and the mine Lojane (Lipkovo) is rich in arsenic, antimony and chrome. There are several sites with non-metals deposits in the planning region (clay, tufa, quartz, diatomaceous earth and send deposits), particularly in the municipality of Kratovo, with deposits sufficient for 50 years of exploitation.

The planning region includes the catchment area of the rivers Pchinja and Kriva Reka, with abundant sources of water (especially in the Osogovo region), two scenic accumulation lakes (Lipkovo and Glazhnja in the municipality of Lipkovo) and two smaller accumulation lakes (Bazjacko Brdo and Vlashki Kolibi in Kriva Palanka).
Geospace of NEPR is structured from the parts of tectonic units Vardar Zone (VZ) and East Macedonian Zone (EMZ), and Kratovo Zletovo Volcanic Area (KZVA).
In the terrain structure of NEPR are present magmatic, sediment and metamorphous rocks from several geological epochs. From aspect of litho heat interested are weak- discontinued litho areas with higher accumulative and better permeability of the geoheat- diabases, gabbro, granite, granodiorite, etc.
Known hydrothermal resources in NEPR are with very low temperature and energy potential. For positioning of the NEPR in VZ and KZVA, potential of the known hydrothermal resources „significantly is down behind geothermal potential of the geospace of NEPR".

Brief history overview of the region - state the most important milestones related to the industrial/ regional development (e.g. significant energy projects, power plants, etc.), ideally related to energy

The Northeast Planning Region is economically the most underdeveloped planning region in the Republic of Macedonia. Its share in the gross domestic product of the Republic of Macedonia is on a level of modest 5.5%, which is much less than the share of the region in the total territory and in the total population number in the country.
NEPR is the region with almost no electricity production capacity installed.
Owing to the geological features of the Osogovo mountain range, the region has several lead and zinc mines.
In NEPR there is a tradition in geothermal water utilization in the tourism and bottling water. In heating of the administrative buildings, industrial and garden facilities till now there are no examples for utilizing geoheat.
The natural conditions and resources of the Northeast Region provide good opportunities for the development and promotion of the meat and dairy processing industry. There is a total of 172 225 hectares agricultural land, 45.7% of which or 78 828 hectares are arable areas, whereas 54.3% or 93 391 hectares are pastures. Of the arable areas in this region, plough lands and gardens predominate covering 64.551 ha, orchards 857 ha, vineyards 1.570 ha and meadows 11 850 ha.
A total of 16 agricultural holdings cultivate 4 475 ha, whereas 20 448 individual agricultural producers cultivate 51 133 hectares. According to this, the average size of cultivated lands by agricultural holdings is approximately 279 ha. Individual agricultural producers cultivate on average 2.5 ha, which indicates a high average size compared to the national average (1,84 ha). In this region, far the most individual holdings have been registered providing services by way of mechanisation, more precisely 28.7% of the total number of such registered services in the Republic of Macedonia. This indicates an effective utilisation of available mechanisation and a large-scale cooperation among farmers.
This region also numbers most of the agricultural holdings processing animal and plant products as an additional activity. Their share in all such holdings in Macedonia is 21.6% for animal processed products and 38.8% for plant processed products. This mostly applies to meat and dairy products, as well as pickle and spices, which are in fact activities for generation of additional income among smaller

farmers. The high number of cattle, sheep, goats and poultry, as well as the available arable lands suitable for cultivation of cereal and fodder crops is a good basis for an even stronger development of livestock husbandry, that is to say meat and dairy farming, as well as egg industry. Most of the dairies in Macedonia are concentrated in this region, which apart from supplying the region itself, also supply Skopje region. The proximity of Skopje and the sound transport communication provide for extraordinary benefits in placing the products on the biggest market in a fresh condition. The economy is far from innovative. In the Northeast Planning Region, there are no research development units, registered patents or centres of excellence. The relative share of energy per product unit is high, and the labour force is insufficiently productive, especially compared with the developed regions, such as Skopje Planning Region for instance. Evaluation of the possible utilization of the local energy resources, lays in the strategic development of the global energy trends. This development has a primary goal creating energy independence, reducing of the conventional fossil fuel utilization, reducing of the anthropogenic burden in the environment, upgrading of the living conditions of the population and sustainable energy development.

Public administration procedure – brief profile of current energy planning process in your region starting from the national level down to the region (see also your desk research within WP3.1)

The Strategy for Energy Development in the Republic of Macedonia by 2030 defines the most appropriate long-term development of the energy sector in the state in order to provide secure and quality supply of consumers with energy.
The main objective of the Strategy for Renewable Energy Sources (RESs) use in the Republic of Macedonia by 2020 is to gather information on the potential and possible exploitation of RESs in Republic of Macedonia.
Strategy for promotion of energy efficiency in the Republic of Macedonia up to 2020. The main objective of the strategy is to develop framework for accelerated adoption of EE practices in sustainable way and through implementation of series of programs and initiatives related to reduction of import dependence, energy intensity, unproductive use of energy, preparation of favourable ambient for maximal inclusion and possibilities of the private sector in complementary advocacy and training.
Strategy for energy development and Strategy for promotion of energy efficiency in the Republic of Macedonia define conditions for implementation of the energy policy of the Republic of Macedonia.
No Regional Energy Policies exist.
Municipalities are preparing three years Programme for Energy Efficiency (PEE) and yearly Action Plan for Energy Efficiency.

Highlight significant characteristics differentiating region from others and give short (!) introduction of energy targets and challenges in the region

As it is mentioned previously, in this region there is almost no electricity production capacity installed. Installed electricity production capacity in RM and the planning regions is presented in the table.

Table 1

in MW	Republic of Macedonia	Vardar Region	East Region	Southwest Region	Southeast Region	Pelagonia Region	Polog Region	Northeast Region	Skopje Region
2013	1 938	331	20	264	2	712	201	**1**	407
2014	1 995	333	23	264	42	713	211	**1**	407
2015	2 029	346	24	270	42	719	214	**6**	408

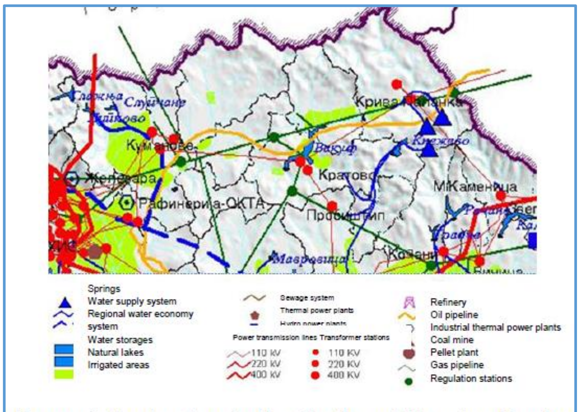
Source: Regions of the Republic of Macedonia, 2016 (http://www.stat.gov.mk/PrikaziPublikacija_1_en.aspx?rbr=628)

The increase in installed capacity is due to the newly installed capacities of small hydropower plants, photovoltaic plants and, for the first time, biogas plants that started producing electricity in 2015.
Electricity consumption in the industry sectors in RM and the regions is presented in the Table below.

in GWh	RM	VPR	EPR	SWPR	SEPR	PEPR	POPR	NEPR	SKPR
"Industry sectors (by NKD Rev.2)" 2012	2.365	920	71	46	154	163	393	41	577
"Industry sectors (by NKD Rev.2)" 2013	2.432	854	75	62	157	170	661	41	412
"Industry sectors (by NKD Rev.2)" 2014	2.336	777	77	42	146	164	664	36	431

According to the data for the period 2012-2014, the total average annual electricity consumption in industry in the Northeast Planning Region amounted to 39 GWh, that is to say, approximately 1.65% of the total consumption in industry in the Republic of Macedonia.
The gas pipeline system in the Republic of Macedonia is a part of the Russian transit natural gas pipeline which passes through Ukraine, Romania and Bulgaria. The connection point of the system of the Republic of Macedonia with the Bulgarian one of the pipeline is in the border area of Deve Bair. The gas pipeline stretches across the Northeast region, more precisely in the areas of Kriva Palanka, Kratovo and Kumanovo. From the perspective of regional development, capacity building for enhanced use of the gas pipeline system may contribute towards stimulating development of the regions. Existing infrastructure: main transmission gas pipeline Deve Bair – Skopje having a length of 98 km, transmission gas pipeline network having a length of 26 km (for Kriva Palanka, Kratovo, Kumanovo and Skopje) and a city network with a length of 31.5 km (for Kriva Palanka, Kratovo, Kumanovo and Skopje). The total capacity of the natural gas transmission system amounts to 800 million m3/year. Taking into account the fact that there are no developed distributional networks for use of natural gas by households and small and medium enterprises, a small number of consumers, exclusively industrial consumers (tariff consumers) are connected to the natural gas transmission system, which results in use of the natural gas transmission system capacity of approximately 9% to 15%.

Figure 2: Energy Infrastructure in the NEPR



Energy infrastructure in the Northeast Planning Region

Source: Programme for Development of the Northeast Planning Region 2015-2019

Evaluation of the possible utilization of the local energy resources, including geothermal energy in the north east region in the Republic of Macedonia lays in the strategic development of the global energy trends. This development has a primary goal creating energy independence, reducing of the conventional fossil fuel utilization, reducing of the anthropogenic burden in the environment, upgrading of the living conditions of the population and sustainable energy development.

Potential has been identified in the region for the use of renewable energy sources.

Solar energy can be exploited across the geographic width of the region throughout most of the year. According to the findings up to now, the region features modest **wind energy potential**. The mountain areas of Kozjak, Bilino and Osogovo Mountains have higher potential (with a mid-flame wind speed of over 4-6 m/s). Flat terrains are marked by a mid-flame wind speed of 2-3 m/s.

The well-known **hydrothermal resources** in the Northeast Planning Region are marked by relatively low temperature and energy potential. Certain research has indicated the existence of geothermal waters that would be suitable for energy generation. With a view to intensifying and promoting the use of geo-thermal energy in the region, it is necessary to undertake the following activities:

Search for new hydrothermal resources according to indications of mineral and thermal water springs;

Develop litho heat exploitation systems from the surface layer up to 200- 250 m depth;

Search for resources with high geothermal potential in the subsurface layer up to depth of over 2km.

Figure 3 Gross production of electricity in the RM in the period 2011-2015

Source: Regions of the Republic of Macedonia, 2016 (http://www.stat.gov.mk/PrikaziPublikacija_1_en.aspx?rbr=628)

3. Basic demographic data and figures

Regional demographic indicators:

Population of region	**176.204**	**cap**
Area of region	**2.310**	**km²**
Population density	**76,3**	**cap/km²**
Number of individual municipalities	**6**	**mun.**

Data from 2015

Basic demographic data

Population growth, age distribution in last 20 year – text description

Population density in the Northeast Planning Region amounts to 76.3 inhabitants per square kilometre. The population in the region in 2015 lived in 59.488 housing units, and the average size of one household was 3.7 members.
In the course of one year (2013), there were 2006 new-born babies which equal a birth rate 11.4 promil. The natural population increase rate in the Northeast Planning Region amounts to only 2.4 promil. In 2013, there were 114 persons who immigrated to the Northeast Planning Region, whereas only eight persons who emigrated, officially at least. Otherwise, even under the population census in 2002, the population literacy rate was satisfactory (94.8%), and year by year, as a result of the natural change of generations, this rate has most probably increased even more. Unfortunately, a large number of the data relating to the demographic statistics is not available due to not having implemented an additional population census. Nevertheless, this data show that the Northeast Planning Region seems to slowly enter a depopulation zone with all the usual effects of that phenomenon, such as decrease in the demand of goods for youth, increase in the demand of services for the elderly, seeming improvement of the relative economic activity indicators caused by narrowing the comparison and measuring base, high unemployment rate, and in practice – a real lack of young labour force.

Socio-economic development of past 3-5 years

Unemployment rate (2016)	**42,2**	**%**
Average annual income per capita (gross) (RM)	**4300**	**EUR**
difference from the EU average (34.500 EUR gross annual earning)	**-87**	**%**
Share of employees in		
agriculture	**10**	**%**
industry	**23,2**	**%**
services	**54,2**	**%**
Share of population with tertiary education	**9**	**%**

Text description for figures above

The Northeast Planning Region economically is the most underdeveloped planning region in the Republic of Macedonia. Its share in the gross domestic product of the Republic of Macedonia is on a level of modest 5.5%, which is much less than the share of the region in the total territory and in the total population number in the country.
The acceleration of the economic activity in the region and the gradual coming out of the crisis at the end of the last decade has conditioned the level of GDP per capita in the region, compared to the national average, to grow faster and from modest 51.4% of the average level in the Republic of Macedonia to rise to 67.7%, which is a relatively sound result, indicating a realistic revival of the economy in this region as well. As a whole, the Northeast Planning Region has developed relatively faster than some other regions. Still, according to the Decision on classification of planning regions according to their level of development, the Northeast Planning Region has a development index of 0,56, economic and social index of 0,33 and a demographic index of 0,701. Thus, the Northeast Planning Region remains to be ranked last of the eight planning regions in Macedonia.

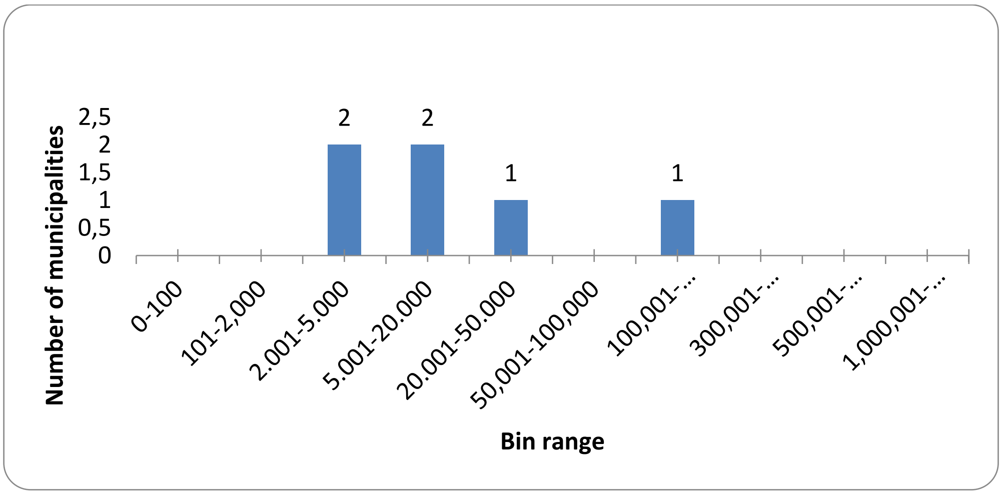
The spatial distribution of the population, level of urbanisation

The spatial distribution of the population is presented below. See the Table and the Grafic.

Municipality	Area km2	Inhabitants/km2	Populated areas	Urban population
Kratovo	375	25	31	66,30%
Kriva Palanka	480	42	34	69,90%
Kumanovo	509	216	48	72,30%
Lipkovo	273	110	22	0,00%
Rankovce	241	15	18	0,00%
Staro Nagorichane	432	9	39	0,00%
Total	**2.310**	**417**	**192**	**56,33%**

Source: State Statistical Office

Figure 4: Distribution of settlement size



4. Regional economy and economic trends

Regional economic indicators:

GDP, total	**426**	million EUR
GDP per capita	**2.419**	EUR/cap
HDI (RM)	**0,748**	

Data from 2014

GDP per economic sectors:

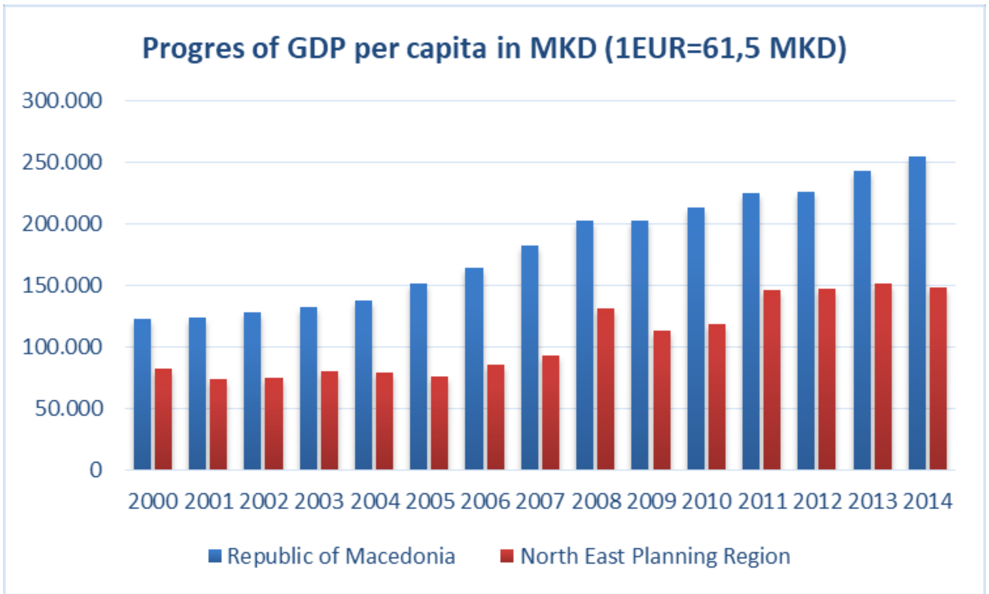
Agriculture	**8,63%**	% of total GDP
Industry	**26,53%**	%
Services	**64,84%**	%

Data from 2014

Regional economy

Please provide information about the regional economy, past development and trends using GDP and other indicators. If available, include graphs about GDP / HDI development of last 10-20 years.

Figure 5: Progress of GDP per capita in MKD (1EUR=61,5 MKD)



Data for HDI at Regional level were not available.

number of operating entrepreneurs (SMEs, large and individual)	**4.139**	
→ share of SMEs	**91**	% of total number of operating businesses
number of operating non-profit organisations	**app. 1.000**	
Amount of EU funds (2007-13)	**No Data**	EUR

What are the main contributors/contributing sectors to the regional GDP? How stable are these sectors (qualitative assessment)?

The Northeast Planning Region had a total of 4.139 in 2015. Nevertheless, speaking about the size of business entities, it turns out that most of them (91%) are practically micro enterprises with a low accumulation power and they have been established for the purpose of economic existence of its founders and employees, and not for some higher business purposes. The whole region had only 86 bigger enterprises and only 5 really large ones.

The share of agriculture in the NEPR is on the level of the country, the share of industry is lower than the average, the share of construction is almost twice as high than its share in the national average, which is a result of the construction boom after the liberalisation of construction in general, but is also due to the fact that in the region one of the traditional construction regions is located (Kriva Palanka).

Describe the regional job market, employment/unemployment rates per sectors – agriculture and forestry, industry, services

The population activity rate in the region has decreased, but the employment rate is on the rise and unemployment is in decline. However, compared to the national average, these indicators, in total, are insufficient for the assessment of the situation on the labour force market in the Northeast region to be positive.

The ratio of unemployed population in towns and population in villages seeking for a job shows that unemployment is in decline both in towns and in villages, by which the decline in towns is somewhat lower.

Unemployed ratio town-village	Total	Town	Village
	2008/2012	2008/2012	2008/2012
RM	-29.11%	-28.21%	-30.90%
NEPR	-29.28%	-27.49%	-32.63%

Source: Programme for Development of the Northeast Planning Region 2015-2019

Importance of trade; Import/ export balance, if available

In the table below is provided the External trade - Total by activity, in thousand EUR, by years

		Total by activity	
		RM	NEPR
2009	export	1.935.838	44.029
	import	3.618.927	96.796
2010	export	2.531.772	48.202
	import	4.034.998	104.636
2011	export	3.211.230	55.843
	import	4.984.142	149.024
2012	export	3.120.026	49.016
	import	5.012.476	144.489
2013	export	3.224.180	53.924
	import	4.920.233	118.679
2014	export	3.743.847	46.418
	import	5.447.461	113.508

Source: State Statistical Office of the Republic of Macedonia

5. National and local energy strategies

List of relevant and most influencing strategies / roadmaps / measures to local energy situation or development

Country/ Region	Brief description of current situation	legal requirement or voluntary initiative	National/ Regional/ Local Level	Original title + link	English title + brief description	Organisation in charge	Type (EE,EPB,RES, etc. or combination...)
MKD	Macedonia was not only the most advanced in the transposition of the European Union law, but also in the effective tackling with the energy sector reforms. However, in recent years, the rate at which reforms are implemented is reduced. Framework EU directives on energy efficiency: Directive 2006/32/EC - partially Directive 2006/32/EC is either transposed by the adoption of the Energy Law of 2011 and its amendments in 2013, or by the bylaws (for energy inspection, monitoring and management). In accordance with the Energy Law, the public sector has an obligation to implement energy efficiency measures in their facilities. The second APEE and draft National Program for Energy Efficiency in Public Buildings respectively put the public sector in the spotlight. Consequently, Macedonia has fulfilled this requirement in accordance with Directive 2006/32 / EC. Directive 2010/30/EU	Legal	National	СТРАТЕГИЈА ЗА РАЗВОЈ НА ЕНЕРГЕТИКАТА ВО РЕПУБЛИКА МАКЕДОНИЈА ДО 2030 ГОДИНА Link: http://www.ea.gov.mk/images/stories/E_Izdanija/Energetika_Strategija_za_energetika_na_RM_do_2030__SV_61_2010__244131078.pdf	Strategy for energy development in Republic of Macedonia by 2030 The Strategy for Energy Development of RM defines the most appropriate long-term development of the energy sector in the state in order to provide secure and quality supply of consumers with energy.	Ministry of Economy of RM	General on energy
MKD		Legal	National	СТРАТЕГИЈА ЗА ИСКОРИСТУВАЊЕТО НА ОБНОВЛИВИТЕ ИЗВОРИ НА ЕНЕРГИЈА ВО РЕПУБЛИКА МАКЕДОНИЈА ДО 2020 ГОДИНА **Link:** ***http://www.gec.mk/EE%20vo%20Makedonija/Strategija%20za%20OIE.28juni2010.pdf***	Strategy for RES use in Republic of Macedonia by 2020 The main objective of the strategy is to gather information on the potential and possible exploitation of RESs in Republic of Macedonia.	Ministry of Economy of RM	RES
MKD		Legal	National	СТРАТЕГИЈА ЗА УНАПРЕДУВАЊЕ НА ЕНЕРГЕТСКАТА ЕФИКАСНОСТ ВО РЕПУБЛИКА МАКЕДОНИЈА ДО 2020 ГОДИНА Link: ***http://www.ea.gov.mk/images/stories/E_Izdanija/Regulativa/Strategija_za_unapreduvanje_na_EE_vo%20RM_do_2020_godina_SV%20143-2010%20(1).pdf***	Strategy for promotion of energy efficiency in Republic of Macedonia up to 2020 The main objective of the strategy is to develop framework for accelerated adoption of EE practices in sustainable way	Ministry of Economy of RM	EE
MKD		Legal	National	ПРВ АКЦИОНЕН ПЛАН ЗА ЕНЕРГЕТСКА ЕФИКАСНОСТ НА РЕПУБЛИКА МАКЕДОНИЈА ДО 2018 Link: ***http://www.ea.gov.mk/images/stories/E_Izdanija/11.Prv_Akcionen_Plan_za_EE_na_RM_do_2018_MK.pdf***	First action plan for energy efficiency of Republic of Macedonia up to 2018 This document sets the national indicative targets for energy savings, the ways and financial means necessary for their achievement..	Ministry of Economy of RM	EE

MKD	on energy labeling – fulfilled. Directive 2010/30/EU and legal related acts are fully transposed by the adoption of the Regulation on the labeling of products related to energy consumption and its amendments in November 2012. Directive 2010/31/EU on the energy performance of buildings – fulfilled. The main provisions of Directive 2010/31 / EU are included in the Energy Law of 2011 (and amendments in May 2013) and the Regulation on the energy performance of buildings. The transposition of this directive is complete. The second draft Action Plan for Energy Efficiency (NEEAP) was submitted to the Secretariat in November 2013.	Legal	National	ВТОР АКЦИОНЕН ПЛАН ЗА ЕНЕРГЕТСКА ЕФИКАСНОСТ НА РЕПУБЛИКА МАКЕДОНИЈА ДО 2018 Link: ***file:///C:/Users/user/Downloads/Nacrt_vtor_APEE_476774617.pdf***	Second action plan for energy efficiency of Republic of Macedonia up to 2018	Ministry of Economy of RM	EE

6. Energy Production

6.1. *Conventional energy production capacities (fossil fuels and nuclear power)*

Give an overview of energy production by fossil fuels and nuclear power plants – concentrate on the most significant 3 to 5 power plants.

Name & Location (city, town)	Owner	Year of commis-sioning (refur-bishment)	Type of plant & fuel	Capacity in MW	Annual energy production in MWh	Annual CO_2-emissions in t	Utilization rate (qualitative assessment)
	[choose: Public / private SME / private large enterprise]			[state: electr. and/or heat]			[choose: Constantly used / sometimes / seldom / to be decommissioned]
	PPP						

Add additional details to describe the conventional energy production capacities in the region. What are current trends? What influence have age, regional economy, fuel imports, and fuel prices on the on the current status?

No *energy production by fossil fuels and nuclear power plants in NEPR*

6.2. *Renewable energy production*

Energy production capacities

Give an overview of energy production by renewable energy capacities (e.g. small/large hydro, solar PV, solar thermal, biomass, geothermal & other production capacities – concentrate on the most significant 3 to 5 power plants or aggregation of production facilities.

Name & Location (city, town)	Owner	Year of commis-sioning (refur-bishment)	Type of plant & fuel	Capacity in MW	Annual energy production in MWh	Annual CO_2-emissions in t	Utilization rate (qualitative assessment)
Kriva Palanka	Small Hydro Power Plants EMK Ltd. Skopje	2012	Small Hydro Power Plant	0,586	no data available	0	Constantly used
Kriva Palanka	Small Hydro Power Plants EMK Ltd. Skopje	2012	Small Hydro Power Plant	0,384	no data available	0	Constantly used
Lipkovo	Small Hydro Power	2013	Small Hydro Power Plant	0,666	no data available	0	Constantly used

	Plants EMK Ltd. Skopje						
Kriva Palanka	Small Hydro Power Plants EMK Ltd. Skopje	2015	Small Hydro Power Plant	0,54	no data available	0	Constantly used
Kriva Palanka	Small Hydro Power Plants EMK Ltd. Skopje	2015	Small Hydro Power Plant	0,99	no data available	0	Constantly used
Lipkovo	Small Hydro Power Ltd. Skopje	2015	Small Hydro Power Plant	2,4	no data available	0	Constantly used
Kriva Palanka	Hydro Osogovo	2015	Small Hydro Power Plant	0,246	no data available	0	Constantly used
Kriva Palanka	Hydro Osogovo	2015	Small Hydro Power Plant	0,32	no data available	0	Constantly used
Kriva Palanka	Hydro Osogovo	2015	Small Hydro Power Plant	0,136	no data available	0	Constantly used
Kriva Palanka	Hydro Osogovo	2017	Small Hydro Power Plant	0,084	no data available	0	Constantly used

Source: Energy Agency of the Republic of Macedonia

Add additional details to describe the renewable energy production capacities in the region. What are current trends? What influence have age, regional economy, fuel availability or renewable energy potential, and subsidy systems on the current status?

Potential has been identified in the region for the use of renewable energy sources. Following the construction of the hydro power system Zletovica, conditions have been created for production of electricity by way of the planned small hydro power plants of the system Zletovica. Furthermore, locations have been identified for the construction of small hydro power plants.

Solar energy can be exploited across the geographic width of the region throughout most of the year.

According to the findings up to now, the region features modest wind energy potential. The mountain areas of Kozjak, Bilino and Osogovo Mountains have higher potential (with a mid-flame wind speed of over 4-6 m/s). Flat terrains are marked by a mid-flame wind speed of 2-3 m/s.

The well-known hydrothermal resources in the Northeast Planning Region are marked by relatively low temperature and energy potential. Certain research has indicated the existence of geothermal waters that would be suitable for energy generation.

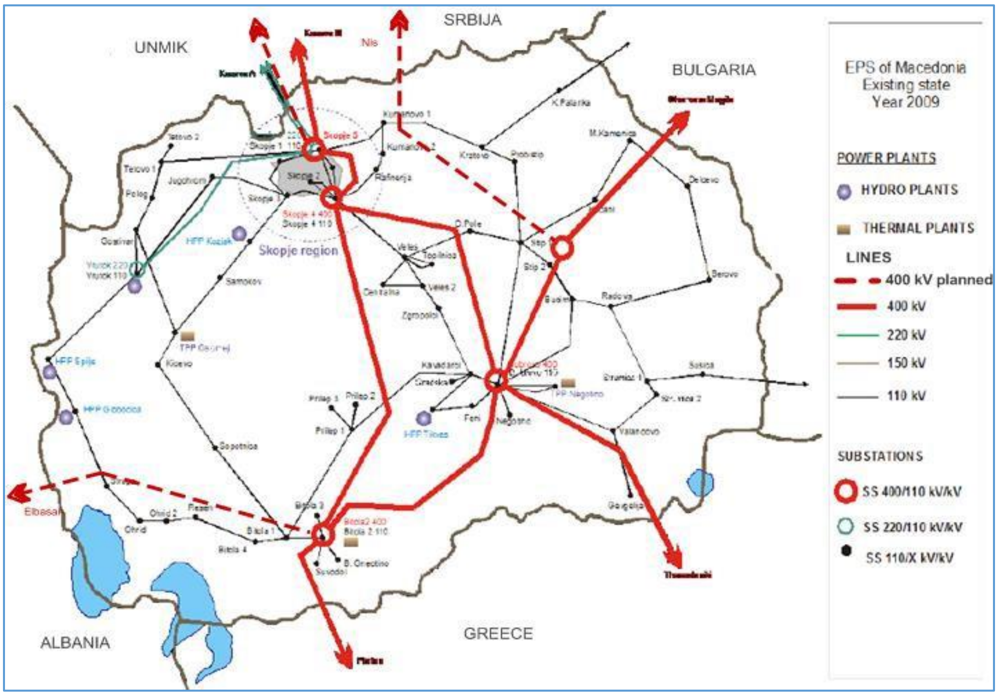
6.3. *Transmission and distributions*

What kind of facilities constitute the electric transmission and distribution system? Who are the owners? Who are the operators? Please add relevant map if available.

Distribution system on the territory of the Republic of Macedonia is being operated by EVN Macedonia (the Company entered the Macedonian market in 2006 as a part of the EVN Group). Distribution network is operated in: 110kV; 35kV; 20, 10, 6 kV; 0,4kV voltage levels. It is supplyed by

MEPSO (Electricity Transmission System Operator of Macedonia) a Joint Stock company fully state-owned, established in 2005. MEPSO has the high voltage transmission line grid in its ownership such as voltage conversion substations from 400 kV to 110 kV.
Distribution network is powered from ELEM (Macedonian Power Plants) a Joint Stock company fully state-owned, which provide around 96 % from the entire domestic production, other local sources and from other importers of electricity.

Figure 6: Existing and planned structures of the transmission system of the Republic of Macedonia



Source: Macedonian Energy Strategy until 2030

Give an overview of other centralised or decentralised energy distribution systems (e.g. natural gas pipelines, heat grids, etc.).

The gas pipeline system in the Republic of Macedonia is a part of the Russian transit natural gas pipeline which passes through Ukraine, Romania and Bulgaria. The connection point of the system of the Republic of Macedonia with the Bulgarian one of the pipeline is in the border area of Deve Bair. The gas pipeline stretches across the Northeast region, more precisely in the areas of Kriva Palanka, Kratovo and Kumanovo. From the perspective of regional development, capacity building for enhanced use of the gas pipeline system may contribute towards stimulating development of the regions. Existing infrastructure: main transmission gas pipeline Deve Bair – Skopje having a length of 98 km, transmission gas pipeline network having a length of 26 km (for Kriva Palanka, Kratovo, Kumanovo and Skopje) and a city network with a length of 31.5 km (for Kriva Palanka, Kratovo, Kumanovo and Skopje). The total capacity of the natural gas transmission system amounts to 800 million m^3/year. Taking into account the fact that there are no developed distributional networks for use of natural gas by households and small and medium enterprises, a small number of consumers, exclusively industrial consumers (tariff consumers) are connected.

No heat infrastructure exist in the Region. The whole region is using mainly wood, biomass and electricity.

Give an overview on interconnections of regional energy production with the rest of the country. Are there large production facilities in the region on which the rest of the country's energy supply might depend?

No significant sources of energy neither for local neither for interregional production.

6.4. *Jobs in the energy sector*

Give an overview about the status of the energy sector in the regional economy. How many jobs are there at the moment in the energy sector. How important are new "green job" for regional economy development. If possible, quantify investments in the energy sector.

Data on actual job opportunities in energy sector in the NEPR are not available.

Are coal and lignite mining undertaken in the region? What role does fossil fuel mining play for the regional economy and for regional energy security?

There are no coal or lignite mines in the NEPR

7. Final energy consumption

We have to notice that the last Census of Population, Households and Dwellings was organized in 2002, which lead to the lack of data related to municipalities and Regions, urban and Rural areas etc. Also data on municipal/regional level are very limited. This mean that this Energy Profile of the NEPR must be assumed as a Draft, and will be updated throughout the other Project activities.

7.1. *Households*

Regional final energy consumption of household sector	**475**	GWh

Heat consumption

Total heat energy consumption of households sector (heating and hot water consumption)	**207**	GWh
Average heat energy consumption per household	**1.014**	kWh/hh

Describe the average building standard. What is their average age of existing building stock? Are energy efficient renovations in progress?

From the total number of households in the NEPR, about 72% are constructed before 1991. About 12% from all households in NEPR are with built in insulation. The energy efficient renovation is in progress in all sectors.

Electricity

Electricity consumption of households	**268**	GWh
Average electricity consumption per household	**5.763**	kWh/hh

Describe if there are any national or regional programmes for reducing household electricity consumption (e.g. washing machine or refrigerator replacement programme). If yes, please elaborate it briefly.

No such activities at regional level in NEPR

Cooking

Gas consumption for cooking appliances of households	**NA**	GWh

Describe if gas is a significant energy source for cooking in the household sector.

The Gas consumption for Data for gas consumption for cooking appliances of households in NEPR are not available.

General information

Household electricity price	**0,0835**	EUR/kWh (incl. taxes)
Household natural gas price	**NA**	EUR/kWh (incl. taxes)
Household district heating price	**NA**	EUR/kWh (incl. taxes)
Household price: other energy sources – wood:	**0,0260**	EUR/kWh (incl. taxes)
Energy expenditure by household	**16,1**	% of income

Is there any element of Demand Side Management of electricity on household level in place? If yes, please describe it (e.g. peak price, smart metering)

No at the moment. Decision for low and high tariff during the day is recently adopted by the parliament.

Is energy poverty an issue in the region? If yes, please describe how many people are affected, in what extent?

About 5000 households users of monthly social assistance

Give an estimate of the trend in final energy consumption in the household sector using values from -5- to +5 where (-5 is a strong reduction, 0 means neither growth nor reduction, +5 strong growth).

Final energy consamption in the housholds is relativly stable. In the period 2005-2015 variation is about +/- 3,5%/year (2005=100)

7.2. *Service Sector*

Regional final energy consumption of service sector	**38**	GWh

What are the main sub-sectors driving energy consumption in the in the service sector (building standard, number of businesses, …)? How important is service sector for the regional economy?

Service sector and Industry sector share the contribution to the GDP in the NEPR. In lack of the regional data, estimation is that the final energy consumption will be close to the energy consumption from the industry.

Give an estimate of the trend in final energy consumption in the service sector using values from -5- to +5 where (-5 is a strong reduction, 0 means neither growth nor reduction, +5 strong growth).

2

7.3. *Industry*

Total energy consumption of the industrial sector	**37**	GWh
Industry electricity price	**0,16-0,07**	EUR/kWh (incl. taxes)
Industry natural gas price	**0,032-0,031**	EUR/kWh (incl. taxes)
Industry district heating price	**NA**	EUR/kWh (incl. taxes)
Industry price: other energy sources – specify:	**NA**	EUR/kWh (incl. taxes)

What are the main sub-sectors driving energy consumption in the industrial sector? How important is industry for the regional economy?

