

# DELIVERABLE D.T2.1.1

---

Energy Report Template

Version n° 0.1/2019

---





# D.T2.1.1: Deliverable

## A.T2.1 State of the art energy report concept

Issued by: Partner n° 3 - Partner MAE  
Version date: 30.09.2019  
Version. Revision 0.1  
Circulation RE - Restricted to PP

### Document History

Date	Version	Description of Changes
30.09.2019	v 0.1	Document issued by PPn° 3

Partners involved



## Interreg CENTRAL EUROPE

Priority:	2. Cooperating on low-carbon strategies in CENTRAL EUROPE	
Specific objective:	2.2 To improve territorial based low-carbon energy planning strategies and policies supporting climate change mitigation	
Acronym:	<b>PROSPECT2030</b>	
Title:	<b>PROMoting regional Sustainable Policies on Energy and Climate change mitigation Towards 2030</b>	
Index number:	CE1373	
Lead Partner:	Piemonte Region	
Duration:	01.04.2019	30.09.2021



## Table of contents

1. EXECUTIVE SUMMARY .....	5
2. INTRODUCTION .....	6
2.1. General description of the region .....	6
2.1.1 Geographical situation .....	6
2.1.2 Settlement structure .....	7
2.1.3 Demographic structure and development .....	7
2.1.4 Regional economy .....	10
2.1.5 Particularities of the region .....	13
3. Infrastructure .....	14
3.1. Energy related infrastructure .....	14
3.1.1 Electricity grid infrastructure .....	14
3.1.2 Gas grid infrastructure .....	15
3.1.3 District heat infrastructure .....	16
3.2. Mobility and transport related infrastructure .....	17
3.2.1 Rail network .....	17
3.2.2 Road network .....	17
3.2.3 Aviation and waterways infrastructure .....	18
3.3. Particularities of regional infrastructure .....	18
4. Transport .....	19
4.1. Basic data and modal split .....	19
4.2. Road transport .....	19
4.2.1 Motor vehicles by type and fuel .....	20
4.2.2 Passenger cars by fuel, kilometre and fuel performance .....	21
4.2.3 Passenger- and tonnes kilometres .....	22
4.2.4 Particularities .....	22
4.3. Rail transport .....	22



4.3.1	Passenger and tonnes kilometres .....	22
4.3.2	Development of passenger and goods transports .....	22
4.3.3	Particularities.....	22
4.4.	Air and waterway transport .....	22
5.	Energy status .....	23
5.1.	Energy in the European and national context .....	23
5.1.1.	Simplified energy balance of EU 28.....	23
5.1.2.	Simplified national balance .....	24
5.1.3.	National electricity fuel mix disclosure.....	25
5.1.4.	Time series of national final energy consumption .....	26
5.1.5.	Energy prices - status quo and and development 2005 to ... (latest available) .....	28
5.2.	Regional energy demand.....	29
5.2.1.	Regional energy demand by fuel and sector .....	29
5.3.	Regional energy supply .....	31
5.3.1.	Regional generation by source, capacity and output .....	31
5.3.2.	Supply mix .....	31
5.3.3.	Energy storage .....	31
5.3.4.	Regional key technologies for supply.....	31
5.4.	Regional demand-supply balance and development potentials .....	31
5.4.1.	Regional-self supply rate .....	31
5.4.2.	Energy efficiency potentials.....	32
5.4.3.	Resource potentials .....	32
5.4.4.	Technology potentials .....	32
6.	CO2 Emissions.....	33
7.	Key figures and bottom line of the situation.....	33
8.	CONCLUSIONS .....	34



## 1. EXECUTIVE SUMMARY

The Mazovian Voivodeship is located in the central-eastern part of Poland. It is the largest voivodship in the country and covers an area of 35558 km<sup>2</sup>, which accounts for 11.38% of Poland's territory. The voivodship has about 5.4 million people, which places them first in the country in terms of population. The population density is 149 people per km<sup>2</sup>. Urban population constitutes about 64% of the total population of the voivodship. The Mazowieckie Voivodship consists of 37 poviats. Poviats are divided into 314 municipalities - 35 urban, 53 urban-rural and 226 rural.

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 and high pace of growth of the economy.