The most important sectors of economic activity in the NEPR are industry (food, chemical and metal industry, tobacco and cigarettes) and construction.

7.4. *Transport*

Regional final energy consumption of transport sector	**430**	GWh

Describe the main characteristics of the transport sector: transport infrastructure, motorisation rate, availability of public transport and differences between urban and rural environments.

The road network density in the Northeast Planning Region amounts to 0.59 and is higher by 7.3% than the road network density on the level of the Republic of Macedonia (0.55). The European corridors VII and X pass through the region. There are three border crossings in the Northeast Planning Region. Two border crossings with the Republic of Serbia (Tabanovce and Pelince) and one with Bulgaria (Kriva Palanka).

Passenger transport

Motorisation rate - number of passenger cars/1 000 inhabitants	**27,675**	
Regional energy consumption of passenger transport in the region	**229**	GWh

Freight transport

Regional energy consumption of road freight transport	**198**	GWh

If the rail, or transport by pipeline is a significant way of the freight transport, please describe their main characteristics.

The main problem of not having an efficient rail transport is the incomplete railway network in the Northeast Planning Region. It is necessary to finalise the construction of the railway line in the direction of the Republic of Bulgaria. The number of passengers carried by means of the

railway has significantly decreased over the period 2010 – 2012. The decrease in the number of passengers carried amounts to 48.83% (a decrease of 32.84% on the level of the Republic of Macedonia), whereas in terms of transportation of goods we have an increase of 26. 15% (2012 – 14.65% decrease on the level of the Republic of Macedonia).

Use of alternative fuels

Describe the market development for alternative fuel vehicles (natural gas, biogas, electric cars). What supporting mechanisms for alternative fuel are available on national and regional level? Describe challenges and barriers, e.g. infrastructure, technological, supply, financial barriers, etc..

No data and no policies are in place at the moment.

Give an estimate of the trend in final energy consumption in the transport sector using values from -5- to +5 where (-5 is a strong reduction, 0 means neither growth nor reduction, +5 strong growth).

2 (on country level the energy consumption in the transport sector in the period 2005-2015 is almost twice increased)

7.5. *Summary*

7.5.1. Final energy indicators

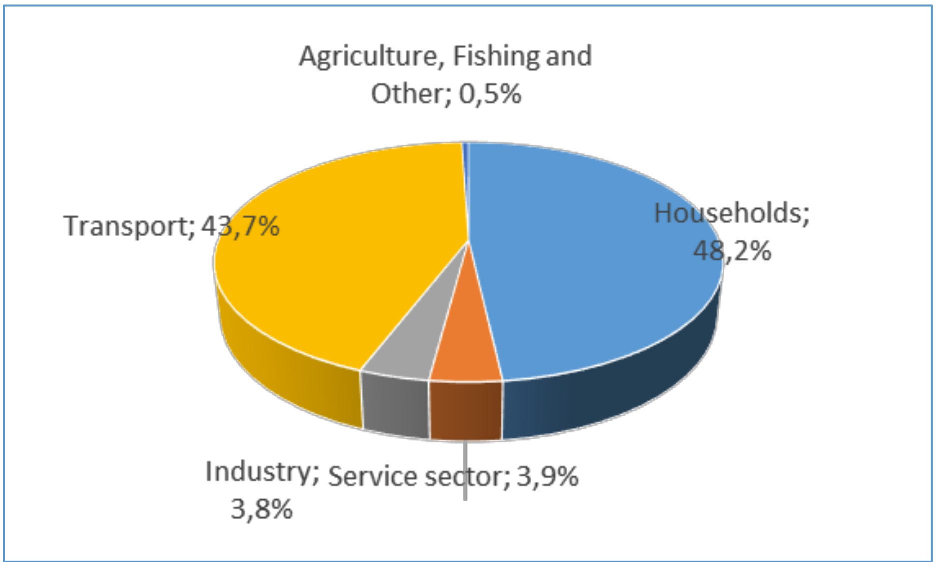
General indicators for the region

Total final energy consumption	**985,13**	GWh
Final energy consumption per capita	**5.591,79**	kWh/cap
Electricity consumption per capita	**1.364,46**	kWh/cap
Heat consumption per capita	**1.014,03**	kWh/cap
% of total country consumption	**0,05**	%

Final energy consumption per sector

Year: 2015			%
Households	**475,00**	GWh	**48,2%**
Service sector	**38,00**	GWh	**3,9%**
Industry	**37,00**	GWh	**3,8%**
Transport	**430,13**	GWh	**43,7%**
Agriculture, Fishing and Other	**5,00**	GWh	**0,5%**
Sum	**985,13**	**GWh**	**100,0%**

Figure 7: Final energy consumption per sector



Give an estimate of the trend in final energy consumption using values from -5- to +5 (where -5 is a strong reduction, 0 means neither growth nor reduction, +5 strong growth).

2

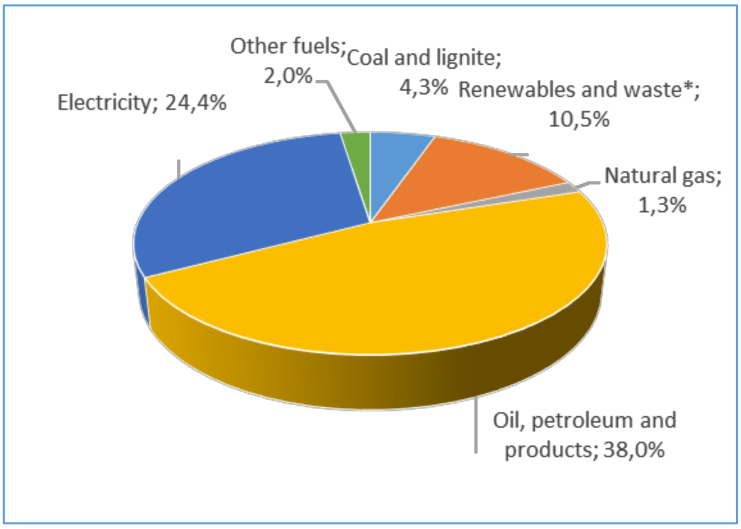
7.5.2. Final energy consumption by fuel

Total final energy consumption by fuel

Year: 2015			%
Coal and lignite	**42,12**	GWh	**4,3%**
Renewables and waste*	**103,89**	GWh	**10,5%**
Natural gas	**13,21**	GWh	**1,3%**
Oil, petroleum and products	**374,62**	GWh	**38,0%**
Electricity	**240,38**	GWh	**24,4%**
Other fuels	**19,43**	GWh	**2,0%**
Sum	**985,13**	**GWh**	**100,0%**

*Hydro, wind, solar, tide/wave, biomass and waste, geothermal

Figure 8: Total final energy consumption by fuel



7.5.3. Primary energy equivalent

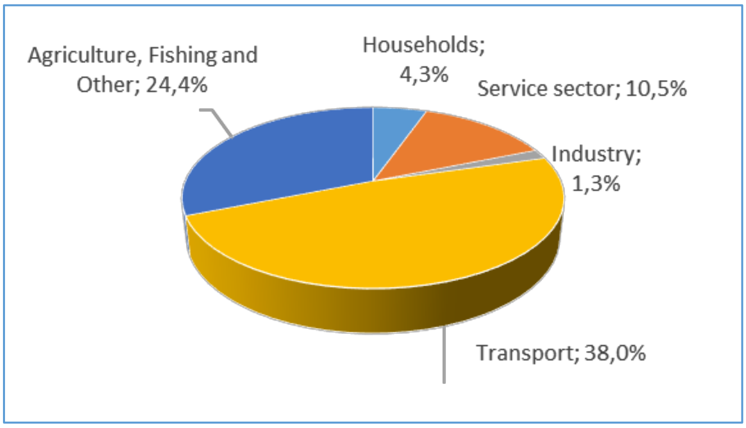
***Primary energy** is an energy form found in nature that has not been subjected to any conversion or transformation process. It is energy contained in raw fuels.*

Total Primary Energy Consumption	**1.533,40**	GWh
Primary energy consumption per capita	**8.703,87**	kWh/cap
Primary energy factor of electricity	**2,20**	-
Energy intensity	**0,64**	TPES/GDP

Primary energy equivalent by sector

Year: 2015			%
Households	**897,55**	GWh	**58,5%**
Service sector	**87,00**	GWh	**5,7%**
Industry	**75,70**	GWh	**4,9%**
Transport	**473,14**	GWh	**30,9%**
Agriculture, Fishing and Other		GWh	
Sum	**1.533,40**	**GWh**	**100,0%**

Figure 9: Primary energy equivalent by sector



What is the level of primary energy supply dependencies: Which fuels need to be imported form the rest of the country and internationally.

Dependency on fuel imports: very high / high / average / low / very low **very high**

7.5.4. Regional CO_2-emissions associated with energy consumption

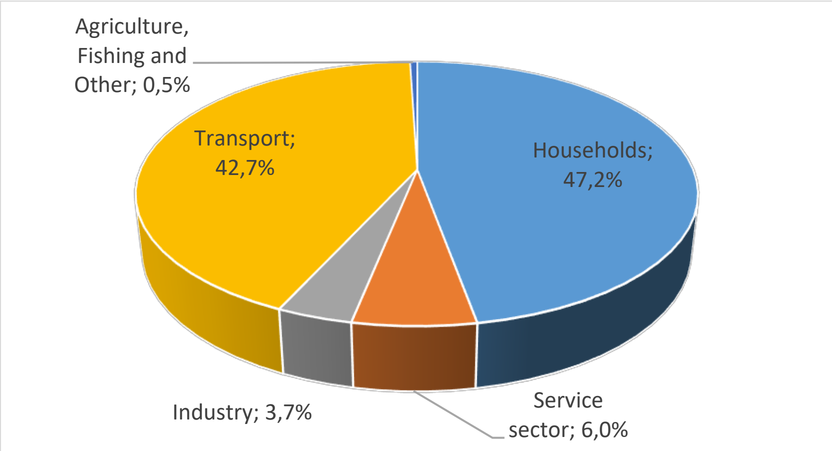
Total CO_2-emission associated with energy sector	**0,0003**	Mio t
CO_2-emissions per capita	**4,71**	t/cap
CO_2-emissions per GDP	**0,0005567**	t/€ GDP

Give an overview of the regional primary energy supply by fuel.
Use the Excel conversion tool using CO_2-emission coefficients suitable for your region.

Energy-related CO_2-emissions by sector

Year: 2015			%
Households	**414.675**	t CO_2	**47,2%**
Service sector	**52.380**	t CO_2	**6,0%**
Industry	**32.301**	t CO_2	**3,7%**
Transport	**375.502**	t CO_2	**42,7%**
Agriculture, Fishing and Other	**4.365**	t CO_2	**0,5%**
Sum	**879.223**	t CO_2	**100,0%**

Figure 10: Energy-related CO_2-emissions by sector



8. Renewable energy sources – status and potential

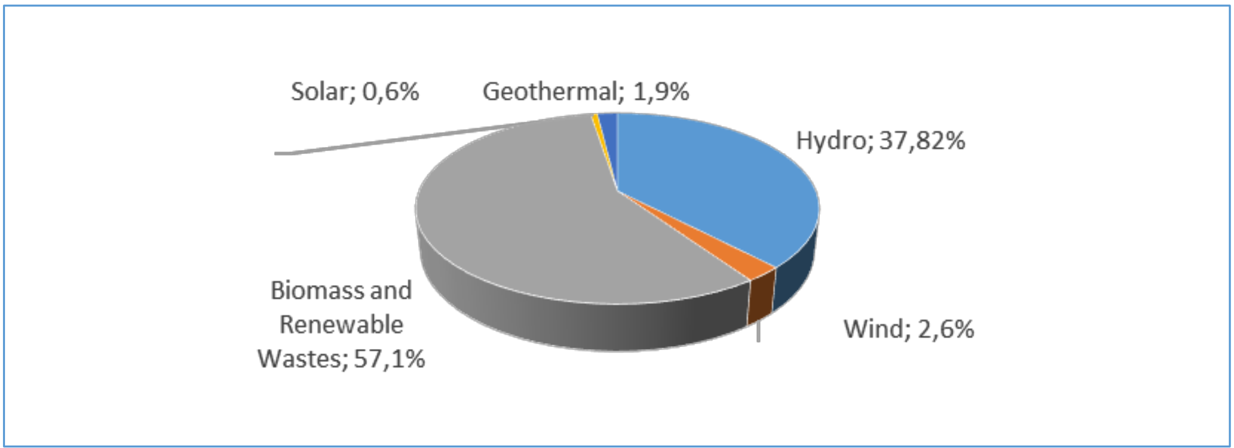
8.1. *General information*

Renewable Energy Targets:		
2020 RES share in gross final energy consumption	**21**	%
2030 RES share in gross final energy consumption	**28**	%
Current RES share (2015)	**21**	%
thereof RES out of the region	**21**	%

Share of final energy consumption produced by renewable fuels

Year: 2015			%
Hydro	39,29	GWh	37,8%
Wind	2,66	GWh	2,6%
Biomass, biofuels and renewable wastes	59,27	GWh	57,1%
Solar	0,67	GWh	0,6%
Geothermal	2,00	GWh	1,9%
Tide, Wave, Ocean		GWh	
Sum	**103,89**	**GWh**	**100,0%**

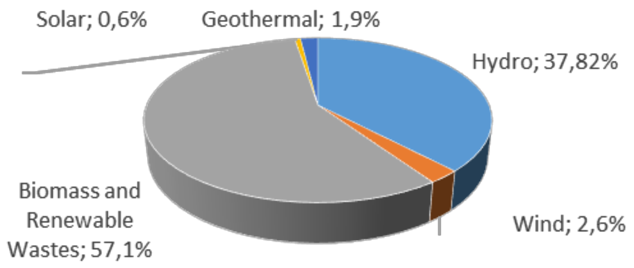
Figure 11: Share of final energy consumption produced by renewable fuels



Share of total electric demand covered by renewable fuels

Year: 2015			%
Hydro	**45,97**	GWh	**91,9%**
Wind	**2,98**	GWh	**6,0%**
Biomass, biofuels and renewable wastes	**0,50**	GWh	**1,0%**
Solar	**0,56**	GWh	**1,1%**
Geothermal	**0,00**	GWh	
Tide, Wave, Ocean	**0,00**	GWh	
Sum	**50**	**GWh**	**100,0%**

Figure 12: Share of total electric demand covered by renewable fuels



Describe if and how renewable energy sources are integrated in the transport sector, e.g. biofuels, electric vehicles.

Renewable energy sources are integrated in the transport sector

Describe the status of REN production in the region. % of total energy and electricity demand covered by REN. If available give a historic overview of the REN production capacities for the last 5 to 10 years.

The positive development policy for renewable energy that is continually taking over RM, implied positive growth of generated electricity as a final product from these sources. It is precisely this and the favourable hydrometeorological conditions that contributed to electricity from renewable sources having a 24.9% share in the total gross consumption of electricity in 2015, which is a significant increase compared to the previous years.

Describe if there are incentive programmes/schemes (financial and non-financial) in place to support REN-development. Are these programmes on national, regional or local level?

NA

Describe the top 5 regulatory barriers slowing down current and future REN-development. Should these barriers be addressed at national, regional or local level?

No adequate tariffs for REN – announced measures by new Government; Limited access to REN market of households - national Law level of awareness for REN – local/regional

Give an estimate of the trend in renewable energy production using values from -5- to +5 (where -5 is a strong reduction, 0 means neither growth nor reduction, +5 strong growth). Describe supporting factor as well as barriers.

2

8.2. *Available natural resources in the region*

8.2.1. Biomass

How are forest areas used? For what purpose? What is the regional energy potential using existing forest areas? Please state whether it is a theoretical or technical potential and describe regulatory support systems as well as barriers.

According to the energy balance, biomass accounts for 6% of total primary energy in Macedonia, i.e. 9.5% of total energy consumption. Most used resource of biomass in the Republic of Macedonia the wood. Biomass in the form of wood or coal is used almost exclusively in the domestic sector. Macedonia has great potential for use of biogas from animal manure for energy purposes and production of biofuel from vegetable crops. NEPR is reach with forest land 19% from total forest land in the country. The forest land in NEPR is in the individual holdings almost 100%.

What are main agricultural products at the moment? What is the regional energy potential from agricultural products? Please state whether it is a theoretical or technical potential and describe regulatory support systems as well as barriers.

There is a total of 172 225 hectares agricultural land, 45.7% of which or 78 828 hectares are arable areas, whereas 54.3% or 93 391 hectares are pastures. Of the arable areas in this region, plough lands and gardens predominate covering 64 551 ha, orchards 857 ha, vineyards 1 570 ha and meadows 11 850 ha. Natural conditions and resources of the NEPR offer a potential for development and enhancement of livestock husbandry and development of the dairy and meat industry.

Provide a land use map or map indicating biomass energy potential of the region, if available.

NA

8.2.2. Hydro power

Give an overview of hydro power sources used at the moment and describe the energy potential for the different technologies: run-of-river hydropower plants, reservoir hydropower plants, use of tide and wave power, if applicable. Differentiate between small and large hydro power. Describe the energy potential based on geographical and political frameworks.

Number of the installed small Hydropower plants

8.2.3. Solar power

Solar irradiation (on optimally inclined plane) per year	**from 1250.to.1530**	kWh/m^2

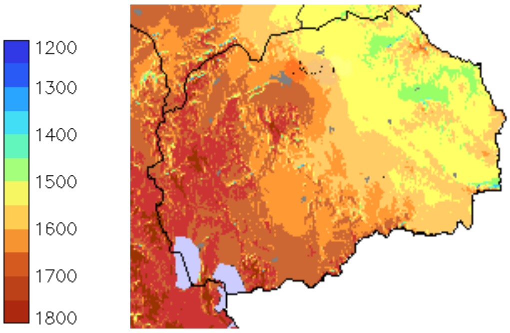
Give an overview of both solar thermal and PV usage hydro power sources at the moment and describe the energy potential based on geographical and political frameworks.

No solar thermal and PV usage. According to the data of the Macedonian academy of sciences and art, there are 2200 hours of sunshine in Macedonia on annual average. Intensity of solar radiation depends on local environmental and weather conditions and the terrain surface, with average annual solar radiation values around 1500 Wh/m2. The highest insolation values are reached in the southwest part of the country although the number of sunny days in the area is comparably less than in the southeast regions (around 100 days on average). Solar energy can be exploited across the geographic width of the region throughout most of the year.

Provide a map indicating solar irradiation in the region, if available.

You can use e.g. the interactive map or posters provided by EU JRC PV database: Photovoltaic Geographical Information System (PVGIS), http://re.jrc.ec.europa.eu/pvgis/

Figure 13 Solar irradiation of the Republic of Macedonia[1]



[1] http://re.jrc.ec.europa.eu/pvgis/countries/countries-europe.htm#wb

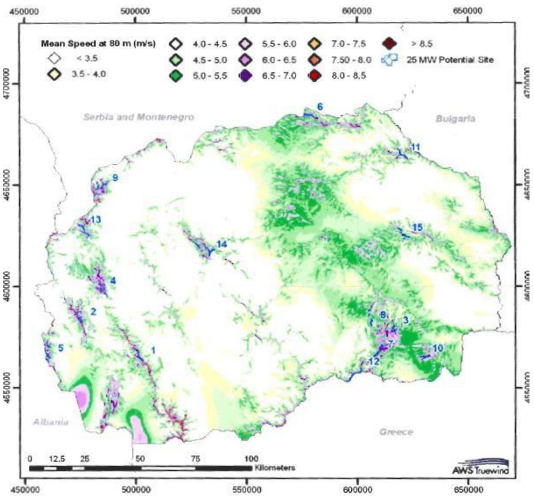
8.2.4. Wind power

Average wind velocity	**from 2 to 6**	m/s
Full load hours	**2.320 (Bend 3) -1.675 (Bend 11)**	h/a

Give an overview of wind power use at the moment and describe the energy potential based on geographical and political frameworks. Differentiate between offshore and onshore potential

Use regional/national studies but if not available, you can refer to the EEA study for approximation of wind speed or full load hours: http://www.eea.europa.eu/publications/europes-onshore-and-offshore-wind-energy-potential/at_download/file

Figure 14: Map of most faworable sites for WPP construction. No 6 and No.11 are in NEPR



Source: Strategy on Use of Renewable Energy Sources in the Republic of Macedonia by 2020

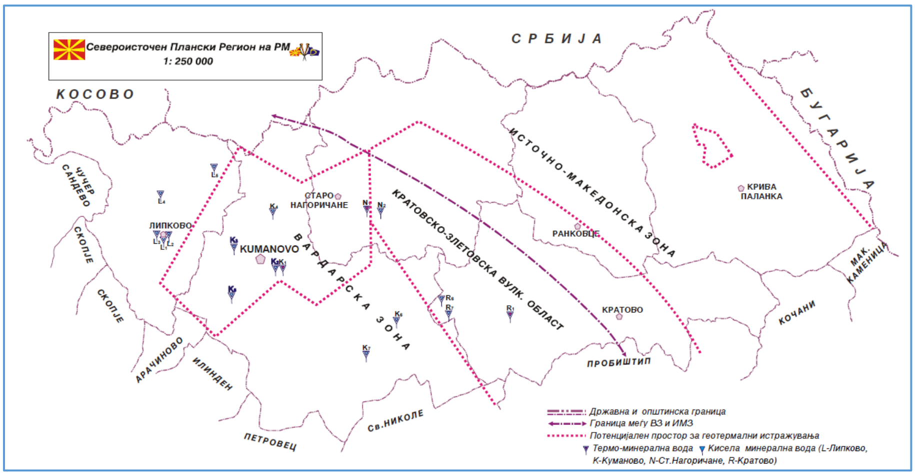
8.2.5. Geothermal energy

Give an overview of use of geothermal energy at the moment and describe the energy potential based on geographical and political frameworks.

The Republic of Macedonia is rich in low to medium yield geothermal resources. Temperatures of the geothermal resources are not sufficient for exploitation for electricity production purposes yet perfectly facilitate their use in other applications. The well-known hydrothermal resources in the Northeast Planning Region are marked by relatively low temperature and energy potential.

Provide a geothermal map for the region, if available

Figure 15: Map of potential area for geothermal research in the NEPR



Source: Study for optimal use of geothermal water for development of tourism and agriculture in NEPR

8.2.6. Waste

Describes overlaps between waste management and energy sector. Is municipal solid waste used for energy production? How is the energy from waste incineration plants used, e.g. electricity generation, district heating (cogeneration)?

Solid waste management in the Northeast Planning Region is brought down to its collection, transport and depositing. Municipal public enterprises are responsible for solid waste management. A Regional Waste Management Plan has been developed and a regional solid waste management enterprise has been established (not yet operational). There are 4 landfills in this region there are many so called illegal dump sites, especially in the rural part which is not encompassed by the service of collecting and depositing solid waste. At the moment, no use of the energy from waste.

8.2.7. Other natural resources

Provide information about any other natural/renewable resources usable for energy production.

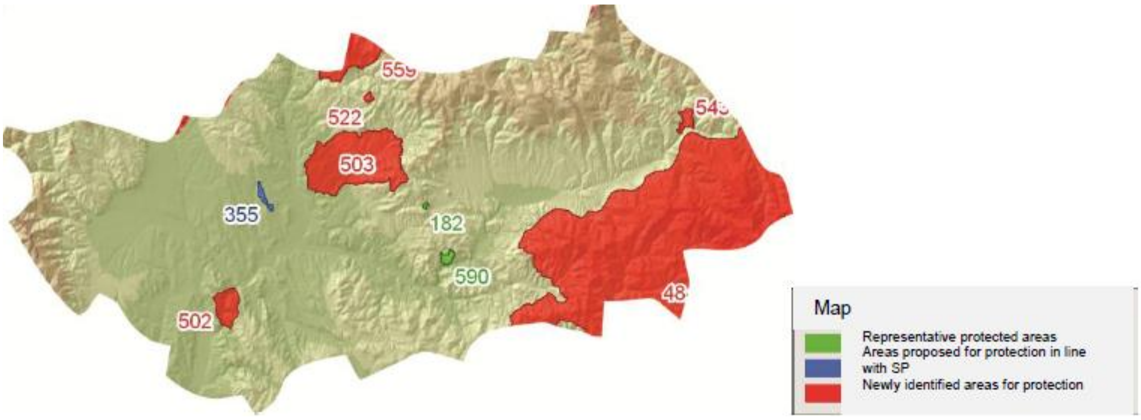
NA

8.2.8. Restriction through protected areas

Are there environmentally protected areas, which are not available for REN facilities or restrict the overall potential?

Nature in the Northeast Planning Region is characterised by protected natural areas and ecological corridors of the national ecological network to connect protected areas and ecologically important areas (including the future NATURA 2000 sites as well). There have been several sites defined as representative areas

Figure 16 NEPR – representative areas



Source: Programme for Development of the Third Northeast Planning Region 2015-2019

9. Energy efficiency – status and potential

What is the status of the implementation of the Energy Efficiency Directive?

Strategy of the Republic of Macedonia for increasing energy efficiency is described in the Action Plans for Energy Efficiency (APEE) until 2018. Three APEE are developed. The Third APEE is for the period 2016-2018. National indicative goal for 2018 is 147,24 ktoe Not all political measures fulfilling national commitment are fulfilled.

What is the status of the implementation of the Energy Performance of Buildings Directive (e.g. data on low/zero energy buildings)?

Report on the implementation of the Energy Performance of Buildings Directive from 2015 identified main barriers and support needed for implementation of EPBD: *- The main barrier is providing sufficient funds to implement EE measures in existing buildings* *- Implementation of provisions for inspections of boilers and air-conditioners is not started yet in the practice* *- Even though costs for energy audits (including inspection of boilers and air-conditioners) are limited in Republic of Macedonia, additional costs for inspection of boilers and air-conditioners could present an additional burden for owners of these systems.* *- Because implementation of provisions of the regulations related to issuing of certificates for energy performance of buildings and inspections of boilers and air-conditioners is just starting, in the Republic of Macedonia there are no gained experience of the functionality of these legal provisions.* *- Not enough capacities of the local and central government institution to implement EE measures/projects*

Analyse the sectors:
Households: Are energy efficiency measures implemented in this sector? Are there awareness campaigns to highlight the potential? Is there support for the implementation (financial and non-financial)?

Since 2007 government support installation of solar thermal collectors by the households (30% of investment, but no more than 300EUR) From this year (2017) households will be supported installation of the PVC and aluminium windows (50% of investment, but no more than 500EUR)

Service sector: Are energy efficiency measures implemented in this sector? Are there awareness campaigns to highlight the potential? Is there support for the implementation (financial and non-financial)?

Energy efficiency measures for public buildings invested by municipalities and grants. No other significant measures.

Industry: Are energy efficiency measures implemented in this sector? Are there awareness campaigns to highlight the potential? Is there support for the implementation (financial and non-financial)?

Main energy companies ELEM, MEPSO and EVN introduced certain measures. No other specific measures for this sector noted.

Transportation: Are energy efficiency measures implemented in this sector? Are there awareness campaigns to highlight the potential? Is there support for the implementation (financial and non-financial)?

No significant measures in this sector.

Give an estimate of the trend in energy efficiency development using values from -5- to +5 where (-5 is a strong reduction, 0 means neither growth nor reduction, +5 strong growth).

2

Demand side management, smart metering, storage

Some activities noted by Big Energy companies

10. SWOT analysis

Please make a SWOT-analysis for the development of your region towards a low-carbon economy in 2050. Include stakeholders in the process.

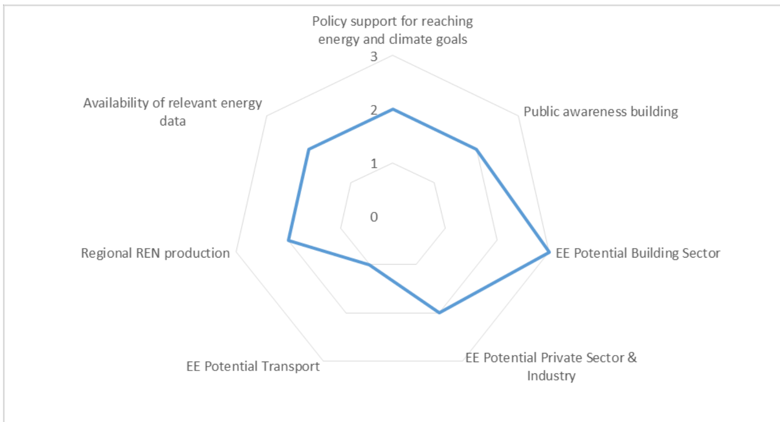
Strengths	Weaknesses
• No electricity production capacity installed • Geographic position • Transit gas system • Municipal Public utilities for gas distribution	• Public awareness building • Low utilisation of the RES • Availability of relevant energy data • Limited institutional knowledge for low carbon economy
Opportunities	**Threats**
• High potential of regional RES • Available financial resources worldwide • New technologies for EE • Regional initiatives for EE • Establishment of PPP • Regional REN production • Policy Support for reaching energy and climate goals • EE Potential Households • EE Potential Private Sector & Industry • EE Potential Transport	• Climate changes • Political influence • Lack of financial resources for EE measures • Negative demographic trends •

Self-assessment:

Points:

1 … no measures set/ potential unused to 5 … fully developed/ potential fully used

Figure 17: Self-assessment



11. Annex: List of sources /bibliography /List of relevant stakeholders/institutions in the region

1. *Programme for Development of the Northeast Planning Region 2015-2019 http://www.northeastregion.gov.mk/Default.aspx?LCID=283&Control=Documents.ascx*
2. *State Statistical Office RM http://www.stat.gov.mk/Default.aspx*
3. *MAKStat Database http://makstat.stat.gov.mk/PXWeb/pxweb/en/MakStat/?rxid=46ee0f64-2992-4b45-a2d9-cb4e5f7ec5ef*
4. *First energy efficiency Action plan of the Republic of Macedonia by 2018*
5. *Second Energy Efficiency Action Plan of the Republic of Macedonia until 2015*
6. *Third Energy Efficiency Action Plan of the Republic of Macedonia for the period 2016-2018*
7. *Strategy for utilisation of renewable energy sources in the Republic of Macedonia by 2020*
8. *Report on the implementation of the Energy Performance of Buildings Directive from 2015*
9. *Strategy for energy development in the Republic of Macedonia until 2030*
10. *Assessment of low carbon measures with a bottom-up energy model in the residential and tertiary sector*
11. *https://evn.mk/*
12. *http://mepso.com.mk/*
13. *http://www.elem.com.mk/?lang=en*
14. *http://www.economy.gov.mk/*
15. *http://www.ea.gov.mk/*
16. *http://www.erc.org.mk/*
17.

REGIONAL ENERGY PROFILE

Region: Mazovian Voivodeship (Mazovia Region)

PANEL 2050 – Partnership for New Energy Leadership 2050
Deliverable 3.1

By: Mazovia Energy Agency (MAE)

Date: 26.06.2017

European Commission

Horizon 2020
European Union funding
for Research & Innovation

Table of Content

1. Methodology

The PANEL 2050 project has the aim to create durable and replicable sustainable energy networks at local (municipality/community) level, where relevant local stakeholders collaborate for the creation of a local energy visions, strategies and action plans. The aim of these networks is to contribute to and actively work for the transition towards low carbon communities in 2050.

The PANEL 2050 partnership will provide support for the creation of first successful local energy networks in the CEE countries. In the course of the project, organisations from 10 CEE countries will collaborate on creating regional energy strategies and action plans.

The present Regional Energy Profile was prepared in order to get a better understanding of the energy-related status quo in the Mazovia Voivodeship (Mazovia Region), analysing strengths and challenges with regard to the transition towards a low carbon community.
This energy profile constitutes the groundwork for the preparation of a Regional Energy Roadmap and related Action Plans and will be essential for the communication with regional stakeholders.

2. General introduction of the region

Name of the region and NUTS identification

Mazovian Voivodeship NUTS2

Geography and policy:

Describe the location of the region + provide also a political map showing location of the region in your country

Mazovian Voivodeship is the largest of the sixteen Polish voivodeships (regions). It is located in the central and eastern part of Poland. It is bordered by six other voivodeships: Warmian-Masurian to the north, Podlaskie to the north-east, Lublin to the south-east, Świętokrzyskie to the south, Łódź to the south-west, and Kuyavian-Pomeranian to the north-west.

Source: *Wikipedia*

https://pl.wikipedia.org/wiki/Wojew%C3%B3dztwo_mazowieckie#/media/File:Masovian_in_Poland_(%2Brivers).svg

Geography of the region, including morphology, geology, climate, hydrology, flora and fauna related to energy (text description)

Present water sources - unsatisfactory quality of surface water with underground water source around 12% of national resources. Quaternary water is dominant among them, thermal water is also used. Mazovian Voivodeship is charactarized by geothermal water area with temperature of 25-135°C occurring at the depth of 3100 meters. Estimated average solar radiation – 950 kWh/m2/year. Estimated wind potential - terrain topography and arrangement of main valleys and rivers in the Mazovia Region affect the influx of wind from the west and the east. Wind from other direction adapt to the valleys of latitudinal course. However, north and south winds are weakened mostly, by 20-40%. In spring - domination of northern sector (NW, N), in summer and autumn - domination of south-east (SE) winds. Fossil fuels in Mazovia - these are energy sources deposits (brown coal, two counties: kozienicki and radomski). There are surveys performed in order to discover crude oil and natural gas in this region. According to the expert opinion made in the Polish Geological Institute, as well as numerous oil companies, eastern and northern Mazovia has been included in zones of high probability for accumulation of natural shale gas.

Brief history overview of the region – state the most important milestones related to the industrial / regional development (e.g. significant energy projects, power plants, etc.), ideally related to energy

The first industrial power plant in Mazovia was build in 1883 by Briggs brothers, investors from the United Kingdom. The biggest power plant in Poland EC Siekierki in Warsaw was put into operation in 1961. Another big power plants are: EC Żerań in Warsaw in 1954 and Kozienice and Ostrołęka in 1972. In 2014 started in Iłża with 27 turbines and installed capacity 54 MW. The huge milestone was after accession of Poland to the European Union in 2004, which helped to promote renewable energy and energy efficiency schemes. Afterwards European funding opportunities for energy sector developed. One of the next steps (2001) to increase knowledge about sustainable energy and Mazovia potentials was "Strategy of development Mazovian Voivodeship till 2020".

Public administration procedure – brief profile of current energy planning process in your region starting from the national level down to the region (see also your desk research within WP3.1)

In Poland the governmental institution responsible for energy sector is Ministry of Energy. It is regulating energy law, setting objectives and deciding on the energy mix. The other important entity is URE – Office of Energy Regulations that is responsible for energy market model. One of its main tasks are the promotion of competition between energy suppliers, setting security frames for Polish energy sector. At present on the political level, there is a big pressure to increase Energy Efficiency. On the local level all communes are to prepare Energy Plans, assisted by Plans of Low Carbon Economy (as an option). All public entities are obligated by Law of Energy Efficiency to optimize use of energy and energy monitoring is becoming more needed. In 2009 MAE was established to coordinate energy sector in the region aiming at participation in sustainable energy planning and contribution to local development policies.

Highlight significant characteristics differentiating region from others and give short (!) introduction of energy targets and challenges in the region

Mazovian Voivodeship is one of the largest electricity consumers in Poland, at the same time producing too little in reference to the needs, and mostly from coal. Now many cities in Mazovia face huge problem of air pollution and smog. Challenges for the region is mostly reduction of contamination and investments in sustainable energy. Huge support for this goal is RPO – Regional Operational Program, which is to support with EU money Low-Carbon Economy. The next energy challenge is to take care of safety of energy sector. It is important to distribute energy effectively – with decentralized energy systems. Different energy sources should be integrated with an unlimited access to the grid. The latter, however, is in a rather state of repair and needs restoration and further investments.

3. Basic demographic data and figures

Regional demographic indicators:

Population of region	5 348 000	cap
Area of region	35 558	km²
Population density	150 400	cap/km²
Number of individual municipalities	314	mun.

Data from 2015

Basic demographic data

Population growth, age distribution in last 20 year – text description

From 2005 to 2015 number of population increased 3.7%. Population in 2005 was calculated as 5 150 000, in 2015 reached 5 340 800. Age distribution in 2015: pre-working age 18,6% of total population, working age 61,4% of total population, post-working age 20% of total population. In year 2005: pre-working age 19,7% of total population, working age 63,5% of total population, post-working age 16,8% of total population.

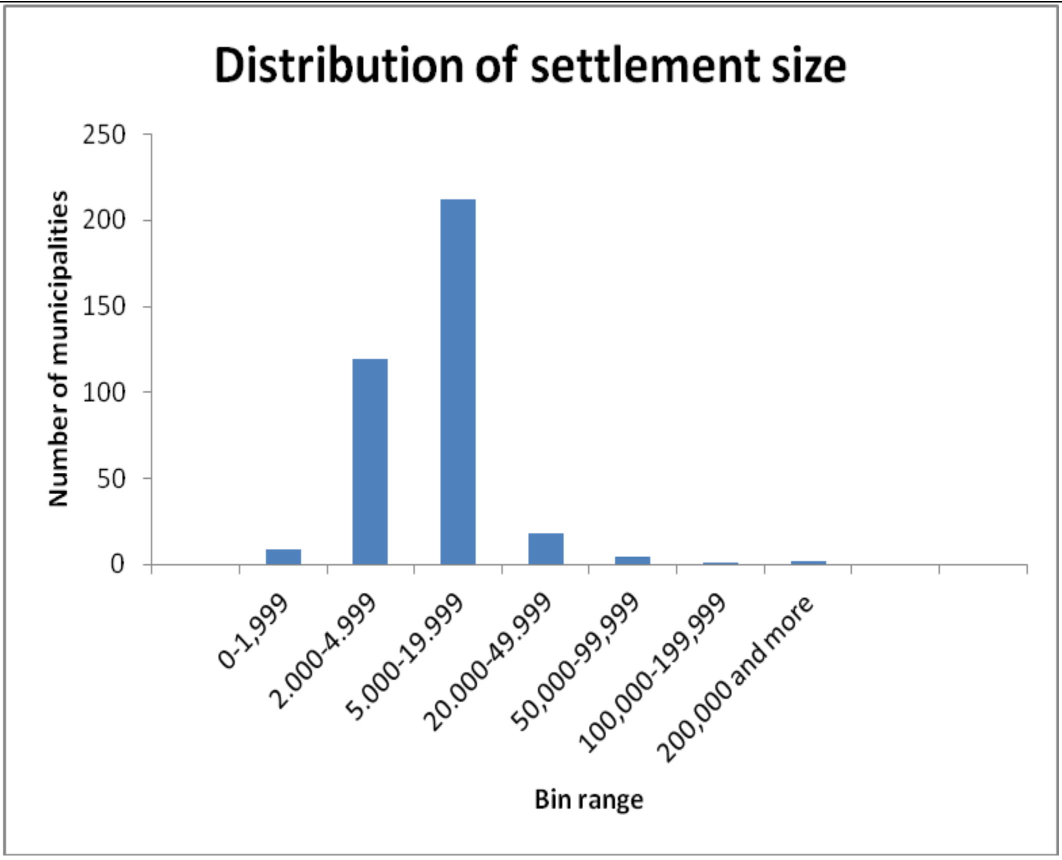
Socio-economic development of past 3-5 years

Unemployment rate	8,3	%
Average annual income per capita (gross)	13215	EUR
difference from the EU average (34.500 EUR gross annual earning)	38,3	%
Share of employees in		
agriculture	0,17	%
industry	12,09	%
services	87,74	%
Share of population with tertiary education	44,33	%

Text description for figures above

Unemployment rate is in an EU margin rate. Average annual income per capita (gross) is well below European Union average. Main sector of employment in Mazovian Voivodeship is service sector with almost 90% share.

The spatial distribution of the population, level of urbanisation


Distribution of settlement size
Number of municipalities
250
200
150
100
50
0
0-1,999
2.000-4.999
5.000-19.999
20.000-49.999
50,000-99,999
100,000-199,999
200,000 and more
Bin range

4. Regional economy and economic trends

Regional economic indicators:

GDP, total	87 511, 7	million EUR
GDP per capita	16 435,5	EUR/cap
HDI	0,834	

Data from 2014/HDI - 2013

GDP per economic sectors:		
Agriculture	2,34	% of total GDP
Industry	16	%
Services	81,66	%

Data from 2015

Regional economy

Please provide information about the regional economy, past development and trends using GDP and other indicators. If available, include graphs about GDP / HDI development of last 10-20 years.

Residents of Mazovian Voivodeship have very good life perspectives if compared to the status of persons from other regions in Poland. It is confirmed by figures indicating the lowest unemployment rate and relatively high level of income. The area is characteristic of high diversity of business activity, considerable financial outlays for development of science, high education level of population, high activity of residents and varied professional qualifications. Those factors affect the advantage of the Mazovian Voivodeship over other voivodeships in the country. Mazovia is one of the most economically developed regions in Poland. The region is the fastest developing region in reference to developed regions in European Union as a result of the highest participation in GDP generation of the country (21.9% in 2009) and high pace of growth of the economy. GDP per 1 resident in reference to the average GDP of EU-27 reached 97% in 2009. In 2010 GDP per 1 resident reached the value of around 60 359 PLN which was 161% of the national average. Warsaw drives the economy of Mazovia. Its GDP in 2009 for the country reached 13.4%, regional - 61%. GDP per one resident in 2011 in Warsaw was three times higher than the national average and four times higher than the least developed subregions of the voivodeship. A considerable growth in GDP from 152 079 million PLN in 2000 to 315 826 mln PLN in 2010 can be observed in the Mazovian Voivodeship. This is doubled. The growth is particularly related to the development of Warsaw which is the seat of numerous international companies which generates growth of GDP.

number of operating entrepreneurs (SMEs, large and individual)	602388	
→ share of SMEs	No data	% of total number of operating businesses
number of operating nonprofit organisations	21000	
Amount of EU funds (2007-13)	1,8 bn	EUR

What are the main contributors/contributing sectors to the regional GDP? How stable are these sectors (qualitative assessment)?

Warsaw drives the economy of Mazovia but constantly increasing role of a western Warsaw subregions is noticable. GDP growth within the metropolitan area is based on trade/services, storage and logistics. Service sector plays also dominant role in the city of Warsaw.

Describe the regional job market, employment/unemployment rates per sectors – agriculture and forestry, industry, services

Mazovian Voivodeship has one of the lowest unemployment rate region in the country. Unemployment rate is lower in urban areas than in rural areas. For total amount of 2 406 734 employed persons: 13% work in agriculture, forestry and fishing, industry 13,3%, main sector is services with more than 70% of working people.

Importance of trade; Import/ export balance, if available

Not available.

5. National and local energy strategies

List of relevant and most influencing strategies / roadmaps / measures to local energy situation or development

Region	Brief description of current …	legal requirement OR voluntary initiative	National/ regional/ local level	Original title + link (if possible)	English title + brief description	Organisation in charge	Type (EE, EPB, RES, etc....)
Central	Mazovia voivodeship is the largest electricity consumer, but it still produces too little electricity with regard to the needs. Moreover, electricity is produced in vast majority out of coal. Concentration of transmission high voltage lines (focused on the territory of Warsaw) is accompanied by slower development of transmission lines in the north and east part of the region. Problems with distribution systems concern 40% of rural areas, which require immediate modernization of 35-40- year old networks, to provide security of supply to end-point users.		regional	Region Centralny	Central Region area includes the Mazowiecki e voivodeship and Łódzkie voivodeship.	The Regional Council	
Central	Directive 2012/27/EU on EE 1) The energy efficiency obligation (white certificates); 2) Priority Programme: Smart Energy Networks (ISE); 3) Operational Programme Infrastructure and Environment 2014-2020 (Priority Investment 4.IV.) - Development and implementation of smart distribution systems at low and medium voltage levels; 4) information and education campaigns; 5) Energy efficiency improvement, Part 4 - Energy-saving investments in small and medium-sized enterprises; 6) Operational Programme Infrastructure and Environment 2014-2020 (Priority Investment 4.II.) - Promoting energy efficiency and use of renewable energy sources in enterprises; 7) Regional Operational Programmes for 2014-2020.	legal requirement	national	Region Centralny	Central Region area includes the Mazowiecki e voivodeship and Łódzkie voivodeship.		EE
Central	Directive 2010/31/EU on energy performance of buildings 1) The Fund Thermo-modernization; 2) Green Investment Scheme. Part 1 - Energy management in public buildings; 3) Operational Programme Infrastructure and Environment 2014-2020 (Priority Investment 4.III.) - Support for energy efficiency, intelligent power management and utilization renewable energy sources in public infrastructures, including in public buildings and in the housing sector; 4) Energy efficiency improvement, Part 3 - Subsidies for loans for the construction of energy-efficient homes; 5) Operational Programme PL04 - "Saving energy and promoting renewable energy sources" within the framework of the EEA Financial Mechanism 2009-2014 (area No. 5 - energy efficiency and the area No. 6 - renewable energy); 6) Green Investment Scheme. Part 5 - Energy management in buildings selected public finance sector entities; 7) Energy efficiency improvement. Part 2 - LEMUR - Energy-efficient Buildings Public Service; 8) Operational Programme Infrastructure and Environment (OPIE) 2007-2013 (Measure 9.3) - Thermal modernization of public utility; 9) Efficient use of energy. Part 6 - OWL Energy-efficient street lighting; 10) Regional Operational Programmes for 2014-2020.	legal requirement	national	Region Centralny	Central Region area includes the Mazowiecki e voivodeship and Łódzkie voivodeship.		EPB
Central	National Energy Efficiency Action Plan (10 August 2011) This document contains a description of the planned measures to improve energy efficiency, outlining the actions aimed at improving energy efficiency in various sectors of the economy, necessary for the implementation of the national target for efficient energy management in 2016. And the measures to achieve the overall objective of energy efficiency understood, as achieving a 20% savings in primary energy consumption in the European Union by 2020.	legal requirement	national	Region Centralny	Central Region area includes the Mazowiecki e voivodeship and Łódzkie voivodeship.		EE
Central	The National Action Plan for energy from renewable sources by 2020 within the framework of the Energy Law of 1997.	legal requirement	national	Region Centralny	Central Region area includes the Mazowiecki e voivodeship and Łódzkie voivodeship.		RES
Central	The National Action Plan aimed at increasing the number of buildings with low energy consumption within the Framework of the Act of 29 August 2014. The energy performance of buildings (Dz. U. item. 1200 and from 2015. Pos. 151). The Act transposes into national law some of the provisions of the Directive of the European Parliament and of the Council 2010/31 / EU of 19 May 2010. On the energy performance of buildings (Acts. Office. EU L 153, 18.06.2010, p. 13). The national plan includes a definition of a building with low energy consumption reflects the existing conditions and achievable, economically feasible measures to improve the energy performance of buildings. Moreover, it represents the actions of government taken to promoting buildings with low energy consumption, including the design, construction and reconstruction of buildings in a way that ensures their energy efficiency and increasing the acquisition of energy from renewable sources in new and existing buildings, and also sets out a timetable achieve its goals.	legal requirement	national	Region Centralny	Central Region area includes the Mazowiecki e voivodeship and Łódzkie voivodeship.		EPB

Central	ACT of 20 February 2015. Renewable energy with the amendment of the Act of 22 June 2016. The Act defines: 1) the terms and conditions of business in the making: a) electricity from renewable energy sources, b) agricultural biogas - Installations renewable energy source, c) bioliquid; 2) mechanisms and instruments to support the production of: a) electricity from renewable energy sources, b) agricultural biogas, c) heat - Installations renewable energy source; 3) rules for issuing guarantees of origin of electricity produced from renewable energy installations renewable energy source; 4) rules for the implementation of the national action plan for renewable energy; 5) the conditions and procedure for certification of installers microinstallations, small installations and installation of renewable energy sources with a total installed capacity of heat is not greater than 600 kW, and the accreditation of training providers; 6) the principles of international cooperation in the field of renewable energy and joint investment projects.	legal requirement	national	Region Centralny	Central Region area includes the Mazowiecki e voivodeship and Łódzkie voivodeship.		RES
Central	ACT of 20 May 2016. Energy Efficiency (Dz. U. of 20 May 2016, item 831). The Act defines: 1) national target for efficient energy management; 2) the tasks of the public sector in energy efficiency; 3) rules to obtain and redeem certificates of energy efficiency; 4) rules for drawing up the audit energy efficiency and obtain permission Auditor energy efficiency.	legal requirement	national	Region Centralny	Central Region area includes the Mazowiecki e voivodeship and Łódzkie voivodeship.		EE
Central	The Act of 10 April 1997. Energy Law (Dz. U. 2006. No. 89, item. 625 with changes). Energy Law regulates the energy sector, but also contains special provisions applicable to renewable energy sources, including: • specific rules related to connecting to the network and transmission of energy electricity generated by using renewable energy companies; • rules for the sale of electricity generated by the company energy using renewable energy sources; • issuing and circulation of certificates of origin issued for energy from renewable energy sources.	legal requirement	national	Region Centralny	Central Region area includes the Mazowiecki e voivodeship and Łódzkie voivodeship.		RES
Central	Polish Energy Policy until 2030 The main directions of Polish energy policy are: • Improving energy efficiency, • Increased security of fuel and energy, • Diversification of electricity generation structure by introducing nuclear energy, • Development of renewable energy sources, including biofuels, • Development of competitive fuel and energy markets, • Reducing the impact of energy on the environment.	legal requirement	national	Region Centralny	Central Region area includes the Mazowiecki e voivodeship and Łódzkie voivodeship.		EE + RES
Central	ACT of 21 November 2008. on thermal and repair (Dz. U. of 18 December 2008). 2010-06-07 d. Dz.U.2010.76.493 art. 1 2011-01-01 d. Dz.U.2009.157.1241 art. 79 2011-07-01 d. Dz.U.2011.106.622 art. 88 The Act defines the principles funding in the Thermo-modernization of the cost of thermal modernization and renovation.	legal requirement	national	Region Centralny	Central Region area includes the Mazowiecki e voivodeship and Łódzkie voivodeship.		EE + EPB
Central	The Operational Programme Infrastructure and Environment 2014-2020. Action 1.3 Promoting energy efficiency in buildings / 1.3.1 Promoting energy efficiency in public buildings	voluntary initiative	regional	Region Centralny	Central Region area includes the Mazowiecki e voivodeship and Łódzkie voivodeship.		EPB
Central	The Regional Operational Programme 2014-2020 MAZOWIECKIE. Action 4.1. Renewable sources of energy. The infrastructure for the production and distribution of energy from renewable sources	voluntary initiative	regional			The Regional Council	
Central	The Regional Operational Programme 2014-2020 MAZOWIECKIE. Action 4.2. Energy efficiency. Retrofitting of public buildings	voluntary initiative	regional			The Regional Council	
Central	Plans for Low-Carbon Economy aim to support the implementation of the climate and energy package in 2020.	voluntary initiative	regional				
Central	Plans for the Supply of Heat, Electricity and Gaseous Fuels for the Municipalities within the framework of the Energy Law of 1997.	legal requirement	national				

6. Energy Production

6.1. *Conventional energy production capacities (fossil fuels and nuclear power)*

Give an overview of energy production by fossil fuels and nuclear power plants – concentrate on the most significant 3 to 5 power plants.

Name & Location (city, town)	Owner	Year of commis-sioning (refur-bishment)	Type of plant & fuel	Capacity in MW	Annual energy production in MWh	Annual CO_2-emissions in t	Utilization rate (qualitative assessment)
Siekierki Power Plant (Warsaw)	Public	1961	Thermal and electricity Coal	622 MWe 2068 MWt			Constantly used
Żerań Power Plant (Warsaw)	Public	1954	Thermal and electricity Coal	386 MWe 1580 MWt			Constantly used
Kozienice Power Plant (Świerże Górne)	Public	1972	Thermal and electricity Coal	2905 MWe 6812, 6 MWt	11825000 MWh	10 mln T	Constantly used
Ostrołęka Power plant (Ostrołęka)	Public	Works A: 1956 Works B: 1972	Thermal and electricity Coal	Works A: 93,5 MWe 456,1 MWt Works B: 681 MWe			Constantly used

Add additional details to describe the conventional energy production capacities in the region. What are current trends? What influence have age, regional economy, fuel imports, and fuel prices on the on the current status?

In Poland the most significant suppliers of energy play fossil fuels energy systems. In the structure of fuel supply for power plants, CHPs and heating plants, coal (hard coal and lignite – almost 90 %participation in fuel charge) play the most important role, lower is natural gas and heating oil. According to the opinion expressed in the project of Development Strategy for the Mazovian voivodeship the total electric power of electricity sources in the Mazovian voivodeship is insufficient in relation to the forecast needs for 2020-2030. Furthermore, most of the power plants in the system are over the age of 30 and they should be replaced by modern, high-efficient and low carbon energy sources.

6.2. *Renewable energy production*

Energy production capacities

Give an overview of energy production by renewable energy capacities (e.g. small/large hydro, solar PV, solarthermal, biomass, geothermal & other production capacities – concentrate on the most significant 3 to 5 power plants or aggregation of production facilities.

Name & Location (city, town)	Owner	Year of commis-sioning (refur-bishment)	Type of plant & fuel	Capacity in MW	Annual energy production in MWh	Annual CO_2-emissions in t	Utilization rate (qualitative assessment)
Dębe	Public	1957-1963	Hydro	21,18 MW	91 MWh	0	Constantly used
Korytnica	Public	2015	Wind	82,5 MW		0	Constantly used
Iłża	Public	2014	Wind	54 MW		0	Constantly used
Żuromin	Public	2012	Wind	60 MW		0	Constantly used

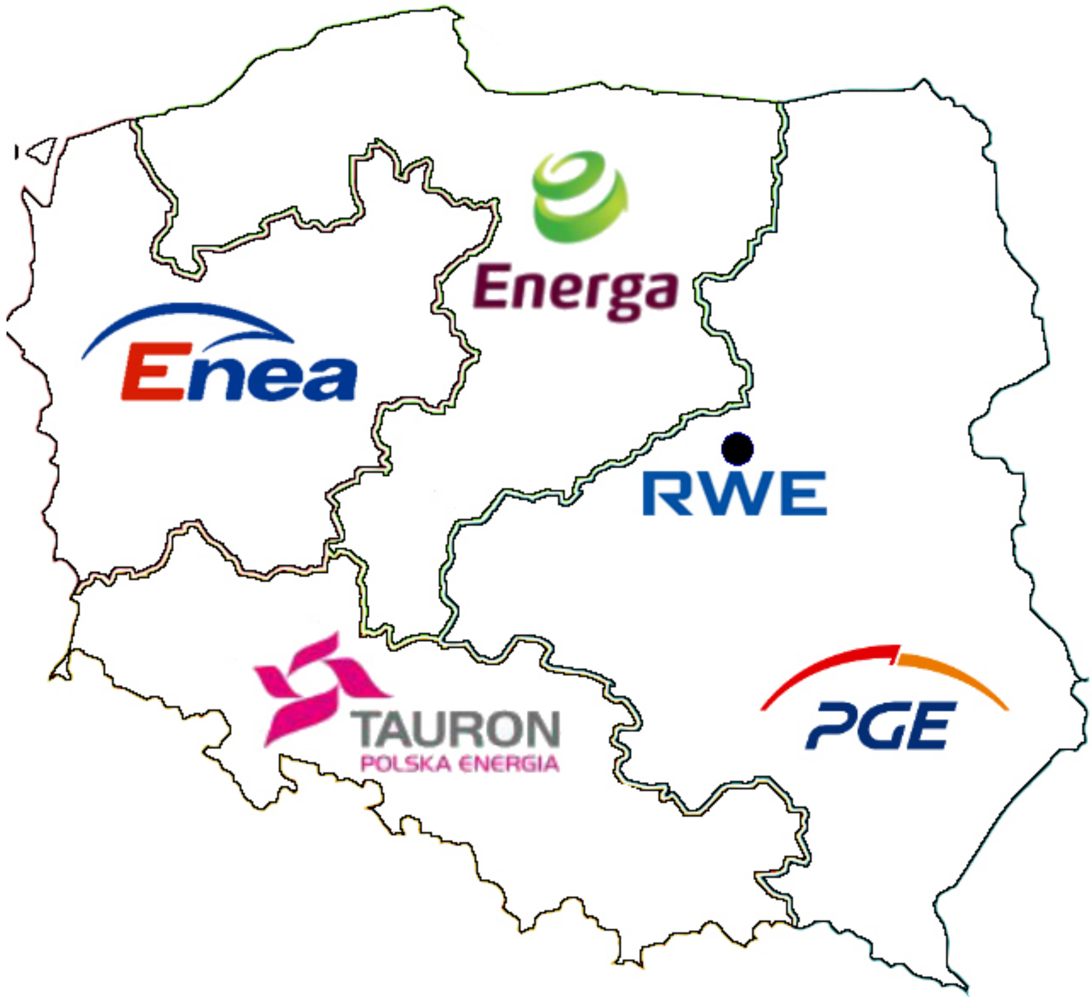
Add additional details to describe the renewable energy production capacities in the region. What are current trends? What influence have age, regional economy, fuel availability or renewable energy potential, and subsidy systems on the current status?

The area of the Mazovian voivodeship lies in the area of favorable conditions for the development of wind energy. Unfortunately, the enacted law on the location of wind farms (2016) slow down and even stopped the development of this industry. As for hydro power still Wisła (the largest river in Mazovian voivodeship and in Poland) energy potential is not fully utilized. Solar energy installations are increasingly used. Unfortunately meteorological conditions in Poland are characterized by very uneven distribution of solar radiation in the annual cycle and that causes lower annual energy production.

6.3. *Transmission and distributions*

What kind of facilities constitute the electric transmission and distribution system? Who are the owners? Who are the operators? Please add relevant map if available.

In Poland the electric system is divided into subsystems: **manufacturing** (power station), **transmission network** (line and substations :750 kV, 400 kV, 220 kV) – the transport network is nationwide network and is managed by the Transmission System Operator (TSO) – Polish Power Grid Company and **distribution network** (line and power stations: high (110kV), medium and low voltage) – distribution networks are regional networks and are managed by regional distribution system operators (THE LARGEST Polish operators: PGE, TAURON, RWE (now Innogy), ENERGA, ENEA.



Source: *http://dobryprad.pl/dostawcy/prad/tradycyjni/energa*

The Mazovian voivodeship lays in the area of three operators :Energa, RWE (now Innogy), PGE. Due to the TPA (Third Party Access) end consumers can individually and freely choose the energy supplier who will offer the most favorable terms of sale while still using the power grid network company (TSO or DSO) with whom the customers have signed transmission or distribution contracts.

Give an overview of other centralised or decentralised energy distribution systems (e.g. natural gas pipelines, heat grids, etc.).

In the Mazovian voivodeship no natural gas mines are connected to the transmission and distribution pipeline system. This means that the entire supply of natural gas in Mazovia comes from the gas transmission system, fed by imported gas, or by gas from domestic production –located in different part of Poland. The winter season is protected from PMG (underground gas storage), which is also located outside Mazovia. Currently, the infrastructure of the national gas system consists of:

a) Gas pipelines: transmission and transit of high pressure - above 1.6 MPa; distribution: high pressure <0.5 - 1.6 MPa>, medium pressure <0.01 - 0.5 MPa>, low pressure - below <10 kPa.

B) Gas compressors

C) Reduction and measurement stations

D) Underground gas storage (PMG)

The national natural gas transmission system consists of two separate systems: high methane gas, nitrogen gas. Mazovia has only a high methane gas system

About 50% of Poland's citizens buy heat from district heating companies. The remaining heat demand is satisfied from individual sources or small local sources. The largest heating network in Poland is located in Warsaw. It has about 1 650 km long, which accounts for 8.5% of all heating networks in Poland. Warsaw also has the largest share of heat demand in the district heating system by 76%. Network heat production is based primarily on hard coal. Due to technical and economic constraints (lack of heat transfer capability over long distances), heat markets are local and often include one city area. In such local markets there are usually at most several large sources of system heat and only one district heating network operator. Heating services are provided to final customers usually on the basis of contracts with a local network operator who buys heat from generators connected to its network or generates them at their own source.

Give an overview on interconnections of regional energy production with the rest of the country. Are there large production facilities in the region on which the rest of the country's energy supply might depend?

Mazovian voivodeship has a large demand on energy and the regional production is enough to cover this. There are no large production on which the rest of the country's energy supply might depend.

6.4. *Jobs in the energy sector*

Give an overview about the status of the energy sector in the regional economy. How many jobs are there at the moment in the energy sector. How important are new "green job" for regional economy development. If possible, quantify investments in the energy sector.

In the fuel and energy sector, approximately 300,000 people are employed in Poland. 125 thousand in the coal and mining sector, almost 150 thousand. It deals with supply of electricity and gas. Earnings in the energy sector are clearly higher than in the Polish economy. The median salary is 4100 PLN which makes it one of the best paid industries.

Are coal and lignite mining undertaken in the region? What role does fossil fuel mining play for the regional economy and for regional energy security?

In the region the coal and lignite mining is not undertaken but it plays a very important role in the country. That is the main that in Mazovian voivodeship coal an lignite still play the main role in energy sector.

7. Final energy consumption

***Final energy** is a form, which might already been subject to conversion from the raw fuel. It is the energy made available to the user.*

For the sectoral analysis please use regional statistics as far as they are available to you and quote your sources. If no regional data is available please use the Excel tool, which will give you a suggestion to estimate the needed indictors using national statistics. Please always use kWh, MWh, GWh, etc.
You can find a good conversion tool here: https://www.iea.org/statistics/resources/unitconverter/

7.1. *Households*

Regional final energy consumption of household sector	22662,52	GWh in a year

Heat consumption

Total heat energy consumption of households sector (heating and hot water consumption)	9733,72	GWh in a year
Average heat energy consumption per household	4446,9	kWh/hh

Describe the average building standard. What is their average age of existing building stock? Are energy efficient renovations in progress?

The average time when the existing buildings were build is the years 1945-1988 (almost 50 % in the urban areas and more than 60% in the rural areas. The renovation of the buildings is becoming more popular in Mazovian voivodeship. There is a lot of new projects to encourage that but it is still not effective.

Electricity

Electricity consumption of households	4550,3	GWh in a year
Average electricity consumption per household	2078,8	kWh/hh

Describe if there are any national or regional programmes for reducing household electricity consumption (e.g. washing machine or refrigerator replacement programme). If yes, please elaborate it briefly.

No data on this kind of regional programmes.

Gas consumption

Gas consumption	8378,5	GWh in a year

Describe if gas is a significant energy source in the household sector.

The Mazovian Voivodeship consumes almost 20% of the natural gas consumption in Poland. In the case of recipients the durability of natural gas supplies is very important now, compared to customers from other voivodeships. It results from about 2 times higher consumption of gas in Mazovia than in other voivodeships..

General information

Household electricity price	0,14	EUR/kWh (incl. taxes)
Household natural gas price	2,8	EUR/kWh (incl. taxes)
Household district heating price		EUR/kWh (incl. taxes)
Household price: other energy sources – specify: Ecoterm Plus fuel oil	0,06	EUR/kWh (incl. taxes)
Energy expenditure by household	15,75	% of income

Is there any element of Demand Side Management of electricity on household level in place? If yes, please describe it (e.g. peak price, smart metering)

No.

Is energy poverty an issue in the region? If yes, please describe how many people are affected, in what extent?

Percentage of energy poor according to the relative definition of LIHC in Mazovia region in 2013 – 13-18%
Percentage of energy poor according to the absolute definition of "13% of income" in Poland in 2013-27-33%

Give an estimate of the trend in final energy consumption in the household sector using values from -5- to +5 where (-5 is a strong reduction, 0 means neither growth nor reduction, +5 strong growth).

+2 – growth of final energy consumption in the household sector

7.2. *Service Sector*

Regional final energy consumption of service sector	21 444	GWh

What are the main sub-sectors driving energy consumption in the in the service sector (building standard, number of businesses, …)? How important is service sector for the regional economy?

Trade is the main sub-sector driving energy consumption. The service sector in Mazovia region provides approximately 64 % of the regional GDP

Give an estimate of the trend in final energy consumption in the service sector using values from -5- to +5 where (-5 is a strong reduction, 0 means neither growth nor reduction, +5 strong growth).

+2 – growth of final energy consumption in the service sector

7.3. *Industry*

Total energy consumption of the industrial sector	8669	GWh
Industry electricity price	To general question	EUR/kWh (incl. taxes)
Industry natural gas price	2,8	EUR/kWh (incl. taxes)

What are the main sub-sectors driving energy consumption in the in the industrial sector? How important is industry for the regional economy?

The industry sector in Mazovia region provides approximately 16 % of the regional GDP

7.4. *Transport*

Regional final energy consumption of transport sector	28314 (without freight transport)	GWh

Describe the main characteristics of the transport sector: transport infrastructure, motorisation rate, availability of public transport and differences between urban and rural environments.

In 2013 at the end of the year in Mazovia Voivodship the length of public roads with the hard surface was 35375.2 km (1.0% more than in the end of last year).. Urban roads accounted for 19.7%, and rural roads accounted for 80.3% of all public roads with hard surface. The total number of motor vehicles and tractors registered in the Mazovia voivodship in 2015 amounted to 3170400. This group was dominated by passenger cars, which constituted about 75% of the total number of motor vehicles and tractors. Most passenger cars had gasoline engines, although the share of these vehicles decreased from 55.1% in 2012 to 54.2% in 2013 for diesel vehicles (up from 25.4% in 2012 to 26 , 6% in 2013). The share of passenger cars in LPG decreased from 18.7% to 18.5% in 2013.

Passenger transport

Motorisation rate - number of passenger cars	3170400	
Regional energy consumption of passenger transport in the region	27478	GWh

Freight transport

Regional energy consumption of road freight transport	No data	GWh

If the rail, or transport by pipeline is a significant way of the freight transport, please describe their main characteristics.

No data.

Use of alternative fuels

Describe the market development for alternative fuel vehicles (natural gas, biogas, electric cars). What supporting mechanisms for alternative fuel are available on national and regional level? Describe challenges and barriers, e.g. infrastructure, technological, supply, financial barriers, etc..

Ministry of Energy September 20, 2016 has submitted to the public consultation the Electromobility Development Plan in Poland, announcing the electrical revolution. This document identifies the benefits of electric vehicle distribution and shows how great potential is for this. The government plans that in Polish streets will drive one million electric cars by 2025. The idea will be popularized in several stages. The first is the testing of electric vehicles under real conditions in some cities. The next step will be the exchange of public administration vehicles and the construction of a charging station. There will also be changes to the tax system that will benefit electric vehicle users and vehicle emissions. The final stage is the implementation of the intelligent metering system and the installation of electricity storage, as well as the adjustment of tariffs.

Give an estimate of the trend in final energy consumption in the transport sector using values from -5- to +5 where (-5 is a strong reduction, 0 means neither growth nor reduction, +5 strong growth).

-1 – reduction of final energy consumption in the transport sector

7.5. *Summary*

7.5.1. Final energy indicators

General indicators for the region

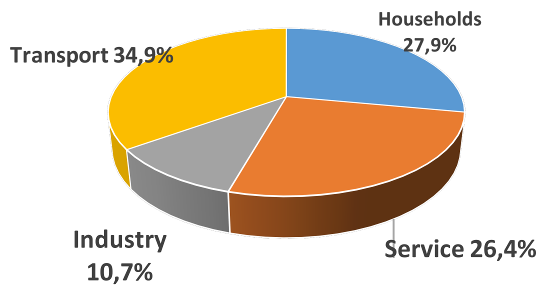
Use the Excel tool to fill the following tables and generate graphs.

If regional data is available, use this information and quote your sources.

Total final energy consumption	81089,52	GWh
Final energy consumption per capita	15162,588	kWh/cap
Electricity consumption per capita	0,56	kWh/cap
Heat consumption per capita	1,5	kWh/cap
% of total country consumption	30	%

Final energy consumption per sector

Year: 2015			**%**
Households	22662,52	GWh	27,9
Service sector	21444	GWh	26,4
Industry	8669	GWh	10,7
Transport	28314	GWh	34,9
Agriculture, Fishing and Other	-	GWh	-
Sum		**GWh**	**100,0**



Give an estimate of the trend in final energy consumption using values from -5- to +5 (where -5 is a strong reduction, 0 means neither growth nor reduction, +5 strong growth).

+2 growth of final energy consumption

7.5.2. Final energy consumption by fuel

Use the Excel tool to fill the following tables and generate graphs.
If regional data is available, use this information and quote your sources.

Total final energy consumption by fuel

Year: 2015		
Coal and lignite	11856000	tones
Renewables and waste*	1872,1	GWh
Natural gas	31133	GWh
Oil, petroleum and products	965000	tones
Electricity	24327	GWh
Other fuels	-	GWh
Sum		**GWh**

*Hydro, wind, solar, tide/wave, biomass and waste, geothermal

7.5.3. Primary energy equivalent

Primary energy *is an energy form found in nature that has not been subjected to any conversion or transformation process. It is energy contained in raw fuels.*

If regional data is not available for these indicators, use specific national indicators to break energy supply down to regional level. Refer to Excel tool for suggestions on calculation methodologies. Quote your sources and assumptions

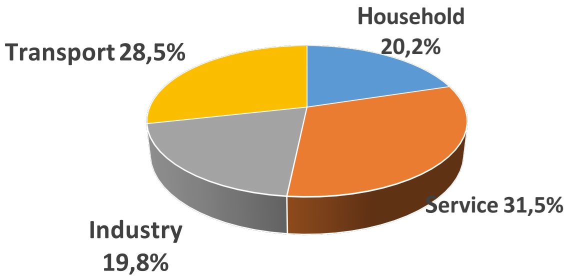
Total Primary Energy Consumption	109276,14	GWh
Primary energy consumption per capita	20433,086	kWh/cap
Primary energy factor of electricity		-
Energy intensity	1,2487032	TPES/GDP

Give an overview of the regional primary energy supply by fuel.
Use the Excel conversion tool using primary energy coefficients suitable for your region.

Primary energy equivalent by sector

Use the Excel tool to fill the following tables and generate graphs.
If regional data is available, use this information and quote your sources.

Year: 2015			**%**
Households	22082,84	GWh	20,2
Service sector	34375,4	GWh	31,5
Industry	21672,5	GWh	19,8
Transport	31145,40	GWh	28,5
Agriculture, Fishing and Other		GWh	-
Sum	**109276,1**	**GWh**	**100,0**



What is the level of primary energy supply dependencies: Which fuels need to be imported form the rest of the country and internationally.

Dependency on fuel imports: very high / high / **average** / low / very low
Gas needs to be imported internationally (Russia).

7.5.4. Regional CO_2-emissions associated with energy consumption

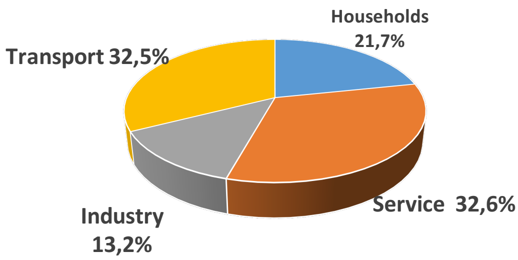
Use the Excel tool to fill the following tables and generate graphs.
If regional data is available, use this information and quote your sources.

Total CO_2-emission associated with energy sector	0,02	Mio t
CO_2-emissions per capita	0,0044	t/cap
CO_2-emissions per GDP	0,2659	t/€ GDP

Give an overview of the regional primary energy supply by fuel.
Use the Excel conversion tool using CO_2-emission coefficients suitable for your region.

Energy-related CO_2-emissions by sector

Year: 2015			**%**
Households	5055,12	t CO_2	21,7
Service sector	7589,03	t CO_2	32,6
Industry	3067,96	t CO_2	13,2
Transport	7553,04	t CO_2	32,5
Agriculture, Fishing and Other	-	t CO_2	-
Sum	**23265,15**	t CO_2	**100,0**



8. Renewable energy sources – status and potential

8.1. *General information*

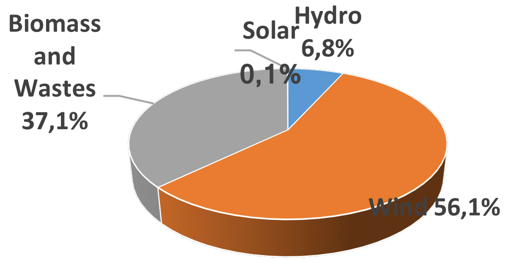
Use the Excel tool to fill the following tables and generate graphs.
If regional data is available, use this information and quote your sources.

Renewable Energy Targets:		
2020 RES share in gross final energy consumption	20	%
2030 RES share in gross final energy consumption	No data	%

Current RES share (2015)	8	%
thereof RES out of the region	No data	%

Share of final energy consumption produced by renewable fuels

Year: 2009			%
Hydro	126,4	GWh	6,8
Wind	1050	GWh	56,1
Biomass, biofuels and renewable wastes	694	GWh	37,1
Solar	0,936	GWh	0,1
Geothermal	0	GWh	0,0
Tide, Wave, Ocean	0	GWh	0,0
Sum	**1872**	**GWh**	**100,0**



Share of total electric demand covered by renewable fuels

Year: 2009		
Hydro	126,4	GWh
Wind	1050	GWh
Biomass, biofuels and renewable wastes	No data	GWh
Solar	No data	GWh
Geothermal	0	GWh
Tide, Wave, Ocean	0	GWh
Sum		**GWh**

Describe if and how renewable energy sources are integrated in the transport sector, e.g. biofuels, electric vehicles.

In Mazovia region there is a new trend of electric vehicles. The new regional programmes and laws are going to encourage this trend. Unfortunately this process is still starting.

Describe the status of RES production in the region. % of total energy and electricity demand covered by RES. If available give a historic overview of the REN production capacities for the last 5 to 10 years.

RES is covering approximately 8 % of total energy production.

Describe if there are incentive programmes/schemes (financial and non-financial) in place to support RES-development. Are these programmes on national, regional or local level?

There are many programmes which goal is to support RES development which are called Regional operating programmes.

Describe the top 5 regulatory barriers slowing down current and future RES-development. Should these barriers be addressed at national, regional or local level?

1. Lack of political support – new laws that makes it difficult for eg. Wind power to develop 2.Lack of interest of society 3. Dilemma: how to save Polish mining under the "rule" of the EU's energy and climate policy is more important 4.It is believed that RES provides less energy than conventional sources and it is not as reliable. 5. Financial not enough new investments Those barriers should be addressed as national ones that cause regional problems.

Give an estimate of the trend in renewable energy production using values from -5- to +5 (where -5 is a strong reduction, 0 means neither growth nor reduction, +5 strong growth). Describe supporting factor as well as barriers.

+2 growth of renewable energy production

8.2. *Available natural resources in the region*

8.2.1. Biomass

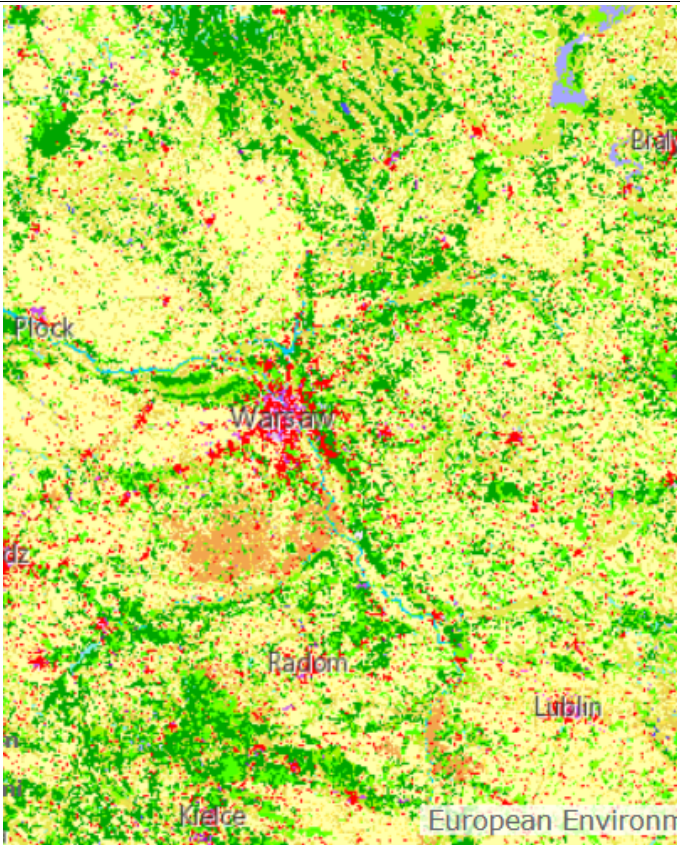
How are forest areas used? For what purpose? What is the regional energy potential using existing forest areas? Please state whether it is a theoretical or technical potential and describe regulatory support systems as well as barriers.

Forests in the Mazovian voivodship occupy an area of 810 thousand. ha, which constitutes about 23% of the structure of land distribution. The highest forest cover is characterized by county: Ostrołęka, Legionowo, Otwock, Przyuski and Szydłowiec (forest index of over 30%). Lowland forests occur in the poviats: Płońsk, Grójeckie, Sochaczew, Grodzisk, Pruszków and Zwoleń (less than 15%). The area of protective forests in the voivodship is 28.6% of the forest area. In 2010 from the forests was acquired 1 867.2 thousand.m^3 merchantable timber, mainly from state forests. The main assortments were sawmill wood and paper wood. In recent years interest in the use of wood for energy purposes has increased again. In households - due to increasing prices of traditional fuels, in the power industry due to regulations.

What are main agricultural products at the moment? What is the regional energy potential from agricultural products? Please state whether it is a theoretical or technical potential and describe regulatory support systems as well as barriers.

In Mazovian Voivodeship there are 2.38 million ha of agricultural land (67.1% of the total area). The concept of development of agricultural land for the production of energy crops in Poland was not successful. At present, there is no emphasis on the production of plants for solid fuels.

Provide a land use map or map indicating biomass energy potential of the region, if available.



Source: http://land.copernicus.eu/pan-european/corine-land-cover/clc-2012/view

8.2.2. Hydro power (incl. tide and wave power)

Give an overview of hydro power sources used at the moment and describe the energy potential for the different technologies: run-of-river hydropower plants, reservoir hydropower plants, use of tide and wave power, if applicable. Differentiate between small and large hydro power. Describe the energy potential based on geographical and political frameworks.

The most favorable conditions for the construction of flow plants exist on the river Vistula. The rivers of Radom, Wkra, Prawny Law, Orzyc, Iłżanka and Liwiec enable the development of small hydropower plants. In many rivers (Wkra, Radomka) there are former water reservoirs suitable for energetic use (around 150). The energy potential of the Vistula River is still not used. Since the construction of large hydro power plants is associated with significant financial expenditures, the future development of small hydropower plants, which is characterized by relatively low investment expenditures, relatively short return period and ecological advantages can be foreseen in the future. According to the Energy Regulatory Authority data, there are 22 installations operating in the Mazovian Voivodeship with a total installed capacity of about 22 MW.

8.2.3. Solar power

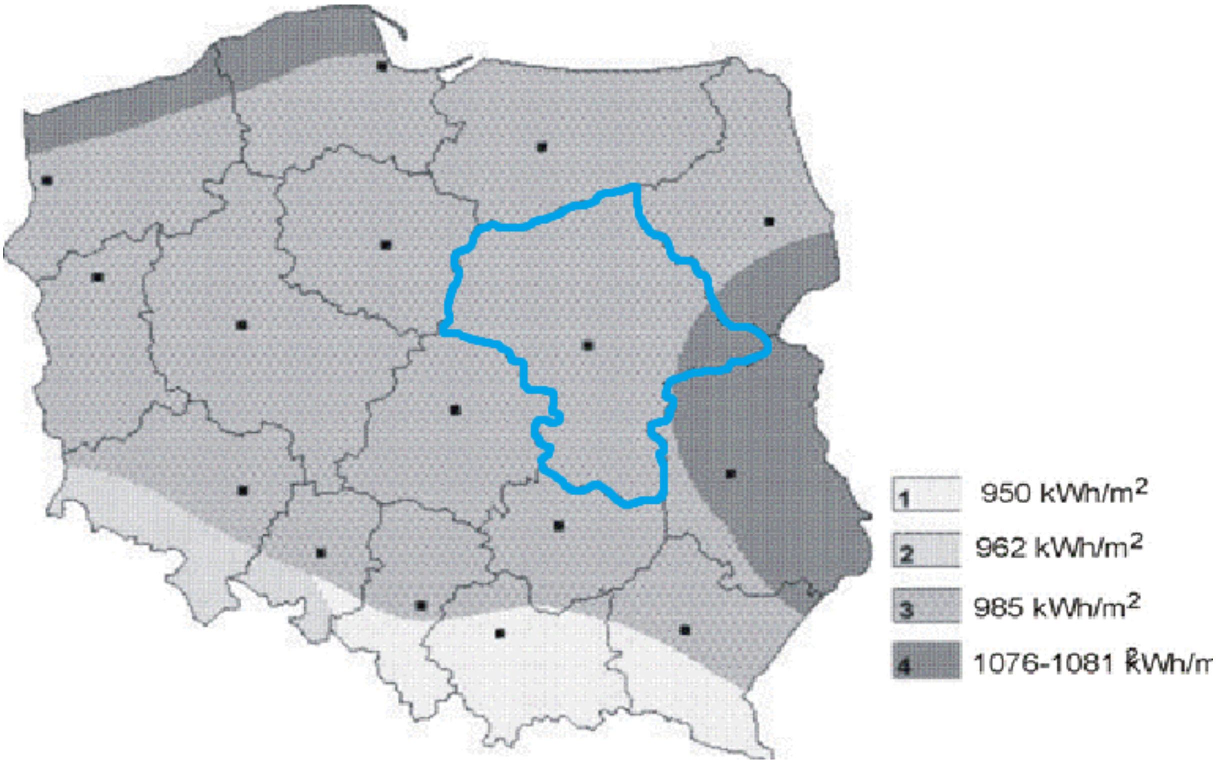
Solar irradiation (on optimally inclined plane) per year	from 1000 to 1050	kWh/m²

Give an overview of both solar thermal and PV usage hydro power sources at the moment and describe the energy potential based on geographical and political frameworks.

Average annual insolation for Mazovian voivodeships range from 1400-1550 in the western part, and 1600-1650 in the east. Total solar radiation is 985 kWh / m2 in the western part of the year and 1081 kWh / m2 in the east. The general conditions of sunshine in the Mazovian voivodeship are good and therefore solar installations can be used throughout. The conditions of solar energy development are similar in the entire Mazovian Voivodeship. Large urban agglomerations are characterized by slightly worse conditions (due to increased levels of air pollution), while the use of solar energy is greater in them due to a much higher density of power and thermal energy demand. Most of the voivodeship's area is characterized by annual total radiation ranging from 1 000 - 1 050 kWh / m2. Only in the western part of the voivodeship average annual radiation exceeds 1055 kWh / m2. According to the data of the Energy Regulatory Office in the area of Mazovian voivodeship there are 26 installations with a total installed capacity of about 1.7 MW.

Provide a map indicating solar irradiation in the region, if available.

You can use e.g. the interactive map or posters provided by EU JRC PV database: Photovoltaic Geographical Information System (PVGIS), http://re.jrc.ec.europa.eu/pvgis/



source: Stanisław Gołębiowski „Solar energetic in Poland" 2007

Administrative map of Poland, showing annual distribution of solar radiation (kWh/m^2 on horizontal surface)

Blue Line – Mazovian voivodeship

8.2.4. Wind power

Average wind velocity	4,5	m/s
Full load hours	1500-2500	h/a

Give an overview of wind power use at the moment and describe the energy potential based on geographical and political frameworks. Differentiate between offshore and onshore potential

In terms of airiness, Poland is characterized by great territorial variability. There are areas where wind energy can be successfully used and estimated at about 40% of the country's area, with a minimum profitability of 1000 kWh/m2/year at 30 m above the ground. The wind speed and frequency of repetition of certain speed values determines the amount of electricity produced per year and the profitability threshold is determined for an annual average wind speed of more than 4 m / s. Under such conditions, the annual capacity utilization of wind turbines is between 1500 and 2500 hours This means that the maximum installed capacity is between 17 and 28%. The area of the Mazovian voivodeship lies in the area of favourable conditions and very favourable wind resources. It is estimated that half of the voivodeship is located in areas where it is possible to use the wind at 2000 hours per year and the potential at 1300 kWh / m2 / year. Areas with the most favourable winds are the ones located in the western part of the voivodeship, including the districts of ciechanowski, garwolinski, grójecki, mława, płocki and płoński. According to the Energy Regulatory Authority data, in the Mazovian voivodeship there are 98 single or group wind turbine installations with a combined installed capacity of approximately 378 MW.

Provide a wind map for the region, if available

Source: http://www.enis.pl/en/wind-energy.html

Legend:
Wind zone depend on colour from the top
Very favourable

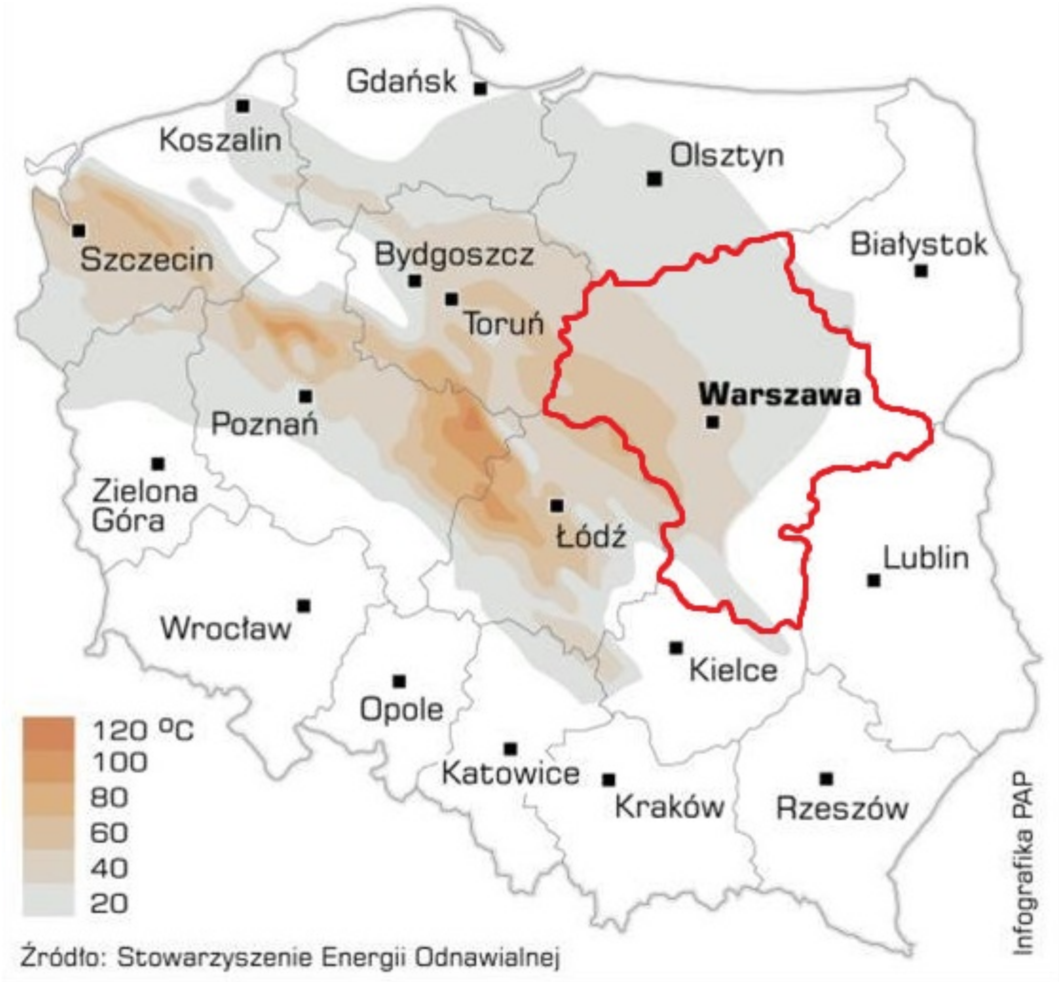
Favourable Kind of favourable Unfavourable Very unfavourable Terrain off

8.2.5. Geothermal energy

Give an overview of use of geothermal energy at the moment and describe the energy potential based on geographical and political frameworks.

The Mazowieckie voivodeship is located in the Polish Lowlands In the geological district of Grudziądz - Warsaw. The area is approximately 70 thousand. km^2 with geothermal waters of 25-135 degrees Celsius, occurring in Triassic, Cretaceous and Jurassic decks, with total resources of 3,100 km^3. The heat resources are estimated at 168 000 t.p.u./km^2. This gives an average of 44 million m^3 of geothermal water per km^2 of surface area. The most favorable conditions for the use of geothermal energy are found in counties : Gostynin, Płock, Żuromin, Płońsk, Sierpc, Sochaczew, Żyrardów.

Provide a geothermal map for the region, if available



Source: Association of Renewable Energy

8.2.6. Waste

Describes overlaps between waste management and energy sector. Is municipal solid waste used for energy production? How is the energy from waste incineration plants used, e.g. electricity generation, district heating (cogeneration)?

Mazovian voivodeship is the largest voivodeship in the country, both in terms of area and number of inhabitants. The largest number of inhabitants results in the largest amount of municipal waste collected in the country. The inhabitants of Mazovia produce about 2 mln Mg (tonnes) of municipal waste annually. These are non-sorted waste. Unfortunately, only a small percentage of waste is disposed of using modern thermal methods. There is also no well-developed system for controlling selective waste collection, for example with glass, paper, plastic and other waste. Because the current system operates mainly on the basis of single-municipal landfills not related by a complex system. Moreover, in Mazovia there are still wild landfill sites and some waste is still burned in domestic ovens. In Mazovian voivodeship there are currently 20 installations using biogas from landfill sites with a combined capacity of 11.9 MW .

8.2.7. Other natural resources

Provide information about any other natural/renewable resources usable for energy production.

No data

8.2.8. Restriction through protected areas

Are there environmentally protected areas, which are not available for REN facilities or restrict the overall potential?

All national parks, landscapes, nature reserves, Natura 2000 areas

9. Energy efficiency – status and potential

What is the status of the implementation of the Energy Efficiency Directive?

The goals of the Energy Efficiency Directive are accepted by the government of Poland. The report on the implementation of the Energy Efficiency Directive (2012/27 / EU) states that the Energy Efficiency Directive: insufficiently implemented but nevertheless provides a framework for energy efficiency. Controversial legislation hampers ecological success, increases bureaucracy and increases energy costs, and that more coherent energy legislation is needed.

What is the status of the implementation of the Energy Performance of Buildings Directive (e.g. data on low/zero energy buildings)?

From January 2017, EP limit values for newly built buildings and certain U factors for external partitions of buildings have changed, in line with the provisions of the ordinance amending the Regulation on technical conditions to be met by buildings. The gradual introduction of the regulation is aimed at adapting all the participants of the construction market to the legal requirements in force. This solution aims to fulfill the provisions of art. 9 sec. 1 of the Energy Performance of Buildings Directive, which states that until 31 December 2020 all new buildings should be buildings with almost zero energy consumption. The modifications concern the permissible values of the EP index (this index determines the building's demand for non-renewable primary energy) and the heat transfer coefficient of the external partitions (ie external and internal walls, roofs, ceilings, windows, doors, etc.), which can not exceed the limits Provisions of the Regulation of the Minister of Infrastructure

Analyse the sectors:
Households: Are energy efficiency measures implemented in this sector? Are there awareness campaigns to highlight the potential? Is there support for the implementation (financial and non-financial)?

There are a lot of awareness campaigns to highlight the potential. MAE started a new project in January called EMPOWER an interregional project aiming to reduce carbon output by dynamically monitoring energy efficiency in buildings

Service sector: Are energy efficiency measures implemented in this sector? Are there awareness campaigns to highlight the potential? Is there support for the implementation (financial and non-financial)?

No data

Industry: Are energy efficiency measures implemented in this sector? Are there awareness campaigns to highlight the potential? Is there support for the implementation (financial and non-financial)?

No data

Transportation: Are energy efficiency measures implemented in this sector? Are there awareness campaigns to highlight the potential? Is there support for the implementation (financial and non-financial)?

No data

Give an estimate of the trend in energy efficiency development using values from -5- to +5 where (-5 is a strong reduction, 0 means neither growth nor reduction, +5 strong growth).

+1 growth

Demand side management, smart metering, storage

No data

10. SWOT analysis

Please make a SWOT-analysis for the development of your region towards a low-carbon economy in 2050. Include stakeholders in the process.

Strengths

- Big RES potential
- A lot of new EU projects that includes low carbon economy politics
- A lot of municipalities have already develop a Low carbon economy plans

Weaknesses

- Poor availability to regional energy data – there is data only on national level
- Lack of investors
- High costs of REN production when compared to conventional energy production sources

Opportunities

- To develop REN
- To improve the EE in Household sector

Threats

- Unpredictable of RES
- No help from politicians

Assess the following trends:

- Policy Support for reaching energy and climate goals
- Public awareness building
- EE Potential Households
- EE Potential Private Sector & Industry
- EE Potential Transport
- Regional REN production
- Availability of relevant energy data

Self-assessment:

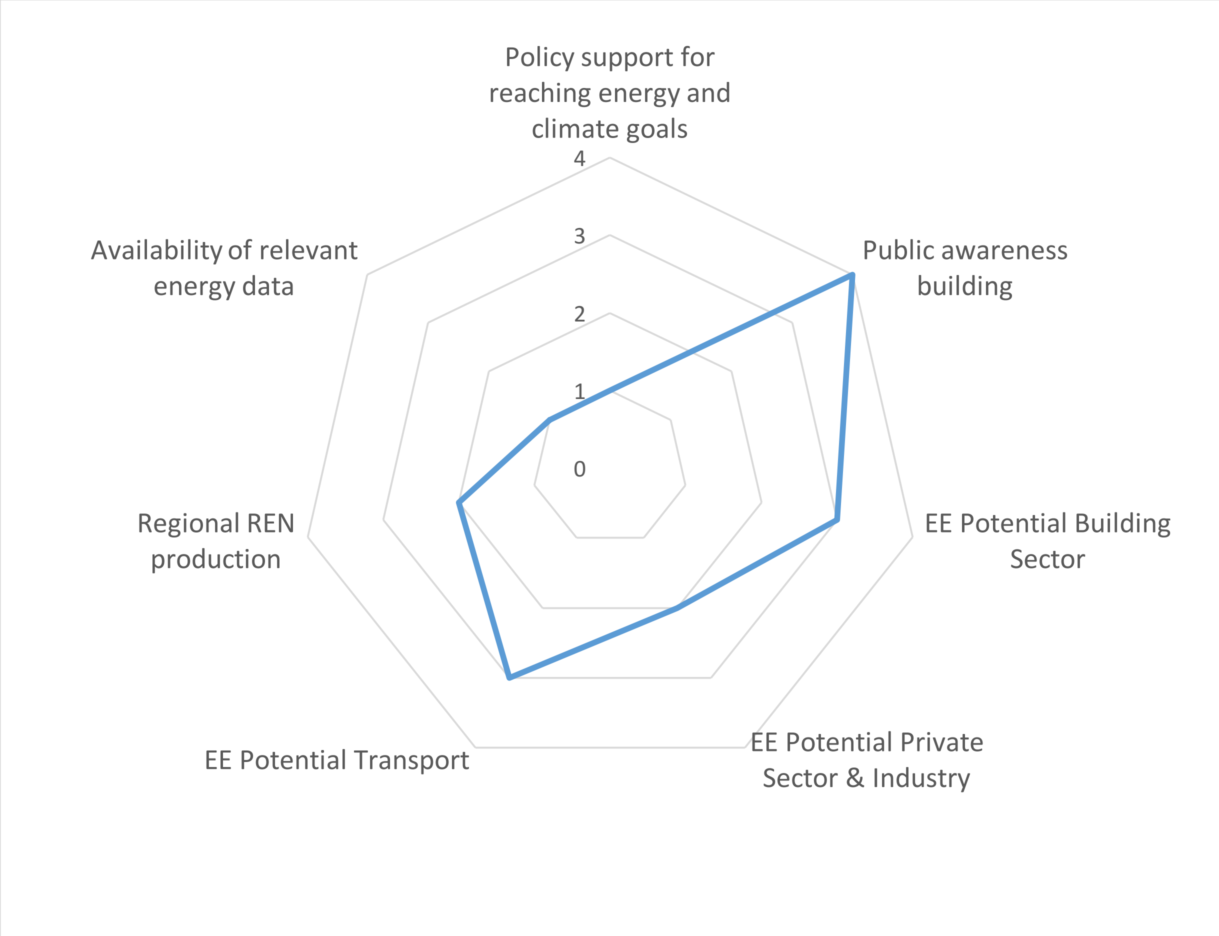
See Excel template or modify the graph provided here (right-click).

Points:

1 … no measures set/ potential unused

to

5 … fully developed/ potential fully used


Policy support for reaching energy and climate goals
4
3
2
1
0
Public awareness building
EE Potential Building Sector
EE Potential Private Sector & Industry
EE Potential Transport
Regional REN production
Availability of relevant energy data

11. Annex: List of sources /bibliography /List of relevant stakeholders/institutions in the region

Please include your sources/bibliography, a list of identified stakeholders, etc

1. Agata Dziakowicz-Grudzień *„Energy expenditure in household budgets in Poland - context of sustainable consumption"*
2. Stanisław Gołębiowski *„Solar energetic in Poland"*
3. Sylwia Słupik *„Restructuring employment in the energy sector in Poland"*
4. Central Statistical Office *„Statistical Yearbook of Poland 2016"*
5. Central Statistical Office *„Consumption of fuels and energy carriers in 2011"*
6. Central Statistical Office " *Energy consumption in households in 2015"*
7. Central Statistical Office *„Residential buildings: National Population and Households 2011"*
8. Institute for Development "*Energy poverty in Poland*"
9. Ministry of Economy "*Strategy for Energy Security and the Environment, the prospect of 2020*"
10. Polish Information and Foreign Investment Agency "*Energy Sector in Poland*"
11. PGNiG *„Environmental report PGNiG Termika 2015"*
12. PWC *„The heat market in Poland"*
13. The Energy Regulatory Office *„Heat energy in numbers 2015"*
14. The Energy Regulatory Office https://www.ure.gov.pl/uremapoze/mapa.html
15. Statistical Office in Warsaw *„Statistical Yearbook of the Mazowieckie Voivodeship 2016"*
16. Statistical Office in Warsaw *„Statistical Newsletter of the Mazowieckie Voivodship"*
17. Statistical Office in Warsaw *„Households and families in Mazowieckie voivodeship. Demographic characteristics"*
18. GeoRenewebles, PGNiG, PGE, Innogy websites

REGIONAL ENERGY PROFILE – 2nd stage

Region: Bucharest-Ilfov,
Romania

PANEL 2050 – Partnership for New Energy Leadership 2050
Deliverable 3.1, English version

By: **AEEPM, Bucharest, Romania**

Date:12/10/2017

Horizon 2020
European Union funding
for Research & Innovation

Table of content

1. Methodology

The main objective of PANEL 2050 project is to create a funcțional network of sustenable energy stakeholders in East and Central Europe. As stakeholders (WHO?) will be included:

- Local government,
- State Energy Agency,
- Energy Service Providers,
- Low-Energy Building Cluster,
- Energy Industries (petroleum, gas, electrical power, coal producers, nuclear power plants, renewable, alternative or sustainable energy companies and traditional energy industry),
- Commercial Energy Interest Groups,
- Commercial non-Energy Interest Groups,
- Umbrella Organizations,
- Higher Education Institutions,
- Advisory Services,
- Grassroots Groups,
- Lobby Group,
- Environmental Centers and
- others.

All of stakeholders will receive support from Local Partners, Project Deliverables and from entire community to collaborate and for creațion of local energy ***visions, strategies and action plans***. The aim of these networks is to contribute to and actively work for the <u>transition towards low carbon communities in 2050</u>. In the course of the project, organisations from 10 CEE countries will collaborate on creating regional <u>*energy strategies*</u> and <u>*action plans*</u>.
This methodology was prepared in order to get a better understanding of the energy-related status quo in the Bucharest – Ilfov Region, analysing strengths, weaknesses, oportunities and threats including challenges with the goal to enforce the transition towards a low carbon community up to 2050.

This energy profile is a basis for the preparation of a **Regional Energy Roadmap** and **related Action Plans** as key elements for the communication with regional stakeholders.

For completing this Regional Energy Profile the following sources were used:

- Romanian legislation related to energy, as follows:
  - Energy Strategy 2016-2030 with the perspective up to 2050 http://www.mmediu.ro/app/webroot/uploads/files/2017-03-02_Strategia-Energetica-a-Romaniei-2016-2030.pdf;
  - National Energy Efficiency Action Plan, the Official Monitor http://ec.europa.eu/energy/en/topics/energy-efficiency/energy-efficiency-directive/national-energy-efficiency-action-plans;
  - Regional Development Plan for Bucharest-Ilfov region, June 2014 http://old.adrbi.ro/media/9437/PDR-BI%20varianta%2012%20iunie%202014.pdf
  - Law 372/2005 – Law for Efficiency Ennergy in Buildings www.mdrap.ro/userfiles/lege372.pdf
  - Law nr. 121/2014 – Energy efficiency law, MO nr. 169 bis/11.03.2015, http://ec.europa.eu/energy/sites/ener/files/documents/MNE%282015%2952216_Monitorul_Oficial_169_bis_PNAEE_3.pdf

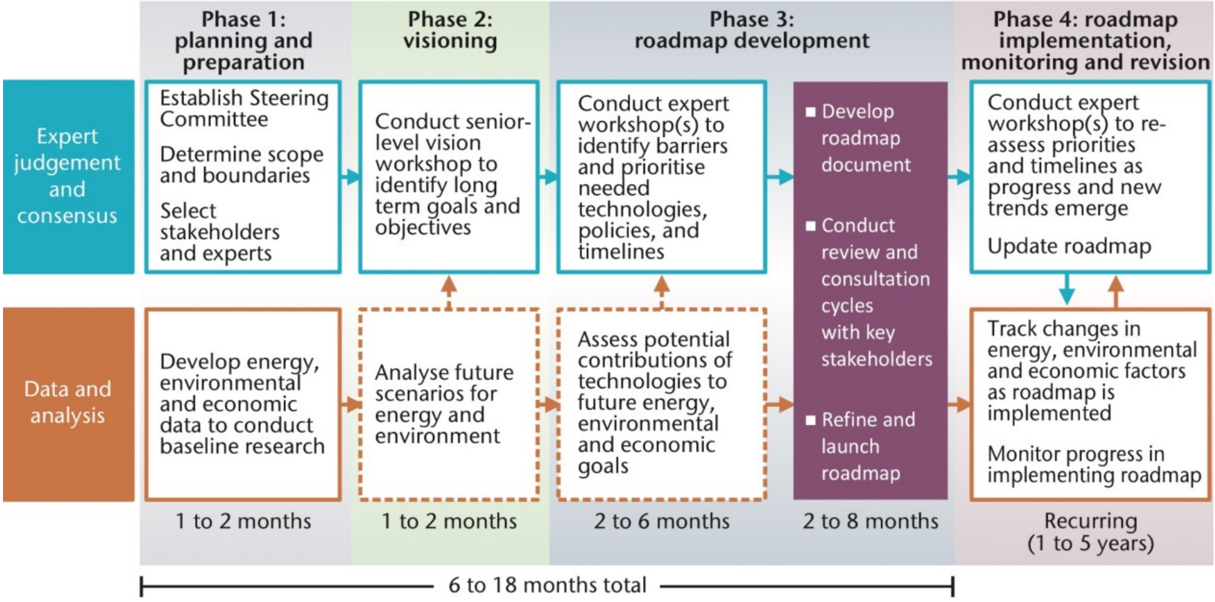
- ANRE Decision 2123/23.09. 2014 – Guide for Energy Audit, http://www.anre.ro/ro/eficienta-energetica/legislatie/legislatie-efic-en
- ANRE Decision nr. 7DEE/12.02.2015 – Recommended model for prepare Energy efficiency program improvement for cities having more than 5000 inhabitants, http://www.anre.ro/ro/eficienta-energetica/legislatie/legislatie-primara
- ANRE Decision nr. 8DEE/12.02.2015 – Recommended model for prepare Energy efficiency program improvement for industry, http://www.anre.ro/ro/eficienta-energetica/legislatie/legislatie-primara
- Law nr. 123/2012 updated in 2016, Law for electrical energy and natural gas

- Operational Program High Infrastructure, 2014-2020, www.fonduri-ue.ro
  - POIM / 60/6/3 / - Projects for the Implementation of Intelligent Measurement of Energy Consumption to Household Users;
  - POIM / 59/6/2 / - Projects for energy consumption monitoring at the level of industrial consumers;
  - POIM / 58/6/1 / - Investment projects in the extension and modernization of power distribution networks;
- Romanian National Institute data related to energy efficiency and sustenable development, http://www.insse.ro/cms/files/Web_IDD_BD_ro/index.htm
  - Objective 1. Structural Transformations and Macroeconomic Balances;
  - Objective 2. Climate change and clean energy;
  - Objective 3. Sustainable transport;
  - Objective 4. Sustainable production and consumption;
  - Objective 5. Conservation and management of natural resources;
  - Objective 8. Global poverty and the challenges of sustainable development;
  - Objective 9. Education and professional training;
  - Objective 10. Scientific research and technological development, innovation;
  - Objective 12. Investment policy and diversification of funding sources;
  - Objective 13. Administrative capacity and quality of public services.

Also, previous projects, developed or in progress, having the contribuțion of Local Agency for Energy Efficiency and Environmental Protection – AEEPM Bucharest, Romania, www.managenergy.ro, can be a very useful source of information related to energy efficiency, such as:

- PUBLENEF, www.publenef-project.eu
- PANEL 2050, www.ceesen.org
- COVENANT CAPACITY, www.covenant-capacity.eu
- INTELLIGENT ENERGY – EUROPE for A SUSTENABLE FUTURE, https://ec.europa.eu/easme/en/intelligent-energy-europe
- MERSHANTILITY, www.meshartility.eu/en

Energy Efficiency Roadmap Outlines Model



Note: dotted lines indicate optional steps, based on analysis capabilities and resources.

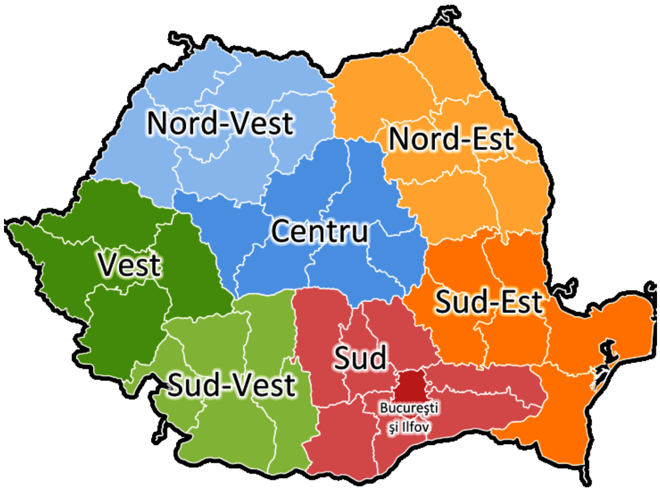
2. General introduction of the region

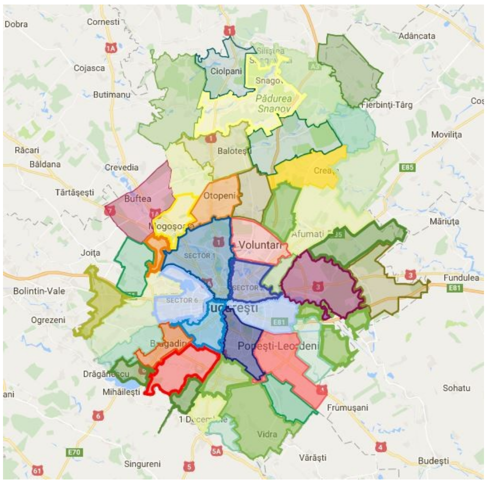
Name of the region and NUTS identification

Name: Bucuresti - Ilfov
NUTS Code: RO32
Region Parent: Macro-regiunea trei (RO3)
Sub-Region(s): Bucuresti (RO321) Ilfov (RO322)

Geography and policy: *Describe the location of the region + provide also a political map showing location of the region in your country*

Bucharest-Ilfov is located in the south of Romania, and includes the capital Bucharest City (13.1% of the territory) and Ilfov county (86,9%). In 2015, about 84,8% of the region's 2.1m population lived in the capital, in contrast with Ilfov county's mostly rural population (National Institute of Statistics - INS 2016). The capital city has the highest socio-economic potential and the highest living standards of the country.





For completing this Regional Energy Profile the following main sources were used:

a) Romanian National Statistic institute www.insse.ro
b) Bucharest Ilfov Regional Development Agency website www.adrbi.ro
c) Romanian Government www.gov.ro and its subsidiaries.

3. Basic demographic data

Regional demographic indicators:

Population of region	2284200	cap
Area of region	1821	km²
Population density	1244	cap/km²
Number of individual municipalities	129	mun.

*Bucharest Capital City, with 6 districts - 8 towns - 32 communes - 91 villages

Source: www.insse.ro, data from 2015

	Buchares	Ilfov	Region Bucharest - Ilfov
Surface (km²)	237,87	1583,28	1821,15
Population	1924299	340566	2264865
Population density (inhabitants per	8090	215	1244
Total dependency ratio	0,37	0,39	0,37
% of population living in urban areas	100	43,5	91,5
% of the population living in rural	0	56,5	8,5
Population by sex urban / rural			
Male	897640	165845	1063485
Female	1026659	174721	1201380
Both sexes urban	1924299	147976	2072275
Male	897640	71950	969590
Female	1026659	76026	1102685
Both sexes rural	-	192590	192590
Male	-	93895	93895
Female	-	98695	98695

During 1990-2011, these regions population has increased significantly as age, a situation unsurprising given the general trend of population aging at national and European level. After a considerable decrease in the percentage of children aged 0-14 years recorded between 1995-2000, the decrease in this category has been slower in recent years. So, during 2000 - 2009, there were decreases of 1.2% per year higher age bracket 0-14 and in 2009 there was even an increase of 0.5% compared to 2007, this increase be positive over the next years, so in 2011 an increase of 0.3% over the previous year. Regarding last 60 years the population growth rate remained around 0.1 percentage annually in 2000-2007, in 2009 was 0.3% higher than in 2007 (19.1% compared of 18.8%), and in 2011 was an increase of 1% compared to 2009.
In our country (like Europe) aging population and declining birth rates are alarming demographic phenomena, which result in progressive reduction in the number of citizens. Increasing life expectancy and declining birth rates became acute in the coming years, as a consequence in the number of people who migrate abroad for a job.

Compared with 2003, total population trends in Bucharest and Ilfov County, there have been increasing number of people, although Bucharest experienced a population decrease over the previous year.
The unemployment rate of persons 20-64 years old was the last in the country (4% in 2009 Eurostat), but it has been gradually increasing after the crisis, reaching 7.2% in 2014 - a sign of Bucharest’s diminishing competitiveness

4. Regional economy and economic trends

Unemployment rate	7,2	%
Average annual income per capita (gross)	9804	EUR
difference from the EU average (34.500 EUR gross annual earning)		%
Share of employees in agriculture industry services	 2,9 25,8 71,3	 % % %
Share of population with tertiary education	?	%

Regional economy

Economy

Regional GDP is the highest of the country (from 24.3% of the national average GDP in 2007 to 27% of the national average GDP in 2012), with GDP per capita 2.4 times higher than the national average (in 2012), showing a striking disparity in terms of living standards between the capital region and the rest of Romanian regions.

However, it is only as large as 0.25% of the EU28 nominal GDP average over the same period.

Bucharest-Ilfov had a 7-8% average annual GDP growth rate over 2009-2012, due to a sharp drop in economic activities in 2008. However, given its economic structure based on services, processing industries, retail and trade, real estate and public administration, the capital region grew by 11.8% in 2011 as opposed to 2010. These sectors also employ the largest shares of workforce. Employment share in high-tech industries and knowledge-intensive services over 2008-2014 is low at 5.2 – 7.2% in comparison to EU28, but it is around three times the national average. (Eurostat).

Bucharest-Ilfov is the most important FDI attractor in the country, receiving a disproportionately large amount of inflows in comparison to the rest of the regions (about 59.2% of the country's total FDI inflow in 2014 (National Bank of Romania & INS, 2016).

The region's strengths are specific mainly to Bucharest City: much higher capacity for regional growth, job creation and workforce attraction, better development of the local service economy and industry base, higher density of HEIs and RDI potential, highly educated workforce, most important national transportation node, higher availability of public utilities and telecom infrastructure. Some weaknesses are more visible in Bucharest City (traffic congestion, social exclusion and fragmentation), others in Ilfov county (inadequate development of basic services, sanitary/health, education and IT/telecom infrastructure, lower work productivity and income than Bucharest).

Regional economic indicators:

GDP, total	12,4	million EUR
GDP per capita	19 063	EUR/cap
HDI		

Data from 2015

GDP per economic sectors:		
Agriculture	7	% of total GDP
Industry	36	%
Services	57	%

Data from 2015

5. National and local energy strategies

Table: The productive specialization of Bucharest-Ilfov region in 2011

	Gross Value Added in Bucharest-Ilfov (%) va_{bi}	**Gross Value Added in Romania (%)** va_R	**Specialisation quotient for Bucharest-Ilfov** (va_{bi}/ va_R)
Agriculture	0.34	6.52	0.05
Constructions	9.95	8.07	1.23
Industry	19.87	28.82	0.69
Services	69.84	56.59	1.23

Source: own calculations based on National Institute of Statistics data

number of operating entrepreneurs (SMEs, large and individual)	**126554**	
→ share of SMEs	24,9	% of total number of operating businesses
number of operating non-profit organisations	?	
Amount of EU funds (2007-13)	?	EUR

	Romania	**Bucharest-Ilfov**
Population	19 870 647	2 284 200
Unemployment Rate	6.6%	4.6% (<2%)* Nat. Ag. Employm.
Employees	5 152 118	1 056 235
Companies	507 440	126 554 (24.93%)
Companies / 1000 people	**25.5**	**55.4**
Industrial Parks	70	2
Gross avg. earnings (EUR)	567	792
GDP/capita (EUR)	8 083	19 063
State aid intensity	10-50%	15% Bucharest / 35% Ilfov

The productive specialisation of the area emphasizes the dominant share and the leading position of Bucharest-Ilfov in services sector. As a matter of fact, the structure of the Gross Value Added by the main activity shows more similarities with the EU profile rather than with other Romanian NUTS 2 regions or national economy. Hence, the share of services is almost 70%, followed by industry (19.87%), constructions (9.95%), and agriculture (less than 1%). The comparison with the national structure reveals a specialisation in services and constructions (Table). Within the services sector, telecommunications, financial agency, education, R&D, transportation and storage, tourism and cultural services, real estate transactions, renting and service activities provided to business firms, and trade have major shares. Although the share of industry (manufacturing) is lower, mention should be made of the fact that it specialises in industries of an increasing demand both at national and

international scale (e.g. ICT components, software, computer components assembly, electronics, mechatronics, mould design and production, etc.), which are knowledge-intensive, creative activities. Important signs of transformation of the urban structure from sectoral specialisation to functional specialisation can also be perceived. These signs can be justified by the changes occurring in the organisation of firms concerning the decrease of remote management costs, combined with the need for a new urban balance and with the requirements for reducing traffic jams, pollution (Duranton and Puga, 2005). Bucharest has begun its shift from specialising by sector - with integrated headquarters and plants - to specialising by function - with headquarters and business services concentrated within the city, and plants located in the surrounding towns or even in smaller cities in the neighbouring counties, belonging to South-Muntenia region (Constantin, 2012).
The attractive business environment of Bucharest-Ilfov has determined a significant orientation of FDI towards this region. Thus, the share of Bucharest-Ilfov in Romania's FDI stock in 2012, which amounted to a total of EUR 59.13 billion, was of 60.6%. The South-Muntenia region has a share of only 7.2% (National Bank of Romania and National Institute of Statistics, 2013). However, it ranks fourth among the eight Romanian regions, showing the huge polarisation between Bucharest-Ilfov and the rest of the country on the one hand and the influence of Bucharest proximity on the attraction of foreign investors by its hinterland, the South-Muntenia region, on the other hand. Thus, South-Muntenia region holds the third position in terms of FDI even if it ranks only the fifth in terms of GDP per capita, with 39% of the EU average.

Table: Turnover, Net Investments and Personnel in South– Muntenia Region against Bucharest- Ilfov Region

	South– Muntenia Region			Bucharest-Ilfov Region		
	Turnover (million RON, current prices)	Net Investments (million RON, current prices)	Personnel (no persons)	Turnover (million RON, current prices)	Net Investments (million RON, current prices)	Personnel (no persons)
Total	97848	7536	472796	316201	36680	971683
Mining and quarrying	854	1466	18606	584	183	2461
Manufacturing	43655	3125	172158	31555	3913	135783
Electricity, gas and water	2204	330	6663	23616	2129	17333
Water supply; sewerage, waste management	1312	120	8405	2707	350	16707
Constructions	8541	447	56114	29056	9011	108067
Trade	30311	919	105075	152757	5639	249608
Transport, storage and postal services	4495	656	35819	13149	5293	76222
Hotels and restaurants	925	98	14014	3182	644	31684
Information and communication	1588	41	6467	23330	2920	78776
Real estate services	3102	277	39004	31421	6036	208640
Education	39	4	1197	248	21	3614
Health and social care	169	32	3266	1290	210	14424
Other services	653	21	6008	3306	331	28364

Source: NIS data

6. Energy production

6.1 Conventional energy production capacities (fossil fuels and nuclear power)

Name & Location (city, town)	Owner	Year of commissioning (refurbishment)	Type of plant & fuel	Capacity in MW	Annual energy production in MWh	Annual CO_2-emissions in t	Utilization rate (qualitative assessment)
Nuclearoelectrica Cernavoda, Constanța	Public company	1995-U1 2007-U2	CANDU-600 U natural	1400 MW	6,4 mil MWh	N/A	Constantly
TermoEnergy Complex Rovinari	Public company	1976-1979	Lignite	1320 MW	5 mil MWh	4,469,942	Constantly
ELCEN Bucharest	Public company	2002	Gas natural Petrol	1286 MW EE 5.634 MWt	2,261 TWh + 4.612,163 Tcal	950,000	Constantly

Details and a complete environment are included in Energy Strategy 2016-2030 with the perspective up to 2050[1] and in website www.anre.ro

6.2 Renewable energy production

Name & Location (city, town)	Owner	Year of commissioning (refurbishment)	Type of plant & fuel	Capacity in MW	Annual energy production in MWh	Annual CO_2-emissions in t	Utilization rate (qualitative assessment)
Iron Gate – Drobeta Turnu Severin	Public	1971	Hidro	1080	7,123,000	0	Constantly
Wind farm Fântânile - Constanța	CEZ	2008-2010	Wind	600	120,000	0	Sometimes
Solar power Romania	Private	2013	Solar	1231	200000	0	Sometimes

The main renewable regenerable energy is produced from hidro and wind.

Details and a complete environment are included in the *National Action Plan on Renewable Energy*, 2010[2]

6.3 Transmission and distributions

The transmition and distribution of energy is split on:

a) **Electrical Energy** transmition and distribution provided by national company Transelectrica www.transelectrica.ro. As structure, it includes:

- 1 station - 750 kV
- 38 stations - 400 kV
- 42 stations- 220 kV
- 8834.4 km aerian electrical lines (LEA)
- 216 local trafo points

This infrastructure supports 7606 MW (EE consumption) and 6777 (EE production - see http://www.transelectrica.ro/web/tel/sistemul-energetic-national

b) **Petrol pipe transport** see www.conpet.ro

c) **Natural gas transport** see:

a. http://govnet.ro/Energy/Economics/Natural-gas-transport-project-AGRI-gets-Romania
b. https://iclg.com/practice-areas/oil-and-gas-regulation/oil-and-gas-regulation-2017/romania

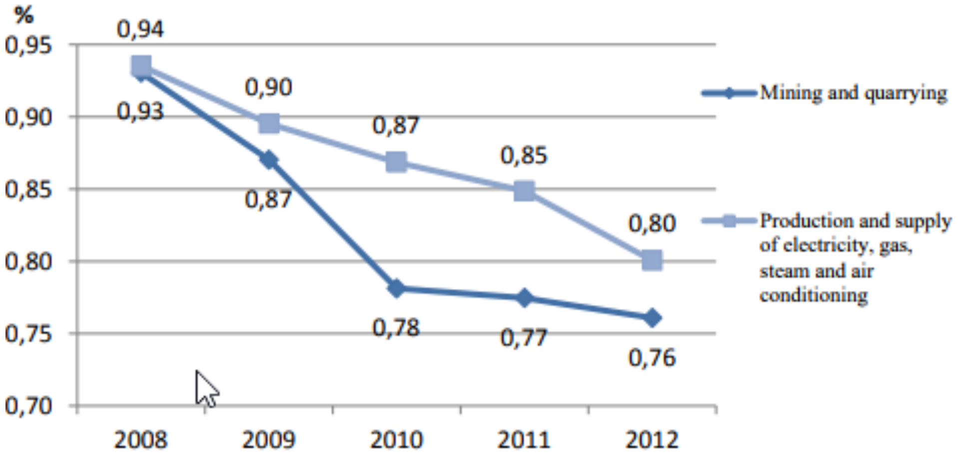
d) **The thermal energy** in a centralised system (partial) in the municipal level and consists all the activities related to the thermal energy transmission, distribution and carried out at the level of administrative and territorial units under the supervision, coordination and responsibility of the local public administration or the community development associatons, as applicable.

Details and a complete environment are described in the General Transport Master Plan for Romania, approved in 2015[3];

6.4. Jobs in the energy sector

Give an overview about the status of the energy sector in the regional economy. How many jobs are there at the moment in the energy sector. How important are new "green job" for regional economy development. If possible, quantify investments in the energy sector.

As you can see in the energy sector, the jobs are in a process of reduction especially in the energy intensive sectors.



Sourse: National Institute of Statistics www.insse.ro

The "green jobs" are increased especially in the private sector, but as temporary. Lack of clear strategy made this sector very oscillating.

There are some initiatives to increase this kind of jobs by:

- Energy Community UE – legal framework fourth edition[4];
- Romanian National strategies for competitivenes [5]

7. Final energy consumption

7.1. Households

***Final energy** is a form, which might already been subject to conversion from the raw fuel. It is the energy made available to the user.*

For the sectoral analysis please use regional statistics as far as they are available to you and quote your sources.

If no regional data is available please use the Excel tool, which will give you a suggestion to estimate the needed indictors using national statistics.

Please always use kWh, MWh, GWh, etc. You can find a good conversion tool here:
[*https://www.iea.org/statistics/resources/unitconverter/*](https://www.iea.org/statistics/resources/unitconverter/)

Regional final energy consumption of household sector	10.110	GWh/a

Heat consumption

Total heat energy consumption of households sector (heating and hot water consumption)	8743	GWh/a
Average heat energy consumption per household	7857,12	kWh/a/hh

Based on local initiatives to renovate residential building stock, about half of Bucharest apartments are renovated and this process is in progress. In the renovated apartments the energy consumption for heating decreases by 20-30%

Electricity

Electricity consumption of households	1354	GWh/a
Average electricity consumption per household	3725	kWh/a/hh

Describe if there are any national or regional programmes for reducing household electricity consumption (e.g. washing machine or refrigerator replacement programme). If yes, please elaborate it briefly.

There are no incentives, but there are few awareness raising campaigns.

Cooking

Gas consumption for cooking appliances of households	2	GWh

Describe if gas is a significant energy source for cooking in the household sector.

The majority of gas is used for space heating and to a lesser extent warm water preparation. A distinction of how much of it is used for cooking cannot be made.
The main distributor of natural gas is GDF SUEZ through its local company ENGIE www.engie.ro No specific information as natural gas consumption for Bucharest -Ilfov region. At national level Engie company reports a 40.5 TWh (2014)

General information

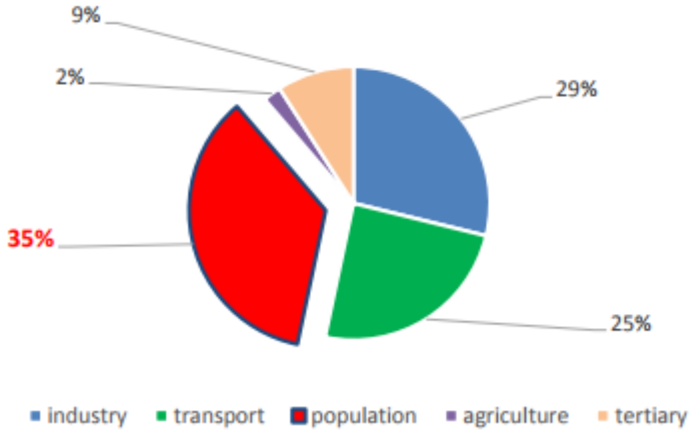
Household electricity price	0.080	EUR/kWh (incl. taxes)
Household natural gas price	0.034	EUR/kWh (incl. taxes)
Household district heating price	0.040	EUR/kWh (incl. taxes)
Household price for energy from firewood	0.037	EUR/kWh (incl. taxes)
Energy expenditure by household	5.5	% of income

Source: http://ec.europa.eu/eurostat/statistics-explained/index.php/Energy_price_statistics

In Romania, the energy market is liberalized. Now, many contracts between consumers and providers are reviewed. It seems that the energy price is decreasing but it has a peak in the winter period. Doesn' t exist a crise of energy in the region.

Average household size, 2015 [people per household]	*Multi-family houses*		*Single-family houses*		*Household energy consumption for space heating [kWh/m2] (Adjusted to EU average weather)*	*Average electricity consumption per electrified household [kWh/hh]*
	% of multi-family dwellings	*Average size of multi-family dwelling [m^2]*	*% of single-family dwellings*	*Average size of single-family dwelling [m^2]*		
2,7	**43**	**48**	**57**	**73**	**145**	**1674**

Share of household energy consumption in total final consumption-2013



Source: Romanian Statistical Yearbook

7.2. Service Sector

Regional final energy consumption of service sector	1805	GWh

The regional economy is service based, but the service sector does not constitute a majority of the energy consumption.

Estimate: 0, because there is a slight growth trend for the electricity consumption in the service sector and a downward trend for the heat consumption.

The region has the largest share of SMEs and large enterprises of the country, reaching 24.9% in 2014 (INS[6] 2016). Bucharest-Ilfov is the most important FDI attractor in the country, receiving a disproportionately large amount of inflows in comparison to the rest of the regions (about 59.2% of the country's total FDI inflow in 2014 (National Bank of Romania & INS, 2016).
The region's strengths are specific mainly to Bucharest City: much higher capacity for regional growth, job creation and workforce attraction, better development of the local service economy and industry base, higher density of HEIs and RDI potential, highly educated workforce, most important national transportation node, higher availability of public utilities and telecom infrastructure. Some weaknesses are more visible in Bucharest City (traffic congestion, social exclusion and fragmentation), others in Ilfov county (inadequate development of basic services, sanitary/health, education and IT/telecom infrastructure, lower work productivity and income than Bucharest).

7.3. Industry

Total energy consumption of the industrial sector	1150	GWh
Industry electricity price	0,080	EUR/kWh (incl. taxes)
Industry natural gas price	0.034	EUR/kWh (incl. taxes)
Household district heating price	0.040	EUR/kWh (incl. taxes)
Household price for energy from firewood	0.037	EUR/kWh (incl. taxes)

The biggest electricity consumer is Iron and steel industry and Chemical, but a high development can be considered in the IT&C.

Only 6.3% of enterprises were active in the industry sector in 2014, with a declining trend that accentuated since the crisis

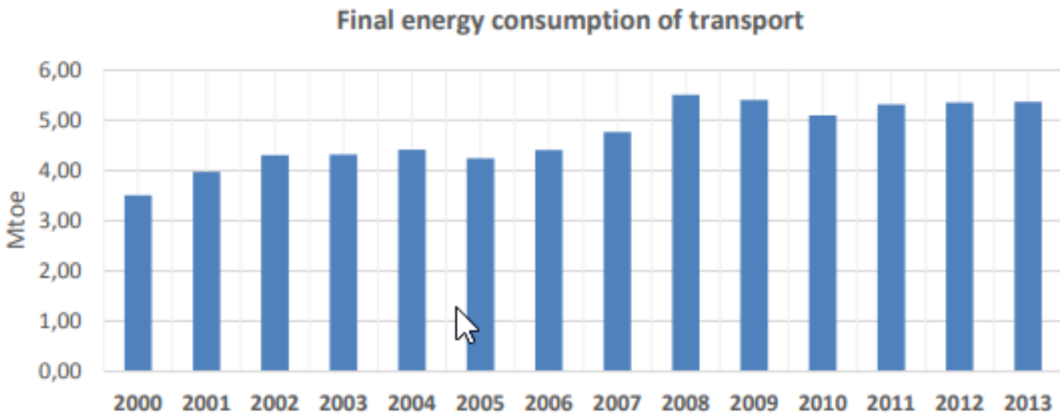
Final energy consumption [TJ]	*Iron and Steel*	*Non-Ferrous Metals*	*Chemical and Petrochemical*	*Non-Metallic Minerals*	*Mining and Quarrying*	*Food and Tobacco*	*Textile and Leather*
Romania	**76.412**	**0**	**59.395**	**39.357**	**1.461**	**23.424**	**7.172**

Paper, Pulp and Print	*Transport Equipment*	*Machinery*	*Wood and Wood Products*	*Construction*	*Non-specified (Industry)*
5.162	**9.466**	**14.716**	**12.128**	**16.321**	**5.948**

Source: Eurostat.

7.4. Transport

At national level the statistics are shown in the following chart:



The share of the transport energy consumption in the total final consumption of Romania in 2013 was 25% of total energy consumption (total consumption of Romania – 32,4 mil tep equivalent x 11.6 = 723000 GWh.

Regional final energy consumption of transport sector	1150	GWh

Romania has a very diversified transport, such as:

- Road: about 6000000 cars on the 86060 Km of roads (747 km highway):
- Rail: 20077 Km railways
- River: Danube + Danube – Black sea channel: 1150 Km
- Maritime: Danube (100Km) & Black sea
- Air: 16 airports, 16.4 million passengers (2016)
- Main airport is Bucharest- Otopeni (OTP).

There is no direct data how much of the final energy consumption attributes to the transport of passengers and how much to freight.

Passenger transport

Motorisation rate - number of passenger cars/1 000 inhabitants	502	
Regional energy consumption of passenger transport in the region	?	GWh

Freight transport

Regional energy consumption of road freight transport	?	GWh

Source: http://www.drpciv.ro/info-portal/ ; http://ec.europa.eu/eurostat/statistics-explained

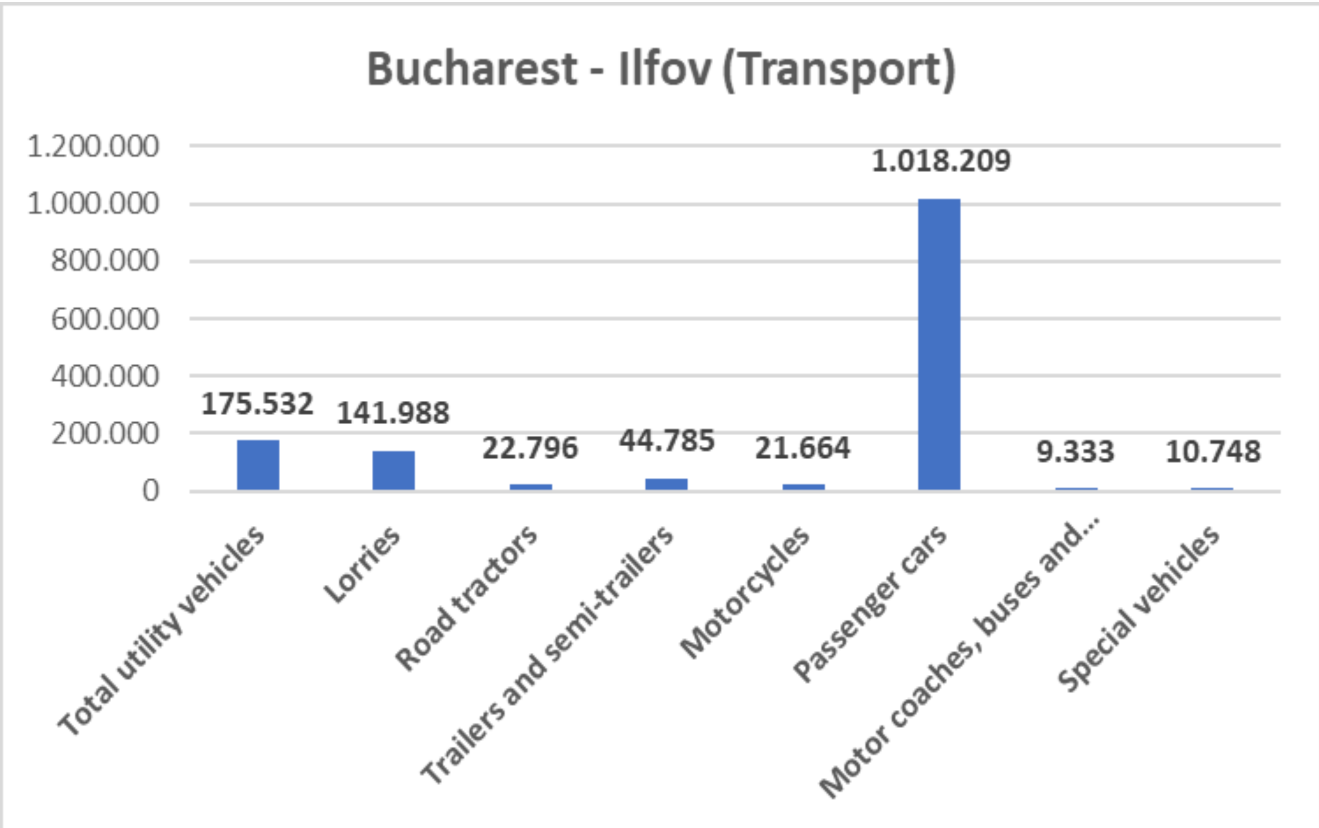
Use of alternative fuels

There was a support scheme in 2016 for purchasing electric cars. The support was up to 30% of the cars price, but not more than 2000 €.

The energy consumption of the transport sector will grow in the coming decades. Estimate: +3.

Urban mobility development plan is developed 9215). More details are described on www.pmud.ro

Stock of vehicles	All vehicles (except trailers and motorcycles)	Total utility vehicles	Lorries	Road tractors	Trailers and semi-trailers	Motorcycles	Passenger cars	Motor coaches, buses and trolley buses	Special vehicles
Romania	**5.792.458**	**840.611**	**712.317**	**94.206**	**324.859**	**100.695**	**4.907.564**	**44.283**	**34.088**
Macroregiunea unu	1.443.504	208.169	175.177	25.610	101.589	32.699	1.225.431	9.904	7.382
Nord-Vest	755.432	112.028	93.225	15.596	48.887	13.603	638.230	5.174	3.207
Centru	688.072	96.141	81.952	10.014	52.702	19.096	587.201	4.730	4.175
Macroregiunea doi	1.345.554	201.384	175.980	19.078	72.658	17.623	1.132.851	11.319	6.326
Nord-Est	688.320	103.959	91.107	9.778	34.560	8.835	578.730	5.631	3.074
Sud-Est	657.234	97.425	84.873	9.300	38.098	8.788	554.121	5.688	3.252
Macroregiunea trei	1.934.630	285.736	235.311	35.038	86.099	32.006	1.633.577	15.317	15.387
Sud - Muntenia	731.556	110.204	93.323	12.242	41.314	10.342	615.368	5.984	4.639
Bucuresti - Ilfov	**1.203.074**	**175.532**	**141.988**	**22.796**	**44.785**	**21.664**	**1.018.209**	**9.333**	**10.748**
Macroregiunea patru	1.068.770	145.322	125.849	14.480	64.513	18.367	915.705	7.743	4.993
Sud-Vest Oltenia	513.217	73.038	65.116	5.472	29.312	5.429	436.192	3.987	2.450
Vest	555.553	72.284	60.733	9.008	35.201	12.938	479.513	3.756	2.543



7.5. Summary

7.5.1. Final energy indicators

General indicators for the region

Use the Excel tool to fill the following tables and generate graphs.

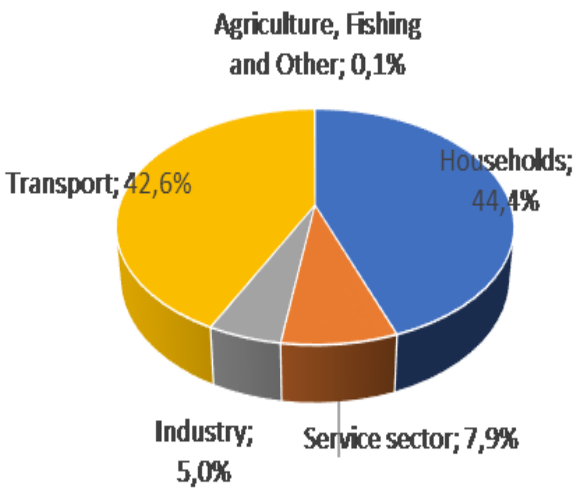
If regional data is available, use this information and quote your sources.

Total final energy consumption	22781,61	GWh
Final energy consumption per capita	8464,52	kWh/cap
Electricity consumption per capita	607,39	kWh/cap
Heat consumption per capita	7857,12	kWh/cap
% of total country consumption	18%	%

Source: www.insse.ro

Final energy consumption per sector

			%
Households	10.109,96	GWh	44,4%
Service sector	1.804,50	GWh	7,9%
Industry	1.149,66	GWh	5,0%
Transport	9.702,49	GWh	42,6%
Agriculture, Fishing and Other	15,00	GWh	0,1%
Sum	**22781,61**	**GWh**	

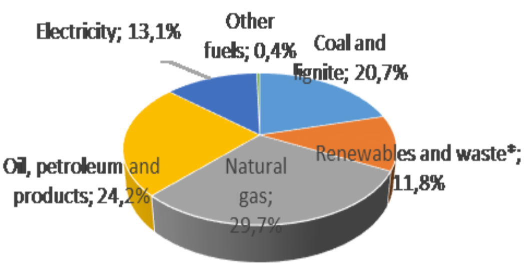


Estimate: -1. There will be a slight reduction, mainly because of the decreasing heat consumption due to energy efficiency measures for buildings. This estimate is based on the actions that are already done. If the state would be more active in this matter, then the estimate could be even better.

7.5.2. Final energy consumption by fuel

Total final energy consumption by fuel

			%
Coal and lignite	3508,37	GWh	15,4%
Renewables and waste*	2984,39	GWh	13,1%
Natural gas	6196,60	GWh	27,2%
Oil, petroleum and products	1298,55	GWh	5,7%
Import	3804,53	GWh	16,7%
Other fuels	4989,17	GWh	21,9%
Sum	**22781,61**	**GWh**	



7.5.3. Primary energy equivalent

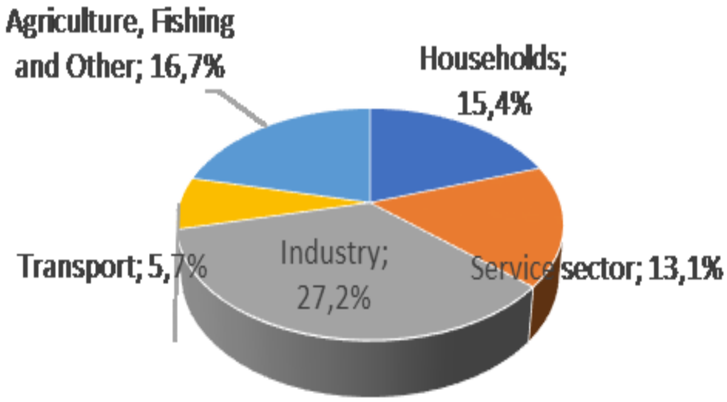
Primary energy *is an energy form found in nature that has not been subjected to any conversion or transformation process. It is energy contained in raw fuels.*

Total Primary Energy Consumption	26158,50	GWh
Primary energy consumption per capita	11626,00	kWh/cap
Primary energy factor of electricity	1,1	-
Energy intensity	226,7	TPES/GDP

11626,00

Primary energy equivalent by sector

		final energy		**Primary energy factor**	**primary energy**		**%**
Household		10109,96	GWh		11414,78	GWh	43,6%
Electricity		1366,64	GWh	*1,315*	1797,13	GWh	
Heat		8743,33	GWh	*1,1*	9617,66	GWh	
Service & industry		1804,50	GWh		1984,95	GWh	7,6%
Electricity			GWh	*1,315*	0,00	GWh	
Heat		1804,50	GWh	*1,1*	1984,95	GWh	
Transport		9702,49	GWh		0	GWh	0,0%
Electricity			GWh	*1,315*	0,00	GWh	
Heat			GWh	*1,1*	0	GWh	
Petrol		9702,49	GWh	1,315	12758,77	GWh	48,8%
			Sum		**26158,5037**	**GWh**	



Source: http://sistemulenergetic.com

Less than 20% of Petrol and Natural Gas is imported

Dependency on fuel imports: low The dependency is in some categories very low, for example the country produces more electrical energy than it consumes (sometimes), but it needs to import other times. On average the dependency is Low.

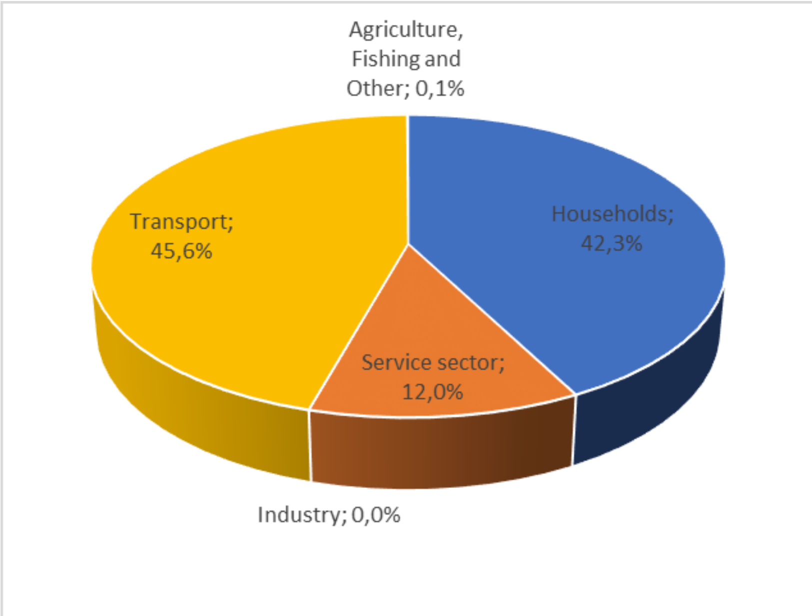
7.5.4. Regional COError! Bookmark not defined.

Total CO_2-emission associated with energy sector	0,01	Mio t
CO_2-emissions per capita	0,02359369	t/cap
CO_2-emissions per GDP	0,531283007	t/€ GDP

Energy-related CO_2-emissions by sector

			final energy		CO2-emission factor [t/MWh]	CO2-emissions		%
Households			10109,96	GWh		2249,43	t CO_2	42,3%
	Electricity		1366,64	GWh	*0,35388*	483,62	t CO2	
	Heat		8743,33	GWh	*0,20196*	1765,80	t CO2	
Service sector			1804,50	GWh	*0,35388*	638,58	t CO2	12,0%
	Electricity		0,00	GWh	*0,20196*	0,00	t CO2	
	Heat		1804,50	GWh	*0,35388*	638,58	t CO2	
Industry			9702,49	GWh	0,20196	0,00	t CO2	0,0%
	Electricity		0,00	GWh	*0,35388*	0,00	t CO2	
	Heat		0,00	GWh	0,20196	0,00	t CO2	
Transport	Petrol		9702,49	GWh	0,24948	2420,58	t CO2	45,6%

Agriculture, Fishing and Other			15,00	GWh	0,26676	4,00	t CO2	0,1%
					Sum	**5312,58**	**t CO2**	



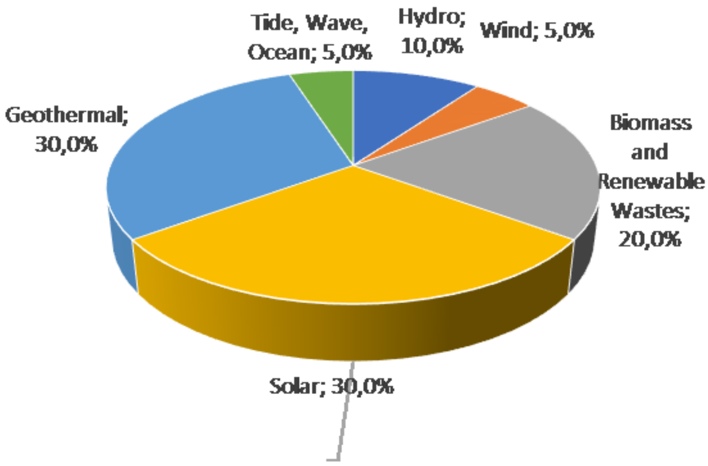
8. Renewable energy sources – status and potential

8.1. General information

Renewable Energy Targets:		
2020 RES share in gross final energy consumption	25	%
2030 RES share in gross final energy consumption	30	%
Current RES share (2016)	25	%
thereof RES out of the region	25	%

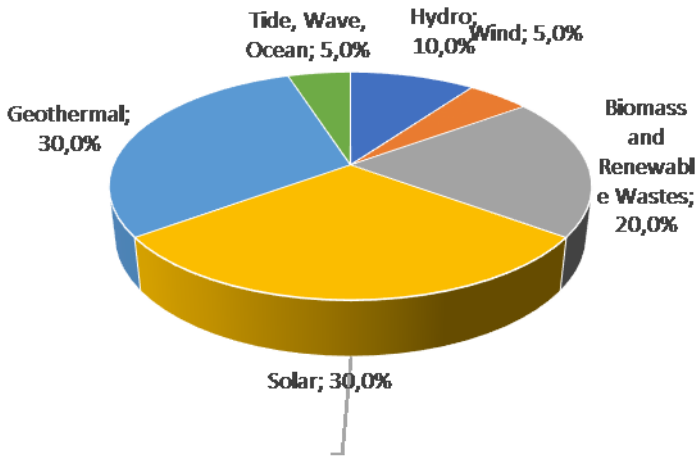
Share of final energy consumption produced by renewable fuels

			weighted average (assumption according to regional capacities)
Hydro	**10**	GWh	**10,0%**
Wind	**5**	GWh	**5,0%**
Biomass and Renewable Wastes	**20**	GWh	**20,0%**
Solar	**30**	GWh	**30,0%**
Geothermal	**30**	GWh	**30,0%**
Tide, Wave, Ocean	**5**	GWh	**5,0%**
Sum	**100**	GWh	**100,0%**



Share of total electric demand covered by renewable fuels

			weighted average (assumption according to regional capacities)
Hydro	5	GWh	10,0%
Wind	2,5	GWh	5,0%
Biomass and Renewable Wastes	10	GWh	20,0%
Solar	15	GWh	30,0%
Geothermal	15	GWh	30,0%
Tide, Wave, Ocean	2,5	GWh	5,0%
Sum	**50**	**GWh**	**100,0%**



Electric vehicles that where bought with state subsidy have a commitment to use electricity from renewable sources.

Wind and solar energy is the energy sources with the second highest share of the renewable sources in electricity production

There have been launched subsidy campaigns for "Green" certificates. This program still it is place.

Legislation does not favour energy unions. If somebody (anybody like household) wants to sell electricity to another entity (to distributor of energy) then they have to register as a grid operator, which is a significant barrier. There is an ongoing debate, if forestry regulations are too strict and restrain biomass use for energy. Renewable energy is not clearly set as a priority by the state.

Estimate: +3. In the long run there is no alternative, but it will take time. A supporting factor is the sentiment of the population to adapt new technologies and also a desire to be an energy producer themselves.

8.2. Available natural resources in the region

Geotermal and photovoltaic energy could be valorified in the region Bucharest - Ilfov. Some development are in progres. For example https://therme.ro/ro.

8.2.1. Biomass

Partial. Even in Romania there a significant biomass (forrest) doesn t exist technology to be used for energy. It is used direcly in rural area for heating.
http://www.interregeurope.eu/fileadmin/user_upload/tx_tevprojects/library/file_1504270036.pdf

8.2.2. Hydro power (incl. tide and wave power)

No significant hydropower plants in the region.

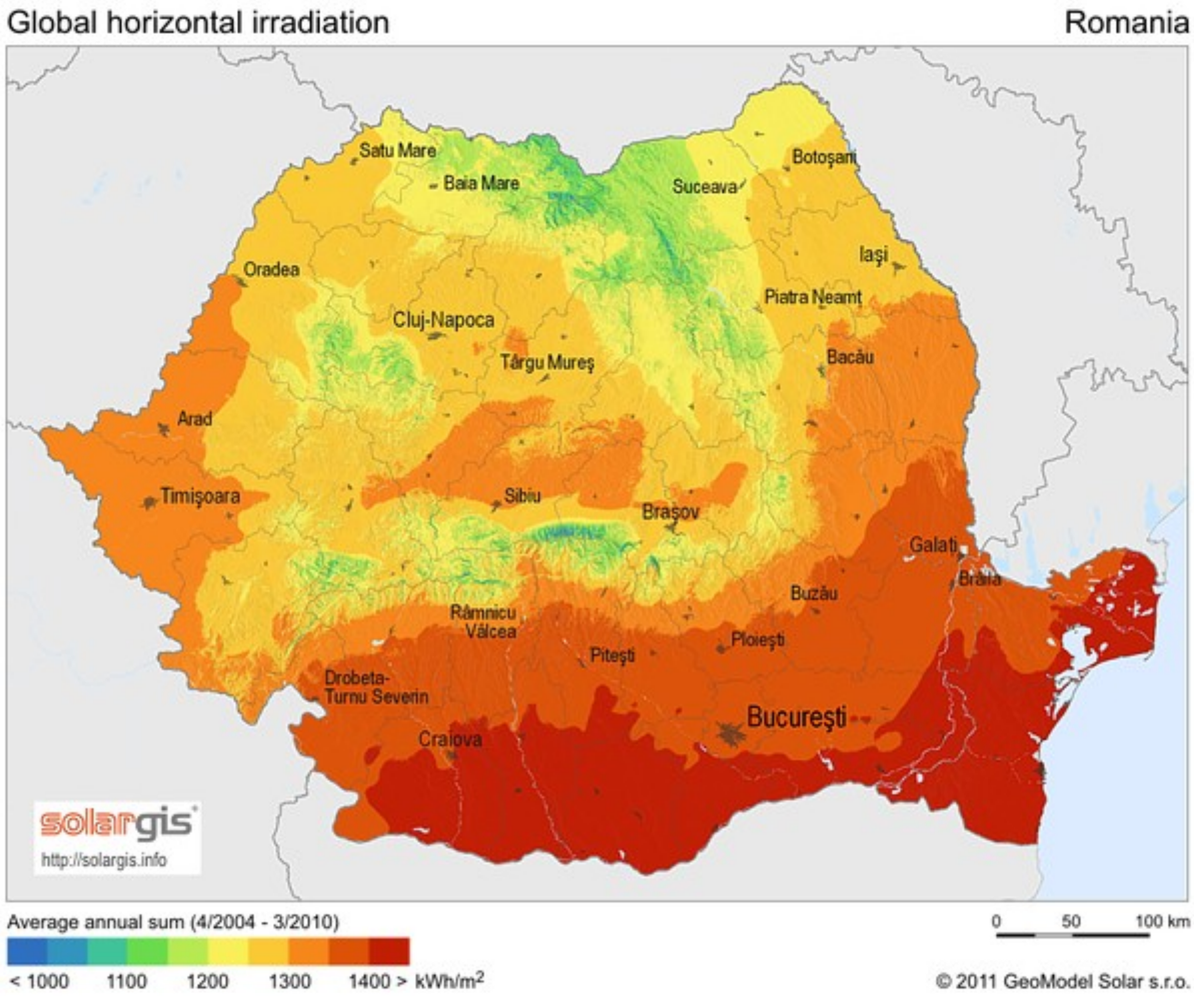
8.2.3. Solar power

Solar irradiation (on optimally inclined plane) per year	from 1050 to 1150	kWh/m²

Give an overview of both solar thermal and PV usage at the moment and describe the energy potential based on geographical and political frameworks.
Signs
Yes

Solar solutions is applied for local photovoltaic systems and bateries for road Some instituțions use photovoltaic systems like Politechnic University https://www.energ.pub.ro

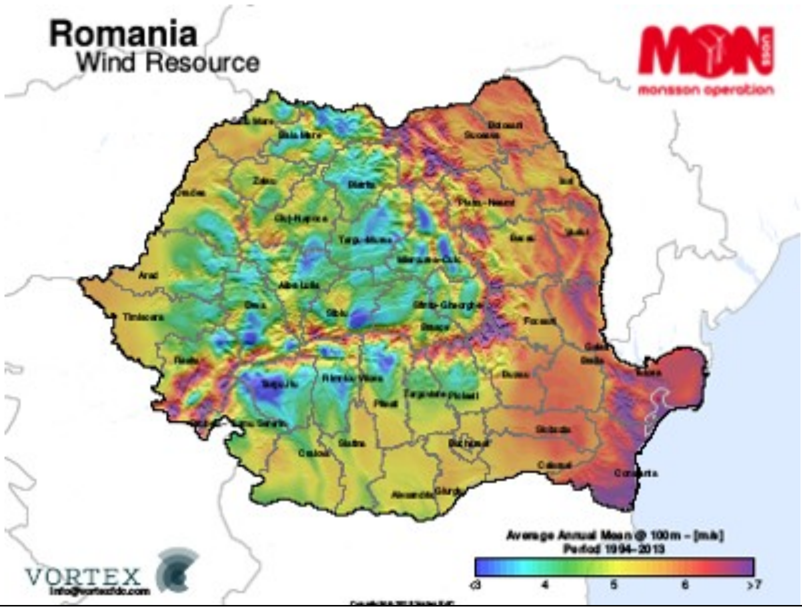
Map indicating solar irradiation in the region.



8.2.4. Wind power

No significant, http://www.wroromania.ro/blog/wp-content/uploads/2016/03/turbina-e.pdf

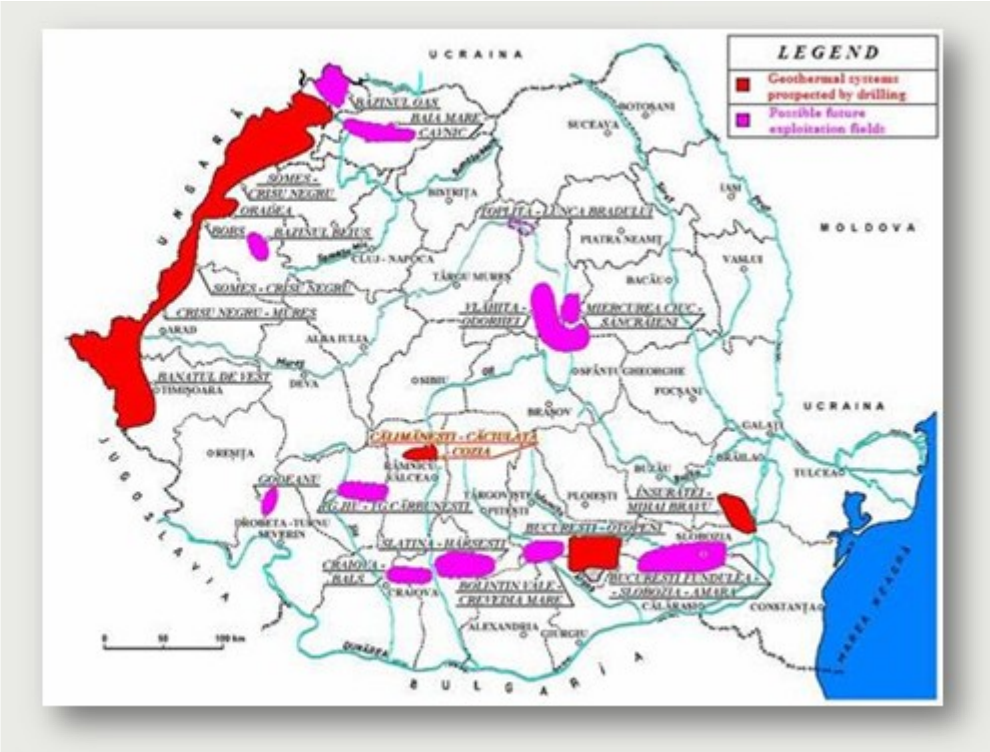
Average wind velocity	from 2.5 to 7	m/s
Full load hours	1900	h/a



No industrial application of wind energy. As experimental for some farms and research institutes it is applied

8.2.5. Geothermal energy

Yes. http://www.ahgr.ro/media/85718/forajgeoterm_balotesti.pdf



Is applied but not for energy production

8.2.6. Waste

Yes. But not as an industrial production
http://www.anpm.ro/web/apm-bucuresti/-/managementul-deseurilor-de-ambalaje?inheritRedirect=true
http://www.anpm.ro/anpm_resources/migrated_content/files/ARPM%20BUCURESTI/Programe%20Proiecte/Strategii/SNDDverVIrev2-10sept.pdf

8.2.7. Other natural resources

N/A

8.2.8. Restriction through protected areas

N/A. No protected area in Bucharest and Ilfov county

9. Energy efficiency – status and potential

Regional Energy Sector Assessment

Due of reduction of economic activity, practically the EU objective of energy consumption reduction is achieved. 20% reduction of fossil use; 20% energy consumption reduction, 20% energy from REN Now the focus is to move to 2030 objectives and to reduce the energy consumption in houses

There are currently no energy efficiency measures specifically targeted for the service sector.

The industry implements energy efficiency measures largely by themselves to be competitive.

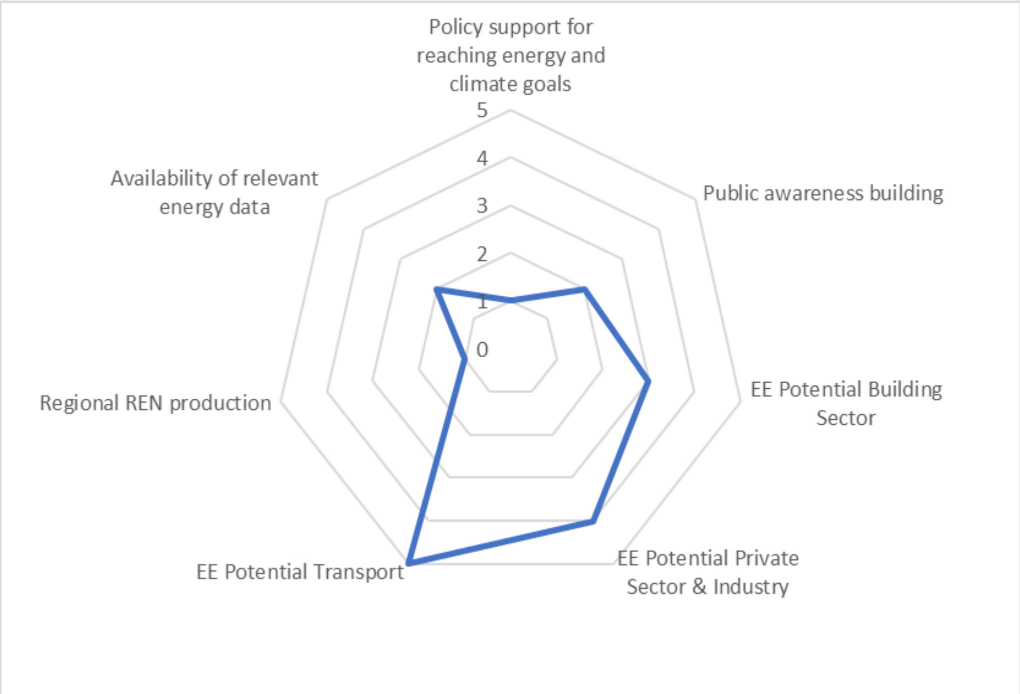
The efficiency of the transport sector is supported with an electro-mobility programme that established a countrywide loading network for electric cars.

There are subsidies to renovate and improve the energy efficiency of the building stock. For both, individual dwellings as well as for apartment buildings.

Demand side management, smart metering and storage

Demand side management gets more widespread as home automation systems is in progress.

	Self-assessment - 1 … no measures set/ potential unused; 5 … Fully developed/ potential fully used
Policy support for reaching energy and climate goals	1
Public awareness building	2
EE Potential Building Sector	3
EE Potential Private Sector & Industry	4
EE Potential Transport	5
Regional REN production	1
Availability of relevant energy data	2



10. SWOT analysis

The Romanian Academy (www.acad.ro) developed a **Strategy for Energy efficiency** at national level. http://www.econet-romania.com/files/document-2014-12-5-18755546-0-strategia-energetica-analiza-stadiului-actual.pdf

In the region Bucharest -Ilfov:

STRENGTHS	OPPORTUNITIES
• High level of professionals • Educated and informed inhabitants • Significant geotermal resources • Using the existing smart metering system • Well-developed infrastructure • Increasing energy efficiency in public and residential buildings • Increasing resource efficiency in private sector • Expanding electromobility • International co-operation projects give input to regional development and R&D. • Positive impact of successful implemented (renovation) projects. • High environmental awareness is good base for development of public awareness and support to low-carbon economy	• Many industrial capabilities unused • Geotermal resourses use • Heavy dependence on one fossil resource (oil-shale) • Weak political and public support • No clear vision on low-carbon economy in Romania • Well-developed infrastructure • Increasing resource efficiency in private sector • Expanding electromobility • International co-operation projects give input to regional development and R&D • Positive impact of successful implemented (renovation) projects
WEAKNESSES	**THREATS**
• Reasearch activity reduction • No natural regenerable resources (wind, water) • Limited human capacity in sectorial development participation (both national and EU level) • Objective technological know-how is insufficient, private sector holds lot of the know-how • Legally binding development plans in energy sector are not followed consistently • Low domestic investment capacity of public and private sector	• Energy crisis • Polution • Urban standard of live • Threat to national energy security • The regional political stability could be threatened when jobs in the fossil energy based industry decrease. • Low political acceptance of participatory democracy in some sectors • Secured (fossil) energy supply impedes innovation and progress •

11. Annex: List of sources /bibliography /List of relevant stakeholders/institutions in the region

Sources/ Bibliography

1. http://www.mmediu.ro/app/webroot/uploads/files/2017-03-02_Strategia-Energetica-a-Romaniei-2016-2030.pdf;
2. http://www.minind.ro/pnaer/pnaer_29%20iunie_2010_final_alx.pdf
3. http://www.europarl.europa.eu/RegData/etudes/IDAN/2015/540376/IPOL_IDA(2015)540376_EN.pdf
4. www.energy-community.org
5. https://www.amcham.ro/UserFiles/committeeRelatedResources/SNC_v2_Trad_ENGL_12161159.pdf
6. National Institute of statistics. www.insse.ro

List of stakeholders

#	Locality	Type	Websites of Public Administration (City Halls) and more information	Development and Energy Efficiency Strategy
1	Bucharest	Metropol	www.pmb.ro , www.pmud.ro	Yes
2	Bucharest sector 1	Sector	www.primariasector1.ro	Yes
3	Bucharest sector 2	Sector	www.ps2.ro	Yes
4	Bucharest sector 3	Sector	www.sector3primarie.ro	Yes
5	Bucharest sector 4	Sector	www.ps4.ro	Yes
6	Bucharest sector 5	Sector	www.sector5.ro	Yes
7	Bucharest sector 6	Sector	www.primarie6.ro	Yes
8	Bragadiru	City	www.primariaorasbragadiru.ro	Yes
9	Buftea	City	www.primariabuftea.ro	Yes
10	Chitila	City	www.primariachitila.ro	Yes
11	Magurele	City	www.primariamagurele.ro	Yes
12	Otopeni	City	www.otopeniro.ro	Yes
13	Pantelimon	City	www.primariapantelimon.ro	Yes
14	Popesti-Leordeni	City	www.ppl.ro	Yes
15	Voluntari	City	www.primaria-voluntari.ro	Yes
16	01 Decembrie 1918	Commune	www.primaria1decembrie.ro	Yes
17	Afumați	Commune	www.primariaafumati.ro	Yes
18	Balotești	Commune	www.primariabalotesti.ro	Yes
19	Berceni	Commune	www.primariaberceni.ro	Yes
20	Brănești	Commune	www.primaria-branesti.ro	Yes
21	Cernica	Commune	www.cernica.ro	Yes
22	Chiajna	Commune	www.primariachiajna.ro	Yes
23	Ciolpani	Commune	www.primariaciolpani.ro	Yes
24	Ciorogârla	Commune	www.primariaciorogarla.ro	Yes
25	Clinceni	Commune	www.primaria-clinceni.ro	Yes
26	Copăceni	Commune	www.primariacopaceniilfov.ro	Yes
27	Corbeanca	Commune	www.primariacorbeanca.ro	Yes

28	Cornetu	Commune	www.primariacornetu.ro	Yes
29	Dascălu	Commune	www.comunadascalu.ro	Yes
30	Dărăști-Ilfov	Commune	No	?
31	Dobroești	Commune	www.primariadobroesti.ro	Yes
32	Domnești	Commune	www.primariadomnesti.ro	Yes
33	Dragomirești-Vale	Commune	www.primariadragomirestivale.ro	Yes
34	Găneasa	Commune	www.primariaganeasa.ro	Yes
35	Glina	Commune	www.primaria-glina.ro	Yes
36	Grădiștea	Commune	www.comunagradisteaif.ro	Yes
37	Gruiu	Commune	www.primariagruiu.ro	Yes
38	Jilava	Commune	www.primariajilava.ro	Yes
39	Moara Vlăsiei	Commune	www.moaravlasiei.ro	Yes
40	Mogoșoaia	Commune	www.mogosoaia.ro	Yes
41	Nuci	Commune	www.primarianuciilfov.ro	Yes
42	Periș	Commune	www.primaria-peris.ro	Yes
43	Petrăchioaia	Commune	www.primaria-petrachioaia.ro	Yes
44	Snagov	Commune	www.primaria-snagov.ro	Yes
45	Ștefăneștii de Jos	Commune	www.primariastefanesti.ro	Yes
46	Tunari	Commune	www.primaria-tunari.ro	Yes
47	Vidra	Commune	www.primaria-vidra.ro	Yes

List of Institution

Acronyms	Name	Website
ANRE	Romanian Energy Regulatory Authority	www.anre.ro
	Ministry of Economy	http://economie.gov.ro
	Ministry of Environment	www.mmediu.ro
ANRSC	National Regulatory Authority for Community Utilities Services	www.anrsc.ro

REGIONAL ENERGY PROFILE

Region: PODRAVJE

PANEL 2050 – Partnership for New Energy Leadership 2050
Deliverable 3.1, English version

By: Local Energy Agency Spodnje Podravje

Date: 27.06.2017

Horizon 2020
European Union funding
for Research & Innovation

Table of Content

1. Methodology

approx. 1 pg

The PANEL 2050 project has the aim to create durable and replicable sustainable energy networks at local (municipality/community) level, where relevant local stakeholders collaborate for the creation of a local energy visions, strategies and action plans. The aim of these networks is to contribute to and actively work for the transition towards low carbon communities in 2050.

The PANEL 2050 partnership will provide support for the creation of first successful local energy networks in the CEE countries. In the course of the project, organisations from 10 CEE countries will collaborate on creating regional energy strategies and action plans.

The present Regional Energy Profile was prepared in order to get a better understanding of the energy-related status quo in the region of Podravje, analysing strengths and challenges with regard to the transition towards a low carbon community.
This energy profile constitutes the groundwork for the preparation of a Regional Energy Roadmap and related Action Plans and will be essential for the communication with regional stakeholders.

For completing this Regional Energy Profile the following sources were used:

- Republic of Slovenia Statistical Office: http://pxweb.stat.si/pxweb/dialog/statfile1.asp
- Republic of Slovenia Ministry for Infrastructure – Energy Portal: http://www.energetika-portal.si/
- Republic of Slovenia ministry of the Environment and Spatial planning – Slovenian Environment Agency (ARSO): http://www.arso.gov.si/en/

European Commission | Horizon 2020 European Union funding for Research & Innovation

2. General introduction of the region

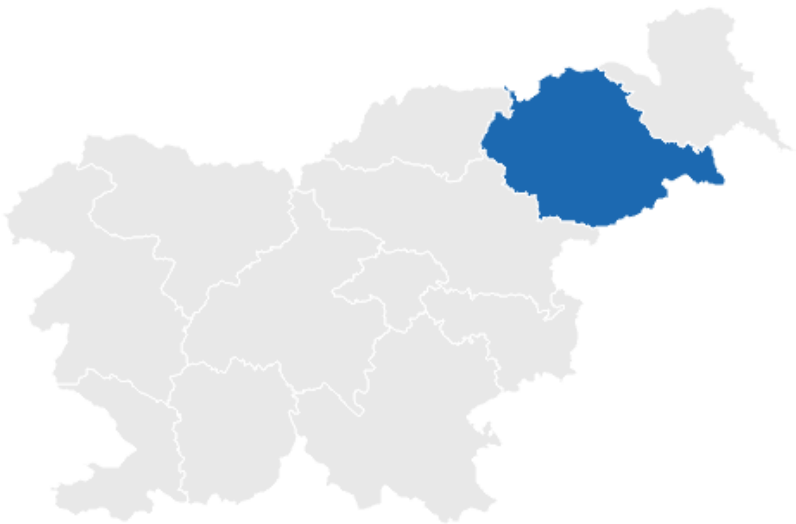
max 2 pgs

Name of the region and NUTS identification

Podravje region – NUTS-3 level, East Slovenia – NUTS-2 level

Geography and policy:

Describe the location of the region + provide also a political map showing location of the region in your country



REPUBLIKA SLOVENIJA
STATISTIČNI URAD

Podravje region is located in the northeast of Slovenia, between the regions Carinthia, Savinja and Mura. In the north Podravje borders with Austria and in southeast with Croatia. With 2.170 km^2, Podravje represents a tenth (10,7 %) of Slovenian territory and after the size, Podravje is on fifth place among Slovenian regions.

Podravje region consists of 41 municipalities, with 322.545 inhabitants (according to year 2015) what represent 15,6 % of total population of Slovenia. The urban centre of the region is Maribor, the second largest Slovenian city that has the largest number and density of population in the region.

Geography of the region, including morphology, geology, climate, hydrology, flora and fauna related to energy (text description)

The natural and geographical image of Podravje region form the hills to the northeast, subalpine wooded mountains (Pohorje and Kozjak) in the west and the Drava-Ptuj plain along the Drava River. 42 % of the region is covered by forests (*Source: Records of the actual use of agricultural and forest land in 2008 and 2012. MKO, 2012*). Water wealth is harnessed to generate electricity. With eight hydroelectric power plants and three small hydroelectric power plants, the Drava River is the most important Slovenian river. With rainfall of only 900 to 1100 mm per year, Podravje region is one of the driest regions in Slovenia. The average annual temperature ranges from 8 to 12° C (*Slovenian Environment Agency*). Podravje region has the most farms compared with other regions. According to data from the Census of Agriculture in 2010, there are 80.516 hectares of farmland and 12.318 farms in use in this region.

Brief history overview of the region – state the most important milestones related to the industrial / regional development (e.g. significant energy projects, powerplants, etc.), ideally related to energy

Podravje was in the seventies one of the most developed areas with favourable development potential and possibilities for further development. In the eighties began the development lag of the region. This was reflected in a decline in economic activity, accumulation and investment activities, which prevented the modernization and development. Dominated by large companies (especially in the field of metal processing and textile industries), the tertiary sector was underdeveloped. Large companies first felt the crisis of the political, economic and social changes and the gradual transition to a market economy. The growth in employment occurred in 1997, as a result of the increase in economic activity. The largest project related to energy in the Podravje region is undoubtedly the construction of the Drava power plants. A closed chain of 8 power plants on the Drava River was built in the period from 1918 until 1978.

Public administration procedure – brief profile of current energy planning process in your region starting from the national level down to the region (see also your desk research within WP3.1)

At the national level, Slovenia designed and adopted key documents governing the energy sector. The Energy Act (EZ-1) brings in the Slovenian legislation the provisions of ten European directives regulating the energy market, the promotion of energy efficiency, renewable energy sources and the supervision and regulation of the market. Strategic documents at the national level in the field of energy are as follows:

- Energy concept of Slovenia (under construction);
- National Energy Efficiency Action Plan 2014-2020;
- National Renewable Energy Action Plan 2010-2020;
- National Action Plan for the nearly zero-energy buildings for the period up to 2020;
- Long-Term Strategy for Mobilising Investments in the ENERGY RENOVATION OF BUILDINGS;
- Operational Programme for the implementation of the EU cohesion policy in the period 2014-2020;
- Operational program of measures to reduce greenhouse gas emissions by 2020;

At the regional level, there are regional development programs, but those programs does not define the energy sector in detail.

At the local level, municipalities have formulated local energy concepts, which serve as a guide for energy development of communities. Another document in the energy sector at the local level is SEAP, which is in Podravje so far adopted only by the municipality of Maribor.

Highlight significant characteristics differentiating region from others and give short (!) introduction of energy targets and challenges in the region

Energy targets of Podravje and other Slovenian regions are directed to the achievement of the national goals set in the field of energy. As a region, Podravje has no regional energy concepts, so the energy targets and strategies are set only on a national and local level. The objectives on a local level vary depending on the resources available, so natural, as well as economic.

3. Basic demographic data and figures

max 1 pg

Regional demographic indicators:

Population of region	322.545	cap
Area of region	2.170	km²
Population density	148,6	cap/km²
Number of individual municipalities	41	mun.

Data from 2015

Basic demographic data

Population growth, age distribution in last 20 year – text description

In 2015, in the Podravje region lived 15,6 % of the population of Slovenia. The proportion of the population aged 0 - 14 years of age, has been in the region one of the lowest (13,5 %). The region's population has increased since 2002 for about 3,8 %. The percentage of deaths before the age of 65 in the year 2015 has been the second highest in Slovenia (18,7 %). Around 69 % of students who live in Podravje are studying in their home region, while in the central region are studying 20,69 %.

Socio-economic development of past 3-5 years

Unemployment rate	13,6	%
Average annual income per capita (gross)	17.043,60	EUR
difference from the EU average (34.500 EUR gross annual earning)	49,40	%
Share of employees in		
agriculture	0,8	%
industry	35,8	%
services	63,4	%
Share of population with tertiary education	16,83	%

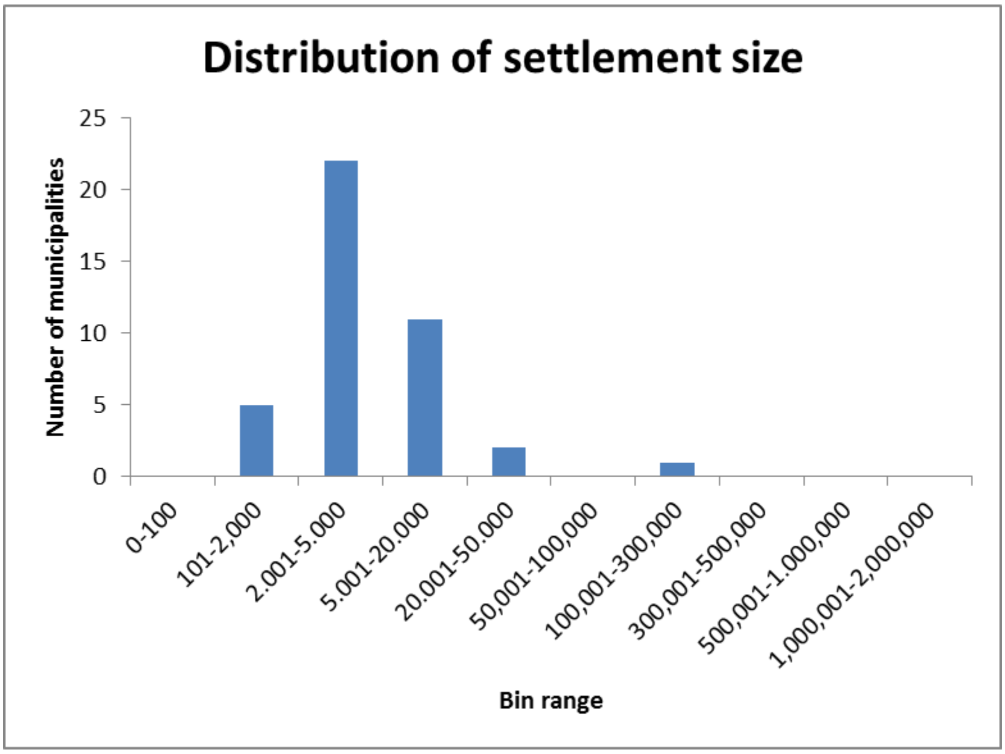
Text description for figures above

The registered unemployment rate in the region (13,6 %) is higher than the average in Slovenia (12,3 %). From 2005 on, the number increased less among all regions, only by 0,1 percentage points. The average annual gross income per capita in the region amounted to 17.043,60 EUR, which is less than the Slovenian average. The largest share of employment in the region is resulting from the service sector. The share of population with tertiary education is 16,83 %.

The spatial distribution of the population, level of urbanisation

Population density in the region in 2015 amounted to 148,6 residents/km^2, which is above the Slovenian average (101,8 residents/km^2) and Podravje ranks second among Slovenian regions.

Insert histogram – use attached xls template to generate it



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4. Regional economy and economic trends

max 2 pgs

Regional economic indicators:

GDP, total	4.986	million EUR
GDP per capita	15.456	EUR/cap
HDI*	0,917	

Data from 2015

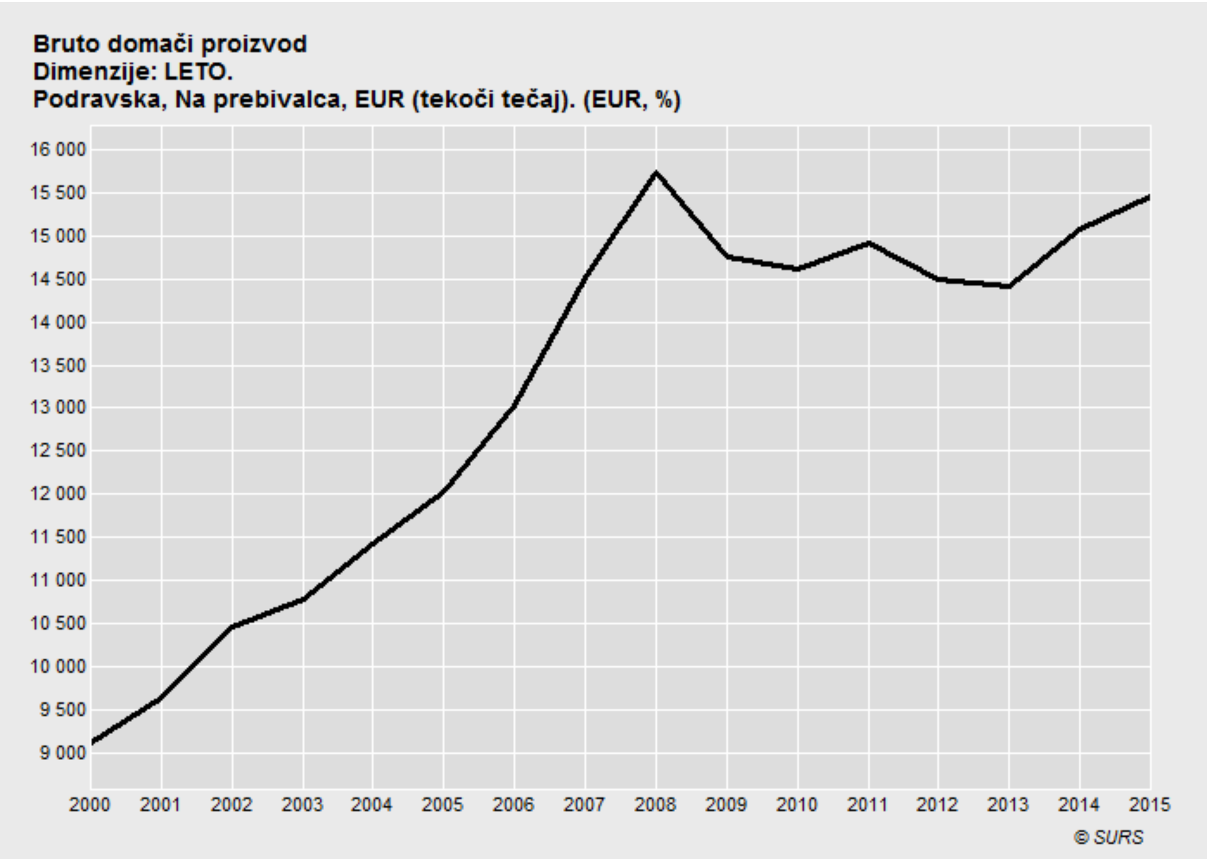
**HDI is provided for whole Slovenia*

GDP per economic sectors:		
Agriculture	2,6	% of total GDP
Industry	33,6	%
Services	63,8	%

Data from 2015

Regional economy

Please provide information about the regional economy, past development and trends using GDP and other indicators. If available, include graphs about GDP / HDI development of last 10-20 years.



Regional development has been in the years 2007-2013 strongly affected by the global economic crisis, which has after 2008 decreased the progress in economic and social development of the region. Number of enterprises in the 2008-2014 period has grown slightly, but led to a sharp reduction in employment because of the collapse of a number of medium-sized enterprises, mainly in construction sector.

number of operating entrepreneurs (SMEs, large and individual)	**25.873**	
→ share of SMEs	5,0	% of total number of operating businesses
number of operating nonprofit organisations	/	
Amount of EU funds (2007-13)	/	EUR

What are the main contributors/contributing sectors to the regional GDP? How stable are these sectors (qualitative assessment)?

Companies in the manufacturing sector have created the largest share (26,8 %) of total revenues in Podravje in the year 2015. Construction sector represented 6,3 % and agriculture 2,6 % of total revenues in Podravje. The manufacturing sector was the driving force, which has paved the way out of the crisis in Podravje and whole Slovenia. After the beginning of the crisis in 2008, the construction sector has suffered serious consequences, but in last years, the construction sector began to strengthen again and with new investments it is expected, that this trend will continue.

Describe the regional job market, employment/unemployment rates per sectors – agriculture and forestry, industry, services

Following the rapid growth of unemployment in the early years of the crisis, the growth after 2010 slowed down. At the end of 2011, the Slovenian economy again took a crisis that was escalating in 2013 and peaked in early 2014. In the following months, the unemployment rate began to decline, but the average unemployment was still higher than the previous year. In the years 2015 and 2016, the number of registered unemployed decreased significantly, mainly due to the expected economic growth and employment.

In 2012 in the Podravje region, agriculture sector represented 6,02 %, non-agricultural sectors 32,00 % and services 61,98 % of all employees.

Importance of trade; Import/ export balance, if available

In the past years, the exports from the Podravje region increased constantly, which had a crucial role in economic recovery in the 25 years of independence. Economy in Podravje and the wider economy of Slovenia are highly dependent on international trade. The ratio of trade (imports and exports) to GDP is one of the highest in the south-eastern part of the EU. External trade accounts for almost 150 % of GDP (68,5 % - imports and 77,8 % - exports).

5. National and local energy strategies (task WP 3.1) max 1 pg

List of relevant and most influencing strategies / roadmaps / measures to local energy situation or development – already provided in task WP 3.1

Region	Brief description of current situation on national, regional and local level in the field of energy planning including fullfilment of EU directives (mainly Directive 2012/27/EU on EE, Directive 2010/31/EU on energy performance of buildings, National Energy Efficiency Action Plans, NREAP, etc.)	legal requirement OR voluntary initiative	List of relevant strategies / policies / roadmaps / action plans / implementation plans / activities								Notes
			National level (NUTS I)				Local level (municipalities / microregions, etc.)				
			Original title + link (if possible)	English title + brief description	Organisation in charge	Type (EE, EPB, RES, etc. or combination ...)	Original title + link (if possible)	English title + brief description	Organisation in charge	Type (EE, EPB, RES, etc. or combination...)	

Podravje	In accordance with the requirements of the Energy Efficiency Directive (2012/27 / EU), Slovenia has set a national target of reducing total energy consumption by 20% by 2020. This target is that primary energy consumption in 2020 will not exceed 7.125 million toe (82, 86 TWh). This means that compared to the year 2012 the consumption will not increase by more than 2%. To achieve the headline target of energy efficiency a quarter of the existing building stock must be energy renovated by 2020, which represents around 22 million m2 of building surfaces. With this, the energy use in buildings would be decrease by almost 10%. In particular, energy renovation of buildings (sustainable construction) is a governmental	Legal requirement	AKCIJSKI NAČRT ZA ENERGETSKO UČINKOVITOST ZA OBDOBJE 2014–2020 (AN URE 2020) Link: http://www.energetika-portal.si/fileadmin/dokumenti/publikacije/an_ure/an_ure_2020_sprejet_maj_2015.pdf	NATIONAL ENERGY EFFICIENCY ACTION PLAN 2014–2020 In this National Energy Efficiency Action Plan 2014–2020, Slovenia sets its national target to improve energy efficiency by 20 % by 2020, in line with the requirements set out in Directive 2012/27/EU (Energy Efficiency Directive). This target states that primary energy consumption will not exceed 7.125 million toe in 2020, meaning that it may not exceed the 2012 figure by more than 2 %. Link: https://ec.europa.eu/energy/sites/ener/files/documents/NEAPSLOVENIA_en.pdf	Ministrstvo za infrastrukturo Ministry of Infrastructure	EE	Lokalni energetski koncept Mestne občine Ptuj Link: www.ptuj.si/API/download.php?fid=6328	Local energy concept of Ptuj The energy concept of the local community enables long-term planned development of the municipality in the energy and energy-related environmental development. It means not only a decisive step towards the preparation, but also the basis for the formation and implementation of appropriate environmental and energy policies. Local energy concept is therefore a document that the municipality and its inhabitants directs to systematic creation and maintenance of databases on planned investments, consumers and energy, facilitates and promotes energy reconstruction, low-energy and passive construction, careful management of energy, introduction of energy efficiency measures energy, raising energy efficiency and introduction of renewable energy sources.	Municipality Ptuj	EE, RES	Since Slovenia is a small country, we don't have any strategies, policies, activities on regional level associated with energy.

Spodnje Podravje	strategic project no. 1. Our aim is to take action and prepare a funding model in which Slovenia will increase the share of energy renovated public and private buildings. Based on European and national legislation, the Government adopted a "long-term strategy to promote investments in energy renovation of buildings". The strategy provides the following operational objectives by 2020 or 2030: • renovate 3% of public buildings annually, • renovation of 1.8 million m2 of buildings in the wider public sector in the period 2014-2023, • improve the relationship between the invested public funds and investments in the public sector to 1: 3, • Implementation of 5 demonstration projects of different types of energy renovation of buildings. Expected result is the renovation of 9.1	Legal requirement	Dolgoročna strategija za spodbujanje naložb ENERGETSKE PRENOVE STAVB Link: http://www.energetika-portal.si/fileadmin/dokumenti/publikacije/dseps/dseps_final_okt2015.pdf	Long-Term Strategy for Mobilising Investments in the ENERGY RENOVATION OF BUILDINGS The existing building stock is the sector providing the greatest potential for achieving energy savings, as buildings account for just over one third of all energy consumed. Buildings are also key to achieving the target of an 80–95 % reduction in greenhouse gas emissions by 2050. The Energy Efficiency Directive therefore lays down that Member States should establish a long-term strategy for mobilising investments in the renovation of the national building stock in order to increase the rate of building renovation. The strategic objective of this document is to achieve carbon-neutral energy use in buildings by 2050. This will be achieved by making considerable improvements in energy performance and by increasing the use of renewable energy sources in buildings. This will, in turn, significantly reduce emissions of other harmful substances into the atmosphere. A further objective is for Slovenia to become recognised for its activities in the field of sustainable construction. Link: https://ec.europa.eu/energy/sites/ener/files/documents/Building%20Strategy%20Slovenia_EN.pdf	Ministrstvo za infrastrukturo Ministry of Infrastructure		Lokalni energetski koncepti za vse občine v regiji Spodnje Podravje	Local energy concepts for all Municipalities in the Spodnje Podravje region	Municipalities of the Spodnje Podravje Region	EE, RES	

	million m2 of buildings, of which: • 6 million m2 of residential buildings, • 1.8 million m2 of public buildings (including the required annual renovation of 3% of the buildings in the narrow public sector) • 1.3 million m2 of buildings in the private service sector in the period 2014-2023.										
Spodnje Podravje		Legal requirement	Akcijski načrt za skoraj nič-energijske stavbe za obdobje do leta 2020 (AN sNES) Link: http://www.energetika-portal.si/fileadmin/dokumenti/publikacije/an_snes/ansnes_final_apr_2015.pdf	Action plan for nearly zero-energy buildings Action plan for the nearly zero-energy buildings include the objectives, programs, and measures for achieving these objectives, as well as human and financial resources to implement these programs and measures. In this plan, the government sets up policies and measures to boost the energy efficiency of existing buildings into nearly zero energy.	Ministrstvo za infrastrukturo Ministry of Infrastructure	EE, RES					
Spodnje Podravje		Legal requirement	AKCIJSKI NAČRT ZA OBNOVLJIVE VIRE ENERGIJE ZA OBDOBJE 2010-2020 (AN OVE) Link: http://www.energetika-portal.si/fileadmin/dokumenti/publikacije/an_ove/an_ove_2010-2020_final.pdf	NATIONAL RENEWABLE ENERGY ACTION PLAN 2010-2020 (NREAP) The objective of the NREAP is to assess and determine the necessary quantitative values of energy consumption from RES by individual sector (heating and cooling, electricity and transport) and to propose measures to facilitate consumption of the desired quantity of energy from RES in future years. Link: http://www.energetika-portal.si/fileadmin/dokumenti/publikacije/an_ove/an-ove_eng.pdf	Ministrstvo za infrastrukturo Ministry of Infrastructure	RES					

Spodnje Podravje		Legal requirement	Pravilnik o učinkoviti rabi energije v stavbah PURES-2 Link: http://www.pisrs.si/Pis.web/pregledPredpisa?id=PRAV10043	Rules on efficient use of energy in buildings This policy sets out the technical requirements that must be met for efficient use of energy in buildings in the area of thermal insulation, heating, cooling, ventilation, hot water preparation and lighting in buildings, providing their own renewable energy sources for technical systems in the building and the methodology for calculating the energy performance of buildings in accordance with Directive 2010/31/EU	Ministrstvo za infrastrukturo Ministry of Infrastructure	EE,RES					
Spodnje Podravje		Legal requirement	Pravilnik o metodologiji za izdelavo in vsebini energetskega pregleda Link: http://www.pisrs.si/Pis.web/pregledPredpisa?id=PRAV11911	Rules on the methodology for the production and content of the energy audit This policy sets out the methodology for producing, minimum requirements and the mandatory contents of an energy audit of buildings, processes and transport end-customers.	Ministrstvo za infrastrukturo Ministry of Infrastructure	EE					
Spodnje Podravje		Legal requirement	Pravilnik o prezračevanju in klimatizaciji stavb Link: http://www.pisrs.si/Pis.web/pregledPredpisa?id=PRAV4223	Rules on the ventilation and cooling of buildings This policy specifies the technical requirements for ventilation and air conditioning of buildings and technical requirements for mechanical ventilation systems, if they are installed in the building.	Ministrstvo za infrastrukturo Ministry of Infrastructure	EE					

Spodnje Podravje		Legal requirement	Pravilnik o metodologiji izdelave in izdaji energetskih izkaznic stavb Link: http://www.pisrs.si/Pis.web/pregledPredpisa?id=PRAV11883	Rules on the methodology of producing and issuing the energy performance certification of buildings This Regulation lays down detailed contents and format of energy performance certificates of buildings and methodologies of the producing and issuing energy performance certificates and data content, method of keeping the register of energy performance certificates and the method of registration of the energy certificates in the register. It also provides more detailed content, format, methodologies and deadlines for the control of issued energy performance certificates. This Regulation also defines the types of buildings that are subject to the obligation of installing the energy performance certificates on a visible place, in accordance with Article 11 of the Directive 2010/31 / EU.	Ministrstvo za infrastrukturo Ministry of Infrastructure	EE					
Spodnje Podravje		Legal requirement	OPERATIVNI PROGRAM ZA IZVAJANJE EVROPSKE KOHEZIJSKE POLITIKE V OBDOBJU 2014 – 2020 Link: http://www.svrk.gov.si/fileadmin/svrk.gov.si/pageuploads/KP_2014-2020/Operativni_program/OP_12_01_2015_koncna_cistopis.pdf	OPERATIONAL PROGRAMME FOR THE IMPLEMENTATION OF THE EU COHESION POLICY IN THE PERIOD 2014-2020 Operational Programme for the implementation of European cohesion policy for the period 2014 - 2020 (SI OP 2014-2020) in priority Axis 4, addresses reduction of greenhouse gas emissions and improvement of air quality, especially in the cities, as well as on other areas facing poor quality of air. The problem of CO2 increasing due to transport is pointed out. The priority tasks of policy is financing of energy renovation of buildings, especially public buildings. To the better air quality contributes also the smart grids .	SLUZBA VLADE REPUBLIKE SLOVENIJE ZA RAZVOJ IN EVROPSKO KOHEZIJSKO POLITIKO GOVERNMENT OFFICE FOR DEVELOPMENT AND EUROPEAN COHESION POLICY	EE,RES					
Spodnje Podravje			EKO Sklad Link: https://www.ekosklad.si	ECO Fund Eco Fund's main purpose is to promote development in the field of environmental protection. It is the only specialised institution in Slovenia that provides financial supports for environmental projects. The financial assistance is offered mainly through soft loans from revolving funds and since the year 2008 through grants. In	Ministrstvo za okolje in prostor Ministry of the Environment and Spatial Planning	EE, RES					

				comparison with commercial banks, Eco Fund's principal advantages in the market for environmental financing are that it provides soft loans at lower interest rates than prevailing commercial market rates and it is able to lend for significantly longer periods than commercial banks. Recent evaluations of the effective interest rates of Eco Fund's loans on the one hand, and those of commercial banks, on the other, have shown that a total of 15 % of the cost of an investments can be saved when opting for Eco Fund's loan.							

6. Energy Production

6.1. Conventional energy production capacities (fossil fuels and nuclear power)

Give an overview of energy production by fossil fuels and nuclear power plants – concentrate on the most significant 3 to 5 power plants.

Name & Location (city, town)	Owner	Year of commis-sioning (refur-bishment)	Type of plant & fuel	Capacity in MW	Annual energy production in MWh	Annual CO_2-emissions in t	Utilization rate (qualitative assessment)
	[choose: Public / private SME / private large enterprise]			[state: electr. and/or heat]			[choose: Constantly used / sometimes / seldom / to be decommissioned]
Ptuj District Heating	Public		Distric heating - Natural gas	27,60 MW 2,34 MW electrical power (CHP)	90.869,69 MWh – heat (theoretical) 8.016 MWh (actual)		Used constantly during the heating season and for heating of sanitary hot water in the summer. Currently preparing projects for renovation and transition to wood biomass
Maribor District Heating	Public		Distric heating - Natural gas				Used constantly during the heating season

Add additional details to describe the conventional energy production capacities in the region. What are current trends? What influence have age, regional economy, fuel imports, and fuel prices on the on the current status?

In the Podravje region are no larger Conventional energy production plants. Electricity is produced mostly in larger hydropower plants and small individually installed CHP plants and PV installations. The heat is mostly produced individually, there are only few district heating systems that are producing heat with larger boilers on Natural gas and Heating oil.

6.2. Renewable energy production

Energy production capacities

Give an overview of energy production by renewable energy capacities (e.g. small/large hydro, solar PV, solarthermal, biomass, geothermal & other production capacities – concentrate on the most significant 3 to 5 power plants or aggregation of production facilities.

Name & Location (city, town)	Owner	Year of commis-sioning (refur-bishment)	Type of plant & fuel	Capacity in MW	Annual energy production in MWh	Annual CO_2-emissions in t	Utilization rate (qualitative assessment)
	[choose: Public / private SME / private large enterprise]			[state: electr. and/or heat]			[choose: Constantly used / sometimes / seldom / to be decommissioned]
Hydropower plant Formin	private large enterprise	1978	Hydropower plant	116 MW	548.000 MWh	0,0	Constantly used
Hydropower plant Zlatoličje	private large enterprise	1969	Hydropower plant	114 MW	577.000 MWh	0,0	Constantly used
Hydropowerplant Mariboski otok	private large enterprise	1948	Hydropower plant	60 MW	247.000 MWh	0,0	Constantly used
Hydropower plant Fala	private large enterprise	1918	Hydropower plant	58 MW	270.000 MWh	0,0	Constantly used

Add additional details to describe the renewable energy production capacities in the region. What are current trends? What influence have age, regional economy, fuel availability or renewable energy potential, and subsidy systems on the current status?

The company DEM is the largest energy producer in the Podravje Region. DEM is the owner of 8 large and 2 small hydropower plants on the river Drava, 1 small hydropower plant on the river Mura (4 large and 3 small hydropower plants are in the Podravje region) and 4 solar power plants. The total installed power of the power station is nearly 600 MW. The river Drava has a potential of 2.896 GWh of produced electricity per year. Currently 97,8 % of the potential is exploited. Company Dem is planning the construction of a pumped storage plant Kozjak with 440 MW of installed power.

6.3. Transmission and distributions

What kind of facilities constitute the electric transmission and distribution system? Who are the owners? Who are the operators? Please add relevant map if available.

The company Elektro Maribor, company for electricity distribution d.d. It is an integral part of the electricity system of the Republic of Slovenia and is the second largest distribution company in Slovenia.
The main activities of the company are:
- Distribution of electricity;
- Utility constructions for electricity and telecommunications.

Elektro Maribor d.d. the owner of the electricity infrastructure. From 1. 7. 2007, the company carried out tasks of distributing electricity on the basis of the Treaty on the lease of electricity distribution infrastructure and provision of services for SODO l.l.c. (Hereinafter referred to as the Treaty), which the Government of the Republic of Slovenia with a decree granted the concession for the utilities of operating the electricity distribution network (Ul. RS, no. 39/07).

These services include:

- Maintenance of electricity infrastructure and organization of the emergency services.
- Management and operation of the electricity network.
- Development, planning and investment in electricity infrastructure.
- Preparation and investment management.
- Monitoring and assessment of quality of care.
- Electricity metering.
- Implementation of the service access to the distribution network and other services to users.
- Implementation of other services for SODO.

Give an overview of other centralised or decentralised energy distribution systems (e.g. natural gas pipelines, heat grids, etc.).

Gasification Slovenia began in the early seventies. Newly discovered deposits of natural gas in Russia and Algeria as well as the growing energy needs of the booming economy of Europe presents a natural gas as an economical and practical power source. With the newly constructed pipelines in Austria and Italy it has become feasible even thinking about the possibilities of natural gas supply in Slovenia, since Slovenia does not have its own gas reserves.

The picture is showing the natural pipeline grid in the Podravje region. With blue colour are marked the existing pipelines and with the red colour the planned pipelines.

In the heating sector in Podravje region we have individual local district heating systems (Maribror, Ptuj, Lenart). The lengths of the hot water pipelines are: Maribor – 34.066 m; Ptuj – 5.990 m; Lenart – 4.800 m.

Give an overview on interconnections of regional energy production with the rest of the country. Are there large production facilities in the region on which the rest of the country's energy supply might depend?

The river Drava flows in Slovenia trough two regions (Drava region and Carinthia). With 8 large and two small hydropower plants on the river Drava and 1 small hydropower plant on the river Mura is produced nearly a quarter of Slovenian electricity. The annual production of the DEM company (owner of the hydropower plants) amounts to 2.664 million kWh, representing 80 percent of the Slovenian electricity that meets the criteria of renewable resources and standards of the internationally recognized certificate RECS (Renewable Energy Certificates System).

6.4. Jobs in the energy sector

Give an overview about the status of the energy sector in the regional economy. How many jobs are there at the moment in the energy sector. How important are new "green job" for regional economy development. If possible, quantify investments in the energy sector.

In the electricity production and services are currently about 1.107 employed. The construction of a pumped storage power plant would mean new yobs in the region. Since there are only two bigger district heating systems and a few individual solar power plants and biogas power plants it is hard to give an exact number of employed people in this field. Since wood biomass is a local resource in every region of Slovenia great emphasis is given on the use of wood as a heat source. The promotion of wood biomass has a positive effect on regional economy in the entire value chain.

Are coal and lignite mining undertaken in the region? What role does fossil fuel mining play for the regional economy and for regional energy security?

In the Podravje region are no coal or lignite mines and therefore the mining plays no role for the regional economy.

7. Final energy consumption

***Final energy** is a form, which might already been subject to conversion from the raw fuel. It is the energy made available to the user.*

For the sectoral analysis please use regional statistics as far as they are available to you and quote your sources.
If no regional data is available please use the Excel tool, which will give you a suggestion to estimate the needed indictors using national statistics.

Please always use kWh, MWh, GWh, etc. You can find a good conversion tool here:
https://www.iea.org/statistics/resources/unitconverter/

7.1. Households

Regional final energy consumption of household sector	2.288	GWh

Heat consumption

Total heat energy consumption of households sector (heating and hot water consumption)	1.719	GWh
Average heat energy consumption per household	12.790	kWh/hh

Describe the average building standard. What is their average age of existing building stock? Are energy efficient renovations in progress?

Older, inadequate isolated buildings in Slovenia consume more than 200 kWh/m^2 per year for heating. By 2020, all newly constructed buildings in Slovenia should achieve values of nearly zero-energy buildings.
Residential buildings from different periods have different structures and energy positions, so energy consumption in them is different - in most cases, too high. Older buildings are less thermally protected and not airtight, worse building furniture, inefficient heating systems - causing large heat demand. In those buildings energy renovation is more difficult because often there is also needed a renovation of the construction.

Construction before 1920

Multi-dwelling buildings before 1920 have mixed stone-brick walls with a thickness of 38 to 65 cm, boxy windows, they have ornamented and often monument protected façades. Due to the age of these buildings they need comprehensive energy and construction renovations. Thermal protection is executed from the inside, windows have to be special because of the historical protection, the thermal bridges are rehabilitated from inside (on the contact of external and internal walls), the ceiling of the basement and attic is being insulated.

Construction until 1940

Residential buildings from the pre-war period until 1940 are normally solid built but poorly maintained, with thick solid brick external walls with a thickness of 38 cm and wooden frame windows. The implementation of the external thermal insulation is already possible as well as insulation of the ceiling in the basement and the attic, mounting passive windows, ventilation with heat recovery, etc ...

Building until seventies without thermal insulation

Residential buildings built until the mid-seventies, are inferior, or the same quality constructed as buildings, which were built until 1940; the reasons were mainly in saving of construction materials. The walls are 30 cm thick with simple facades without thermal insulation. These buildings require thorough construction and energy restoration, window replacement and other maintenance measures. In buildings of this period it is possible to achieve a significant reduction of energy needed, with minimal additional investment measures.

The eighties with a minimum of thermal insulation

New regulations in the eighties, when the period of intensive construction of large housing estates has begun, have demanded greater control for multi-storey residential buildings, especially high-rises. The buildings are solid with an additional layer of thermal. The windows are large, aluminium or wood and mostly unsuitable because of the single or double glazing. Energy and construction - measures for such buildings should be based primarily on the replacement of the inadequate windows and additional thermal insulation of roofs and ceilings as well as the rehabilitation of major thermal bridges, air tightness, sound protection and establishing ventilation with heat recovery

Newer buildings are better insulated

In the nineties, the construction has become very diverse, in addition to the brick building appears prefabricated construction, especially for single-family houses. The share of brick buildings with thermal insulation of structural components increases, so that the buildings are on average quite well insulated. Windows are wooden, aluminium or PVC. Everywhere prevails double glazing, until 2000, mainly "thermopane" and after 2000 they implement energy-efficient double-layer glazing.

73 % of buildings in Slovenia are single-family houses and because of rising energy prices (especially fossil fuels for heating) the energy renovation of buildings is a very important topic in the last few years. Energy renovation of old buildings is also supported by subsidies and therefore even more attractive.

Electricity

Electricity consumption of households	522	GWh
Average electricity consumption per household	3.883	kWh/hh

Describe if there are any national or regional programmes for reducing household electricity consumption (e.g. washing machine or refrigerator replacement programme). If yes, please elaborate it briefly.

ECO FUND

Eco Fund's main purpose is to promote development in the field of environmental protection. It is the only specialised institution in Slovenia that provides financial supports for environmental projects. The financial assistance is offered mainly through soft loans from revolving funds and since the year 2008 through grants. In comparison with commercial banks, Eco Fund’s principal advantages in the market for environmental financing are that it provides soft loans at lower interest rates than prevailing commercial market rates and it is able to lend for significantly longer periods than commercial banks. For the purpose of reducing household electricity are currently no subsidies for replacement of larger household appliances like washing machines, refrigerators, etc. ECO FUND offers a soft loan for that purpose.

Cooking

Gas consumption for cooking appliances of households	47	GWh

Describe if gas is a significant energy source for cooking in the household sector.

For cooking in households following energy sources are used: natural gas, liquefied petroleum gas (LPG), wood fuels and electricity. Natural gas represents the lowest ratio (about 10 %) while LPG represents 33,8 % of the energy for cooking. The dominating energy source for cooking is electricity (43,4 %).

General information

Household electricity price	0,160	EUR/kWh (incl. taxes)
Household natural gas price	0,0627	EUR/kWh (incl. taxes)
Household district heating price*: variable part	0,0748376	EUR/kWh (incl. taxes)
fixed part	3,4587	EUR/kW of installed power
Household price: Heating oil	0,0855	EUR/kWh (incl. taxes)
Energy expenditure by household	6,7 %	of income

**the district heat price is divided on a variable and fixed part. The variable part is including the actual energy used (kWh). The fixed part depends on the installed power (kW).*

Is there any element of Demand Side Management of electricity on household level in place? If yes, please describe it (e.g. peak price, smart metering)

Households can decide for measurement and payment of electricity by one or double tariff system. The double tariff system is divided on peak and lower tariff. The peak tariff (VT) is the electricity consumption measured every weekday between 6.00 and 22.00 hour. The lower tariff (MT) is measured every weekday between 22.00 and 6.00 and every Saturday, Sunday and Holidays between 00.00 and 24.00. The aim of double tariff system is to encourage the consumer to use less energy during peak hours, or to move the time of energy use to off-peak times such as night time and weekends. The Slovenian Government decides on the tariff system for the sale of electricity. Peak demand management does not necessarily decrease total energy consumption, but could be expected to reduce the need for investments in networks and/or power plants for meeting peak demands.
Existing electricity meter are being replaced with the so-called smart meters. The replacement should be completed by 2022.

Is energy poverty an issue in the region? If yes, please describe how many people are affected, in what extent?

According to one of the definitions, energy-poor are those households that use over 10 % of their income to provide adequate warm housing and cover other energy needs. Households in Slovenia in 2015 spent for electricity, gas and other fuels, on average, 6,7 % of its available resources. Households with the lowest incomes have spent for energy purpose almost 18 % of its available funds.
20 % of households (households with the lowest incomes) are using 17,7 % of their income for energy needs.

Give an estimate of the trend in final energy consumption in the household sector using values from -5- to +5 where (-5 is a strong reduction, 0 means neither growth nor reduction, +5 strong growth).

+2
The estimation of the trend is given according the data and predictions for the final energy consumption of Slovenia households in the *Energy Balance of the Republic of Slovenia (ebrs 2016).*

7.2. Service Sector

Regional final energy consumption of service sector	774	GWh

What are the main sub-sectors driving energy consumption in the in the service sector (building standard, number of businesses, …)? How important is service sector for the regional economy?

The service sector in Podravje employs 63 % of all employed people in the region and provides over 60 % of the regional GDP. The main sub-sector in the field of market activities are trade and catering and public and health in the field of nonmarket activities. The overall building standard is improving in the last years as a result of energy renovations, especially in the public sector.

Give an estimate of the trend in final energy consumption in the service sector using values from -5- to +5 where (-5 is a strong reduction, 0 means neither growth nor reduction, +5 strong growth).

-1
The estimation of the trend is given according the data and predictions for the final energy consumption of Slovenia service and industry sector in the Energy Balance of the Republic of Slovenia (ebrs 2016).

7.3. Industry

Total energy consumption of the industrial sector	1.821	GWh
Industry electricity price	0,926	EUR/kWh (incl. taxes)
Industry natural gas price	0,0418	EUR/kWh (incl. taxes)
Industry district heating price	/	EUR/kWh (incl. taxes)
Industry price: other energy sources – specify:	/	EUR/kWh (incl. taxes)

What are the main sub-sectors driving energy consumption in the in the industrial sector? How important is industry for the regional economy?

The main sub-sector in the Industry is the manufacturing sector. Industry represents 35,8 % of all employed people in the Podravje region and therefore still very important for the regional economy.

7.4. Transport

Regional final energy consumption of transport sector	2.687	GWh

Describe the main characteristics of the transport sector: transport infrastructure, motorisation rate, availability of public transport and differences between urban and rural environments.

The regional motorisation rate is 508 cars per 1000 inhabitants in the region. The total length of the roads in Podravje region (national and municipal owned) is 6.555,6 km. According to the definition of the OECD (*Organisation for Economic Co-operation and Development*) Podravje is a predominantly rural region. Public transport is well developed in Maribor, the Urban center of Podravje, in other city centers the public transport is not so common because of their relative small size. There are public transport connections between cities and the rural areas of the region.
In 2016 in the Podravje region 7,47 million tonnes of goods were transported and unloaded and 7,97 million tonnes of goods were loaded and transported with the road freight transport. Since joining the EU in 2004, Slovenia has become an important transit country in freight transport. The freight transport is daily polluting, causing excessive noise, burdens the road network and causes many accidents. It is important that Slovenia develops the rail network and redirects the freight transport there.

Passenger transport

Motorisation rate - number of passenger cars/1000 inhabitants	508	
Regional energy consumption of passenger transport in the region	1.420	GWh

Freight transport

Regional energy consumption of road freight transport	1.222	GWh

If the rail, or transport by pipeline is a significant way of the freight transport, please describe their main characteristics.

40 % of incomes from the railroad transport is provided with the freight transport. The railroad transport is an important aspect in decreasing the transit freight road transport. According to the white paper *Roadmap to a Single European Transport Area* the EU has set a target of redirecting 30 % of road freight transport of over 300 km to the rail freight transport. The current railroad network would not be able to transfer such an increase. In the past years the railroad through the region has been renovated but to take over such increase of the transport new investments in the railroad network are necessary.

Use of alternative fuels

Describe the market development for alternative fuel vehicles (natural gas, biogas, electric cars). What supporting mechanisms for alternative fuel are available on national and regional level? Describe challenges and barriers, e.g. infrastructure, technological, supply, financial barriers, etc..

In accordance with the Directive 2009/28/EC on the promotion of the use of energy from renewable sources, is required a 10 % share of energy from renewable sources in all modes of transport by 2020. One possibility to reach the goal is electricity, which has to be produced from renewable sources. Therefore, the electricity used in the transport sector will need a proof of the share of RES. Other possibility are biofuels. In the Podravje region are relative good conditions for the cultivation of oilseed rape, which is the raw material for the biodiesel production

Despite the rather promising predictions of the positive effects of biofuels, there is a growing doubt about the use of biofuels in recent years. In particular, the disputed production and the use of the first generation biofuels (agro fuels), which are expected to have negative effects on biodiversity, water and soil protection, global land use change, rising food prices. Therefore, attention is therefore slowly shifting to the second generation of biofuels (waste, plant residues, such as wood biomass, straw, grass), which has not yet been sufficiently explored, and production on the basis of existing technology is rather expensive (EEA, 2008). The EU, with high motor fuel prices and a growing energy dependence, places a lot on biofuels, which, together with other renewable energy sources, will represent 10% of the energy mix by 2020 (EEA, 2009; Renewable Energy Directive 2009/28 / EC).

In 2010, almost 3 times more land was sown with oilseed rape than in 2005. In 2010, it was sown to 6.464 ha, which, with a yield of 15.518 tons, enabled the production of over 5.000 tons of biodiesel. Biodiesel was produced by only one registered producer, producing 20.561 tonnes of biodiesel from oilseed rape in 2012, imported raw material was also used. In 2013, the same registered producer produced only 1,7 ton of biodiesel, which was produced from imported raw materials. In 2014 and 2015, the only producer, due to economic reasons, completely stopped biodiesel production. In recent years, the production of biodiesel in the RS has been disproportionately small in terms of production capacities, for which producers blame the market/price situation in the area of mineral/fossil fuels and biofuels.

Give an estimate of the trend in final energy consumption in the transport sector using values from -5- to +5 where (-5 is a strong reduction, 0 means neither growth nor reduction, +5 strong growth).

+1

The estimation of the trend is given according the data and predictions for the final energy consumption of Slovenia transport sector in the Energy Balance of the Republic of Slovenia (ebrs 2016).

7.5. Summary
Final energy indicators

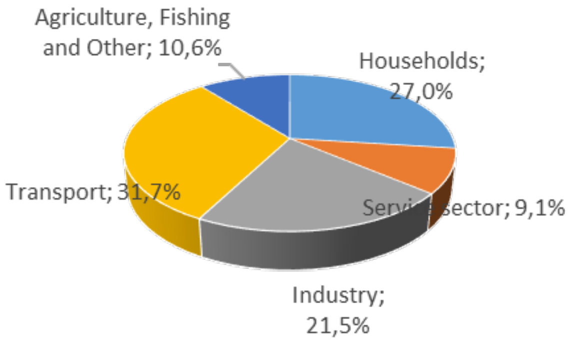
General indicators for the region

Use the Excel tool to fill the following tables and generate graphs.
If regional data is available, use this information and quote your sources.

Total final energy consumption	8.469,90	GWh
Final energy consumption per capita	26.259,59	kWh/cap
Electricity consumption per capita	6.156,11	kWh/cap
Heat consumption per capita	7.975,81	kWh/cap
% of total country consumption	15,5	%

Final energy consumption per sector

Year: 2015			%
Households	2.288,00	GWh	27,0
Service sector	774,00	GWh	9,1
Industry	1.821,00	GWh	21,5
Transport	2.687,00	GWh	31,7
Agriculture, Fishing and Other	899,90	GWh	10,6
Sum	**8.469,90**	**GWh**	**100,0 %**



Give an estimate of the trend in final energy consumption using values from -5- to +5 (where -5 is a strong reduction, 0 means neither growth nor reduction, +5 strong growth).

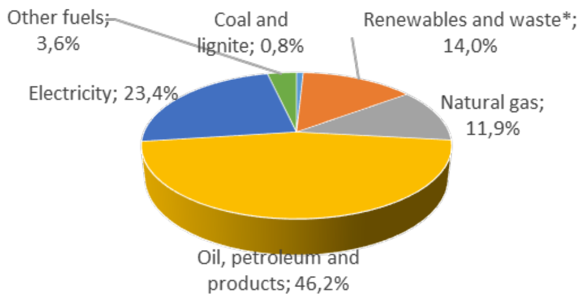
+1
The estimation of the trend is given according the data and predictions for the final energy consumption in the Energy Balance of the Republic of Slovenia (ebrs 2016).

Final energy consumption by fuel

Use the Excel tool to fill the following tables and generate graphs.
If regional data is available, use this information and quote your sources.

Total final energy consumption by fuel

Year: 2015			%
Coal and lignite	71,65	GWh	0,8
Renewables and waste*	1.187,50	GWh	14,0
Natural gas	1.007,76	GWh	11,9
Oil, petroleum and products	3.911,72	GWh	46,2
Electricity	1.985,62	GWh	23,4
Other fuels	305,65	GWh	3,6
Sum	**8.469,90**	**GWh**	**100,0 %**



*Hydro, wind, solar, tide/wave, biomass and waste, geothermal

Primary energy equivalent

Primary energy *is an energy form found in nature that has not been subjected to any conversion or transformation process. It is energy contained in raw fuels.*

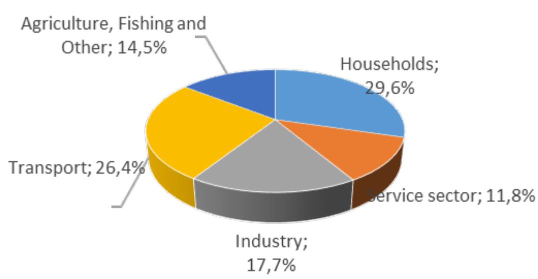
If regional data is not available for these indicators, use specific national indicators to break energy supply down to regional level. Refer to Excel tool for suggestions on calculation methodologies. Quote your sources and assumptions

Total Primary Energy Consumption	11.189,83	GWh
Primary energy consumption per capita	34.692,29	kWh/cap
Primary energy factor of electricity	2,5	-
Energy intensity	0,00224425	TPES/GDP

Give an overview of the regional primary energy supply by fuel.
Use the Excel conversion tool using primary energy coefficients suitable for your region.

Primary energy equivalent by sector
Use the Excel tool to fill the following tables and generate graphs.
If regional data is available, use this information and quote your sources.

Year: 2015			%
Households	3.311,42	GWh	29,6
Service sector	1.322,01	GWh	11,8
Industry	1.977,17	GWh	17,7
Transport	2.955,70	GWh	26,4
Agriculture, Fishing and Other	1.623,52	GWh	14,5
Sum	**11.189,83**	**GWh**	**100,0 %**



What is the level of primary energy supply dependencies: Which fuels need to be imported from the rest of the country and internationally.

Dependency on fuel imports: very high / high / average / low / very low
With domestic energy sources, Slovenia in 2015 meet 52% of all energy needs. The remaining required amount has been secured from imports; supply of petroleum products and natural gas has been fully guaranteed by imports.

Regional CO_2-emissions associated with energy consumption

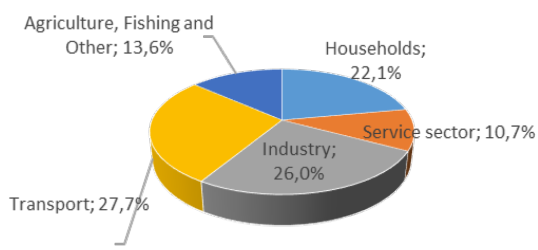
Use the Excel tool to fill the following tables and generate graphs.
If regional data is available, use this information and quote your sources.

Total CO_2-emission associated with energy sector	2,53	Mio t
CO_2-emissions per capita	7,832	t/cap
CO_2-emissions per GDP	0,507	t/€ GDP

Give an overview of the regional primary energy supply by fuel.
Use the Excel conversion tool using CO_2-emission coefficients suitable for your region.

Energy-related CO_2-emissions by sector

Year: 2015			%
Households	558.882	t CO_2	22,1
Service sector	270.109	t CO_2	10,7
Industry	656.091	t CO_2	26,0
Transport	698.620	t CO_2	27,7
Agriculture, Fishing and Other	342.756	t CO_2	13,6
Sum	**2.526.457**	**t CO_2**	**100,0%**



8. Renewable energy sources – status and potential

8.1. General information

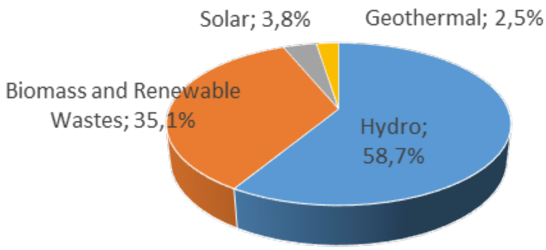
Use the Excel tool to fill the following tables and generate graphs.
If regional data is available, use this information and quote your sources.

Renewable Energy Targets:		
2020 RES share in gross final energy consumption	25	%
2030 RES share in gross final energy consumption	/	%
Current RES share (2015)	22,8	%

thereof RES out of the region	/	%

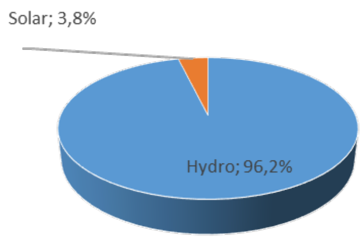
Share of final energy consumption produced by renewable fuels

Year: 2015			%
Hydro	1.642	GWh	58,7
Wind	0	GWh	0
Biomass, biofuels and renewable wastes	981	GWh	35,1
Solar	105	GWh	3,8
Geothermal	70	GWh	2,5
Tide, Wave, Ocean	0	GWh	0
Sum	**2.798**	**GWh**	**100,0%**



Share of total electric demand covered by renewable fuels

Year: 2015			%
Hydro	1.642	GWh	96,2
Wind	0	GWh	0
Biomass, biofuels and renewable wastes	0	GWh	0
Solar	65	GWh	3,8
Geothermal	0	GWh	0
Tide, Wave, Ocean	0	GWh	0
Sum	**1.707**	**GWh**	**100,0%**



Describe if and how renewable energy sources are integrated in the transport sector, e.g. biofuels, electric vehicles.

The target share of renewable energy in the transport sector is 10 % of renewables in the year 2020. The target for the year 2017 is at least 6,2 % of renewable energy in the transport sector (according to the *Regulation on renewable energy in transport; Uradni list RS, št. 64/16*).

Describe the status of REN production in the region. % of total energy and electricity demand covered by REN. If available give a historic overview of the REN production capacities for the last 5 to 10 years.

As already described above, the main RES energy producer in the region is the river Drava. Four large hydropower plants in the region are producing about 1.642 million kWh of electricity per year, what is about 15 % of total electricity produced in Slovenia.

In the field of heat production there is a district heating on wood biomass running in municipality Lenart. The installed power of the biomass boiler is 3,5 MW. Other district heating systems on wood biomass are planned.

Describe if there are incentive programmes/schemes (financial and non-financial) in place to support REN-development. Are these programmes on national, regional or local level?

On the national level we have a support scheme for the electricity production from renewable energy sources. Borzen is implementing support schemes for the production of electricity from renewable energy sources and highly efficient cogeneration of heat and electricity.

Describe the top 5 regulatory barriers slowing down current and future REN-development. Should these barriers be addressed at national, regional or local level?

In most Member States, there are still many barriers to the introduction of renewable energy sources that reduce the effectiveness of measures to promote them and irritate their introduction.
In Slovenia and the Podravje region these barriers are:
- very long procedures in issuing the necessary permits and documents,
- ignoring the potential of RES in the process of spatial planning,
- financial - lack of investors
- social acceptability - disapproval of local communities or civil initiatives

Since Slovenia is a small country and the barriers are a problem also on national not just regional level, they should be addressed on national level, but maybe the success rate would be better when addressing these barriers on local level first staring with small communities (bottom-up approach).

Give an estimate of the trend in renewable energy production using values from -5- to +5 (where -5 is a strong reduction, 0 means neither growth nor reduction, +5 strong growth). Describe supporting factor as well as barriers.

+2

The estimation of the trend is given according the data and predictions for the energy production from RES in the Energy Balance of the Republic of Slovenia (ebrs 2016). Supporting factors for the energy production from RES are mainly of financial nature either financial support for electricity production or subsidies for replacement of fossil fuel heat boilers and the transition to renewable sources. A supporting factor as well is also the increasing environmental awareness, but at the same time the environment is also a barrier. Excessive use and a non-sustainable use of renewable sources can also have negative effects on the environment, for example: Hydropower plants can have a strong impact on aquatic flora and fauna and the natural environment. One of the barriers is also the higher price for the energy produced from RES due to the higher price for the RES technology.

8.2. Available natural resources in the region

Biomass

How are forest areas used? For what purpose? What is the regional energy potential using existing forest areas? Please state whether it is a theoretical or technical potential and describe regulatory support systems as well as barriers.

The total area of forests in the Podravje region is 84.339,42 ha and 74,82 % of them are private forests, 24,22 % are owned by the state and less than 1 % is owned by municipalities. The wood stock amounts to 29,503.456,27 m^3 and the annual growth amounts to 777.605,01 m3. The theoretical potential of wood suitable to be used for energy purposes is 142.704,94 tonnes. The actual potential of wood for energy purposes is the amount of wood that is currently available on the market. The actual (technical) potential of wood that can be used for energy purposes is 40.988,36 tonnes, what means that the theoretical potential is exploited by less than 30 %. The reason for the difference between these values are because of the high share of private woods, where much less logging is taking place.

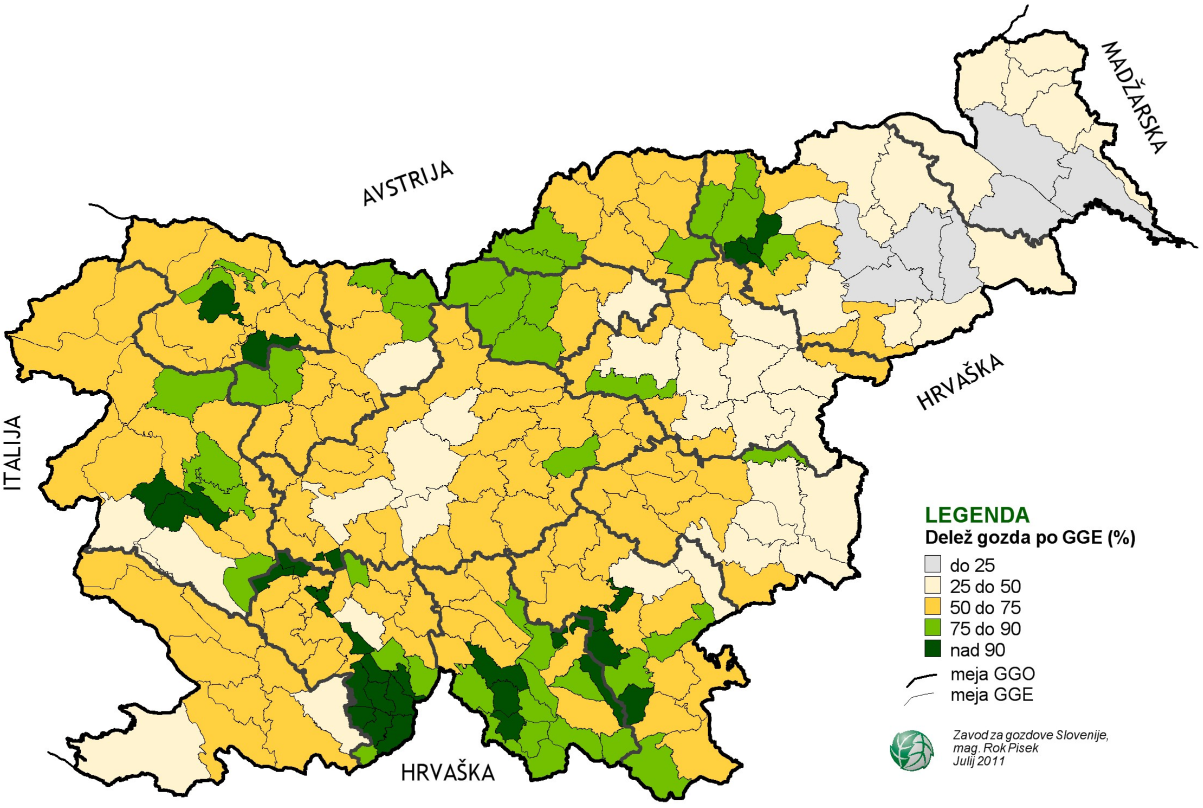
What are main agricultural products at the moment? What is the regional energy potential from agricultural products? Please state whether it is a theoretical or technical potential and describe regulatory support systems as well as barriers.

The main agricultural products in the region are wheat and corn. Some of the possibilities for the use of biomass for energy purposes are the use of corn, residues from the harvest and animal faeces in biogas plants or the production of biofuel from rapeseed. The energy potential from agricultural products are also residues from vineyards and orchards.

Overgrown areas are presenting a great potential of wood biomass. Wood biomass is not only in forests but also in other areas of trees and bushes. According to assumptions of the Forestry institute of Slovenia these areas represent 21 % of the total wood biomass potential.

Provide a land use map or map indicating biomass energy potential of the region, if available.

You can use e.g. the Corine Land Cover 2012 database: http://land.copernicus.eu/pan-european/corine-land-cover/clc-2012/view



The share of forests in the Podravje region is less than 25 % in the central part and up to 90 % or more in the north-western part of the region.

Hydro power (incl. tide and wave power)

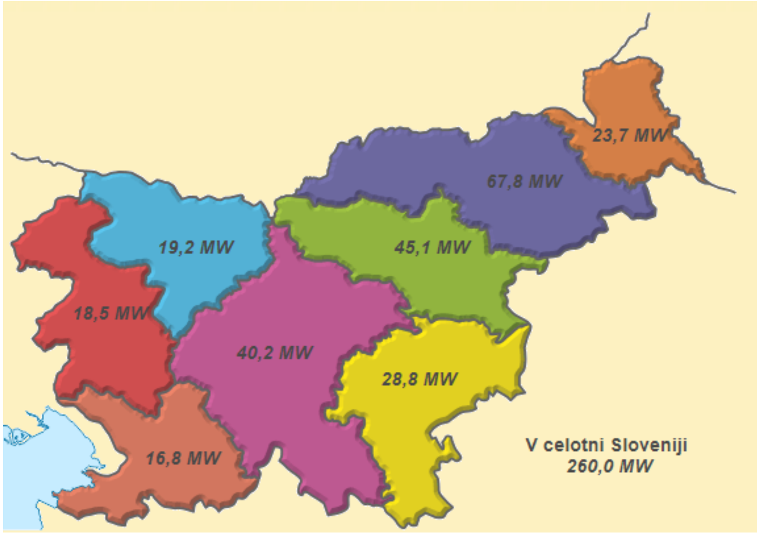
Give an overview of hydro power sources used at the moment and describe the energy potential for the different technologies: run-of-river hydropower plants, reservoir hydropower plants, use of tide and wave power, if applicable. Differentiate between small and large hydro power. Describe the energy potential based on geographical and political frameworks.

The river Drava flows through two Slovenian regions – Carinthia and Podravje region. Drava is the most "energy" exploited river in Slovenia. The river Drava has a potential of 2.896 GWh of produced electricity per year. Currently 97,8 % of the potential is exploited. On the river Drava are installed 8 large hydropower plants (4 of them are in the Podravje region) and 2 small hydropower plants. There is also one small hydropower plant on the river Mura and one private owned on the river Dravinja. The difference between micro, small and large hydropower plant are in their capacity (nominal installed power of the turbine): micro hydropower plant – up to 36 kW; small hydropower plants – from 36 kW – 10 MW, large hydropower plants – over 10 MW.
Near the main city of Podravje – Maribor is planned a pumped storage hydro plant. The use of tide and wave is not possible because Podravje has no sea side.

Solar power

Solar irradiation (on optimally inclined plane) per year	from 1.028 to 1.250	kWh/m²

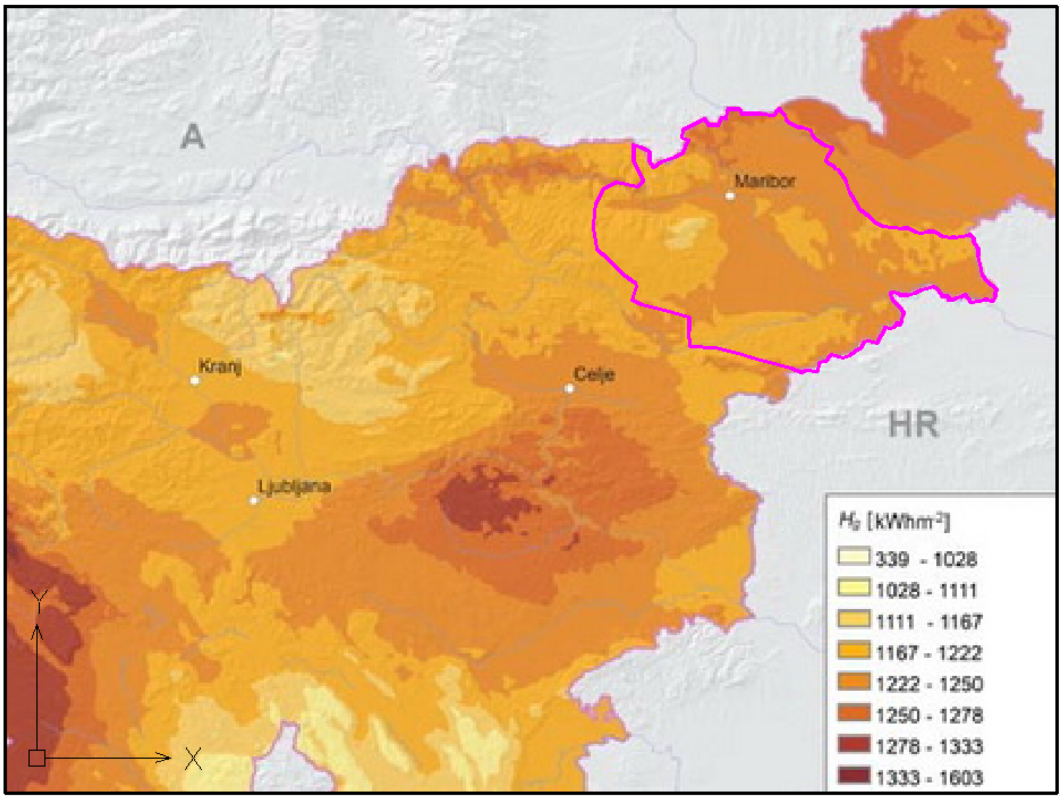
Give an overview of both solar thermal and PV usage hydro power sources at the moment and describe the energy potential based on geographical and political frameworks.



In the Podravje region are installed around 680 PV plants with the total installed power of 58,9 MW. They are producing around 65 GWh of electricity.

Provide a map indicating solar irradiation in the region, if available.

You can use e.g. the interactive map or posters provided by EU JRC PV database: Photovoltaic Geographical Information System (PVGIS), http://re.jrc.ec.europa.eu/pvgis/



The average value of the solar radiation in Podravje amount to about 1.200 kWh/m^2

Wind power

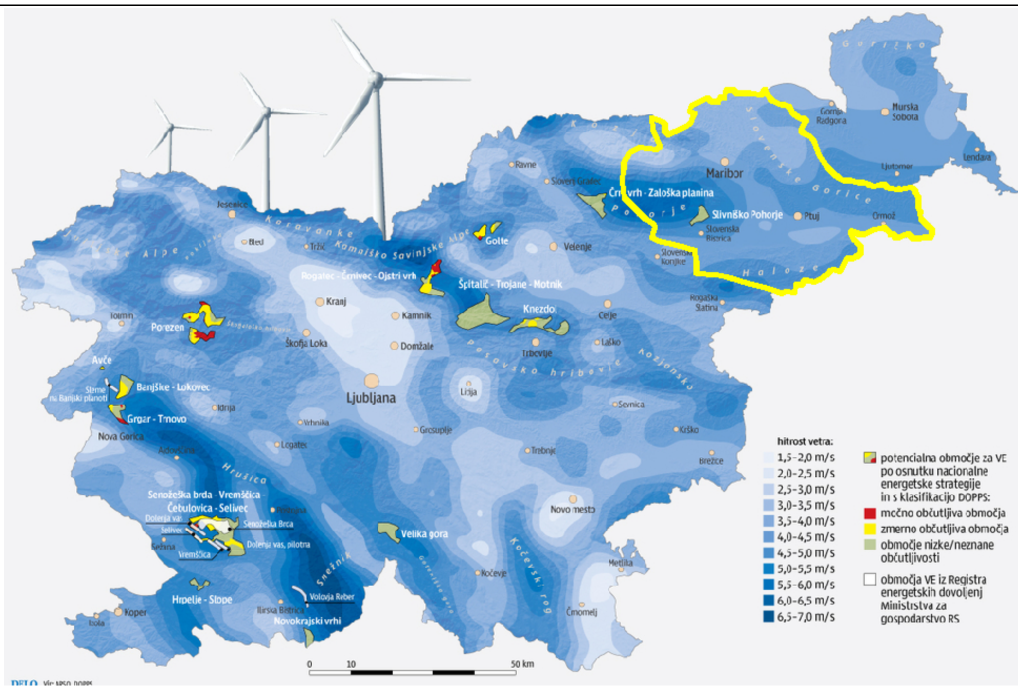
Average wind velocity	From 2.5 to 6.0	m/s
Full load hours	< 1,000	h/a

Give an overview of wind power use at the moment and describe the energy potential based on geographical and political frameworks. Differentiate between offshore and onshore potential

Use regional/national studies but if not available, you can refer to the EEA study for approximation of wind speed or full load hours: http://www.eea.europa.eu/publications/europes-onshore-and-offshore-wind-energy-potential/at_download/file

Since Podravje region has no sea site there is no offshore potential. In Slovenia are currently operating 2 wind turbines and larger fields of wind power plants are planned. In the Podravje region are no such plants and at the moment. According to the national energy strategy there is only one possible location for the installation of a wind power plant in the Podravje region.

Provide a wind map for the region, if available



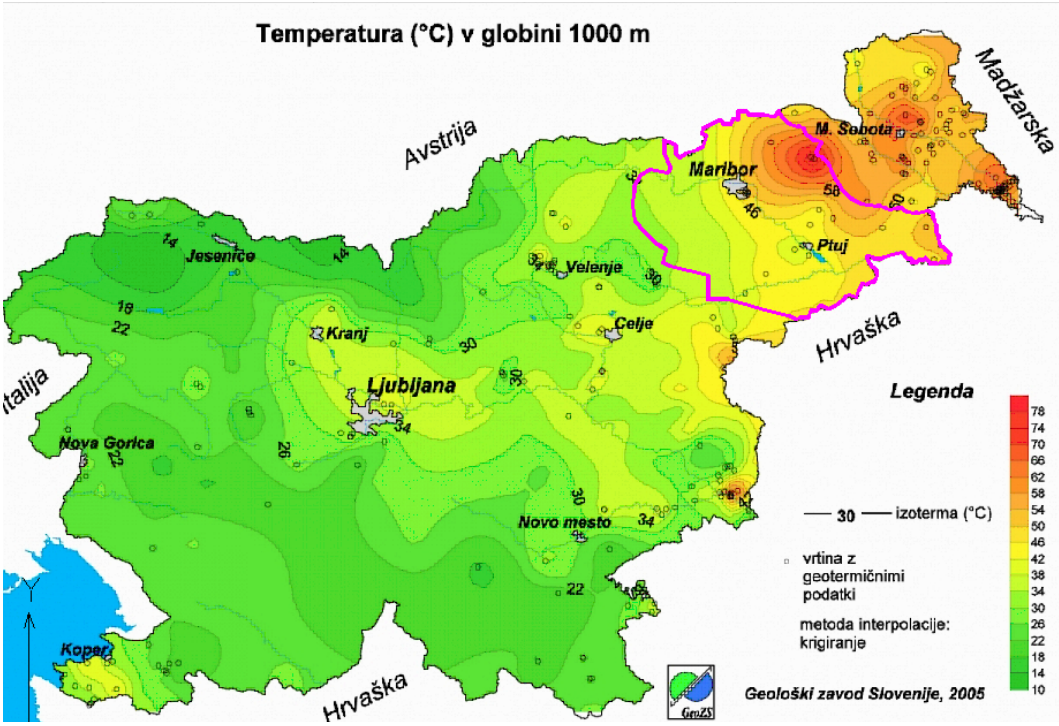
Geothermal energy

Give an overview of use of geothermal energy at the moment and describe the energy potential based on geographical and political frameworks.

You can use e.g. this study as staring point: A prospective study on the geothermal potential in the EU http://www.geoelec.eu/wp-content/uploads/2011/09/D-2.5-GEOELEC-prospective-study.pdf

The geothermal energy potential in Podravje is quite well. Geothermal energy in the region is used only directly in thermal spas. Geothermal energy for district heating is currently used only in the neighbouring region (Pomurje region). In the Podravje region we have an Aquifer called Termal II lying at different depths (up to 5000 m), which is suitable to produce electricity. The water temperatures are between 90 °C and 175 °C. First projects are already made and the construction should begin in few years.

Provide a geothermal map for the region, if available



Waste

Describes overlaps between waste management and energy sector. Is municipal solid waste used for energy production? How is the energy from waste incineration plants used, e.g. electricity generation, district heating (cogeneration)

Every person in the Podravje region annually produces in average 438 kg of waste, this means 141.275 tonnes per year. 25 % of the waste - the so-called light fraction is suitable for energy processing, because this fraction has a calorific value of 20 MJ/kg or even more. That means a theoretical potential of 196 GWh of energy per year.
Currently, there are no plants for the energy recovery of waste in the region.

Restriction through protected areas

Are there environmentally protected areas, which are not available for REN facilities or restrict the overall potential?

One of the problems in Slovenia as well as in the Podravje region are the natural protected areas (Natura 2000) and in the case of exploiting the wind power is the situation that the most suitable areas for wind power plants are at the same time protected areas. There were also plans for pumped storage hydro power plant but the project has met with resistance and disapproval by civil initiatives and environmental associations due to excessive intervention in nature.

9. Energy efficiency – status and potential

What is the status of the implementation of the Energy Efficiency Directive?

The goals set in the National Action plan for energy efficiency (in accordance with the Energy Efficiency Directive) are:
- the reduction of the use primary energy until 2020 (Article 3 of EED);
- every year to renovate 3 % of the building stock owned by the government (Article 5 of EED);

The process of primary energy reduction runs in the frame of set annual targets but the use in the industry sector must be reduced in the future. The goal in the frame of the 5th Article of EED was not reached in the year 2014.

What is the status of the implementation of the Energy Performance of Buildings Directive (e.g. data on low/zero energy buildings)?

The goals set in the Energy Performance of Buildings Directive are:
- all new buildings after 31.12.2020 must be built as near zero energy buildings,
- all new public buildings after 31.12.2018 must be built as near zero energy buildings.

Slovenia as a EU member has prepared the National plan for increasing the number of nearly zero-energy buildings according with the provisions of the EPBD. Slovenia has prepared an analysis of cost-optimal requirements for energy efficiency of three types of buildings (single family houses, multi-family houses, and non-residential buildings). The analysis serves as a technical basis for the planning of nearly zero-energy buildings.

Analyse the sectors:
Households: Are energy efficiency measures implemented in this sector? Are there awareness campaigns to highlight the potential? Is there support for the implementation (financial and non-financial)?

At the local level in Slovenia there is set a network of energy consultants (called ENSVET) with the purpose to advise citizens in energy matters. People can get free information's of how to reduce energy costs of their households, on measures to achieve energy efficiency, on programs of co-financing of those measures, etc. The counselling increases energy awareness of citizens, increases energy savings and reduces greenhouse gas emissions and thereby facilitates the implementation of certain measures and programs related to energy policy. The financial support is provided with the ECO Fund. Eco Fund's main purpose is to promote development in the field of environmental protection. It is the only specialised institution in Slovenia that provides financial supports for environmental projects. The financial assistance is offered mainly through soft loans from revolving funds and since the year 2008 through grants.

Service sector: Are energy efficiency measures implemented in this sector? Are there awareness campaigns to highlight the potential? Is there support for the implementation (financial and non-financial)?

In the field of awareness campaigns on energy efficiency the ECO fund offers co-financing of Educational, awareness raising and promotional projects on topics that represent priority areas of the ECO Fund.

Industry: Are energy efficiency measures implemented in this sector? Are there awareness campaigns to highlight the potential? Is there support for the implementation (financial and non-financial)?

The provisions of National Action plan for energy efficiency are covering all sectors. The Industry is a big energy consumer has a great impact on the environment therefore energy efficiency measures are implemented in this sector. The ECO Fund is offering soft loans and subsidies for energy audits, implementation of energy efficiency measures (energy renovations, heating system optimizations) and installation of cogeneration of heat and power systems (CHP plants).

Transportation: Are energy efficiency measures implemented in this sector? Are there awareness campaigns to highlight the potential? Is there support for the implementation (financial and non-financial)?

ECO Fund offers favourable loans and subsidies, for the purchase of electric or hybrid vehicles, for citizens, service and the public sector.

Give an estimate of the trend in energy efficiency development using values from -5- to +5 where (-5 is a strong reduction, 0 means neither growth nor reduction, +5 strong growth).

+3

Demand side management, smart metering, storage

Demand side management is already in use and the replacement of electricity consumtion meters with the so-called smart meters is in progress but in terms of integration of information and communication technology and the power system we are still at the beginning of the development. One of the aims in the future for Podravje is to become a “smart region”, what means that a lot of effort and emphasis will be put to develop all the necessary strategies and later to implement all the measures such as management systems and storage.

10. SWOT analysis

Please make a SWOT-analysis for the development of your region towards a low-carbon economy in 2050. Include stakeholders in the process.

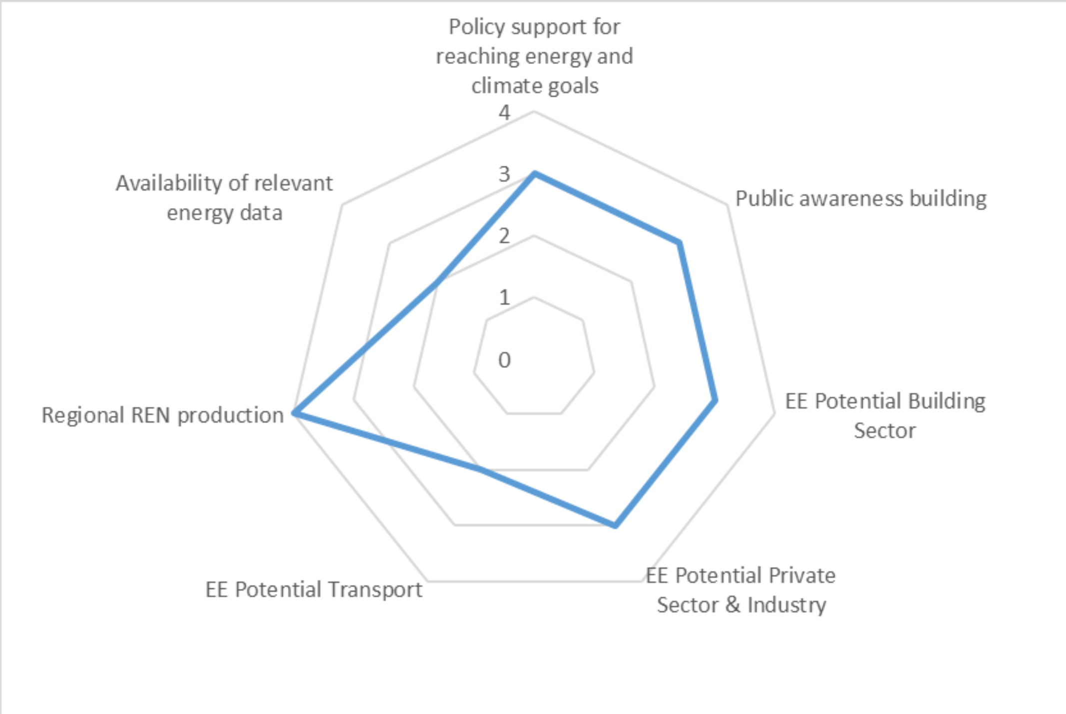
Strengths	**Weaknesses**
• Well-developed REN production • Good RES potential • Good awareness of the general public	• Poor availability on regional energy data • No regional policies and strategies on energy matters • Very long procedures in issuing the necessary permits and documents • Lack of investors • High costs of REN production compared with conventional energy production
Opportunities	**Threats**
• To strengthen the production of REN • To improve the EE in Transport sector • To take advantage of EU and national financial supports until 2020 and improve the EE of residential buildings and buildings in the public sector, private sector and Industry	• Unsustainable use of renewable sources • Disapproval of general public

Assess the following trends:

- Policy Support for reaching energy and climate goals
- Public awareness building
- EE Potential Households
- EE Potential Private Sector & Industry
- EE Potential Transport
- Regional REN production
- Availability of relevant energy data

Self-assessment:
See Excel template or modify the graph provided here (right-click).

Points:
1 … no measures set/ potential unused
to
5 … fully developed/ potential fully used



11. Annex: List of sources /bibliography /List of relevant stakeholders/institutions in the region

Please include your sources/bibliography, a list of identified stakeholders, etc.

- Republika Slovenija, Statistični uradhttp://pxweb.stat.si/pxweb/dialog/statfile1.asp
- Republika Slovenija, Ministrstvo za infrastrukturo, portal energetika, http://www.energetika-portal.si/
- Republika Slovenija, Ministrstvo za okolje in prostor, Agencija Republike Slovenije za okolje (ARSO): http://www.arso.gov.si/en/
- Dolar G., 2016, *Geografske zasnove rabe obnovljivih virov v Sloveniji do leta 2030*, diplomsko delo, Univerza v Ljubljani
- PV portal, Slovenski portal za fotovoltaiko, http://pv.fe.uni-lj.si/.
- Republika Slovenija, Ministrstvo za okolje in prostor, Lesna biomasa. http://www.zgs.si/slo/delovna-podrocja/lesna-biomasa/index.html
- Dravske elektrarne Maribor. http://www.dem.si/sl-si/Elektrarne-in-proizvodnja/Elektrarne
- Mariborska razvojna agencija, Maribor 2015, *Regionalni razvojni plan podravske razvojne regije 2014 - 2020*.
- Humar M., Ljubljana 2008, *Potencial lesne biomase za energetske namene v Sloveniji*, diplomsko delo, Univerza v Ljubljani.
- Mag. Kovič S., mag. Praznik M., *SANACIJA VEČSTANOVANJSKIH STAVB V PASIVNEM IN NIZKOENERGIJSKEM STANDARDU,* http://www.lesena-gradnja.si/html/img/pool/SANACIJA_STANOVANJSKIH_STAVB.pdf
- Energijska izraba komunalnih odpadkov z zgorevanjem*, https://www.zfm.si/novice/varnost-zdravje-okolje/arhiv/364-energijska-izraba-komunalnih-odpadkov-z-zgorevanjem*
- Energetska revščina, Slovenija, 2015, http://www.stat.si/StatWeb/News/Index/6319
- Rogelja T., dr. Krajnc N., Triplat M., Ščap Š., avgust 2014, *Analiza potencialov lesne biomase iz gozdov in hitrorastočih nasadov a območju podravske, spodnjeposavske, jugovzhodne regije,* project BioHeatLocal.