In the region there is a big problem with access to regional energy data. The energy related data are available only on national level and in general view on regional level. The final energy consumption from official statistics in the Mazovia Region region for 2016 is app. 22.612 GWh. The share of the regional consumption is around 7% of the total national final consumption. The amount of CO<sub>2</sub> emissions, based on energy consumption, was estimated to an amount of app. 268.5 Million tons per year

Mazovian Voivodeship is one of the largest electricity consumers in Poland, produced 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.



## 2. INTRODUCTION

The Mazovia Energy Agency carries out tasks in the field of environmental protection, energy conservation as well as the promotion of rational use of energy. The agency conducts activities aimed at popularizing pro-ecological methods of energy production, especially based on renewable sources, and will undertake works aimed at identifying the possibilities, needs and resources related to energy in the Mazovian Voivodeship.

### 2.1. General description of the region

#### 2.1.1 Geographical situation

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](https://pl.wikipedia.org/wiki/Wojew%C3%B3dztwo_mazowieckie#/media/File:Masovian_in_Poland_(%2Brivers).svg)

The voivodship is located mostly in the Central European Lowland, only its small eastern fragments are located in the Eastern Baltic-Belarusian Lowland, and the southern ones in the Polish Highlands. The shape of the surface is mostly Mazovian lowlands consisting of vast plateaus, which are separated by valleys of large rivers. In the middle of the territory there is a valley depression, the Central Mazovian Lowland, with the Warsaw Valley in the center. Larger rivers flow into it: Narew with Wkra, Bug, Pilica, Bzura, Liwiec, Świder, and the waters are discharged westwards by the Vistula. The highest point is the summit of the Gazebo - 408 m a.s.l., on the southern edge of the province, at the edge of the Kielce Upland.

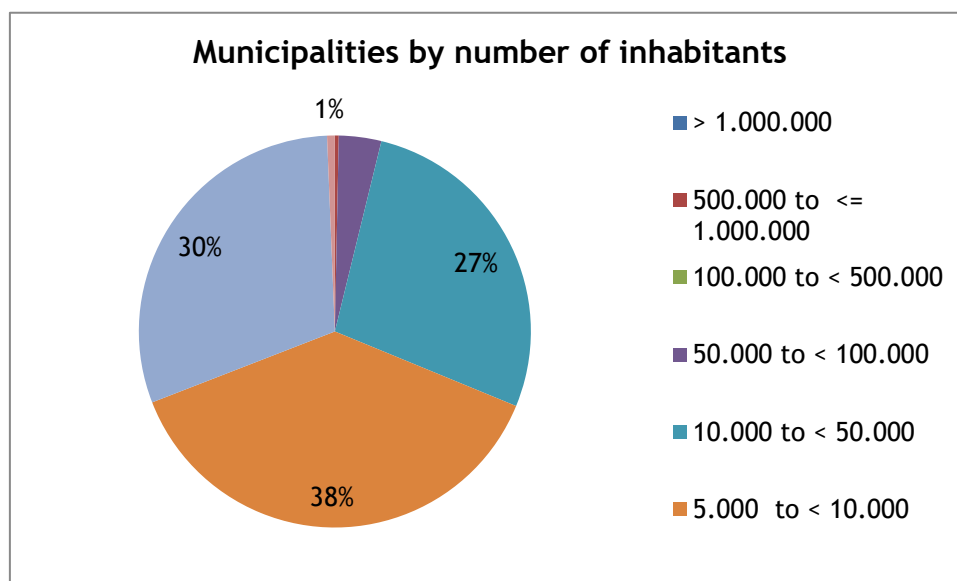


### 2.1.2 Settlement structure

According to data Mazovian voivodship had 5 403 400 inhabitants, which constituted at about 14% of the Polish population. Mazovian voivodeship is a voivodship with the largest population in Poland.

Settlement structure	National	Regional
<i>Area (km<sup>2</sup>)</i>	312 696	35 558
<i>Population (thousands)</i>	38411,1	5403,4
<i>Number of municipalities (total)</i>	2 477	314
<i>Municipalities with inhabitants (number)</i>	2477	314

The main character of the settlements is the small and medium-village-type. About 40% of the municipalities are inhabited by 5.000 to 10.000 inhabitants, one third of the municipalities are smaller, with less than 5.000 inhabitants and also one third of municipalities are between 10.000 -50.000 inhabitants

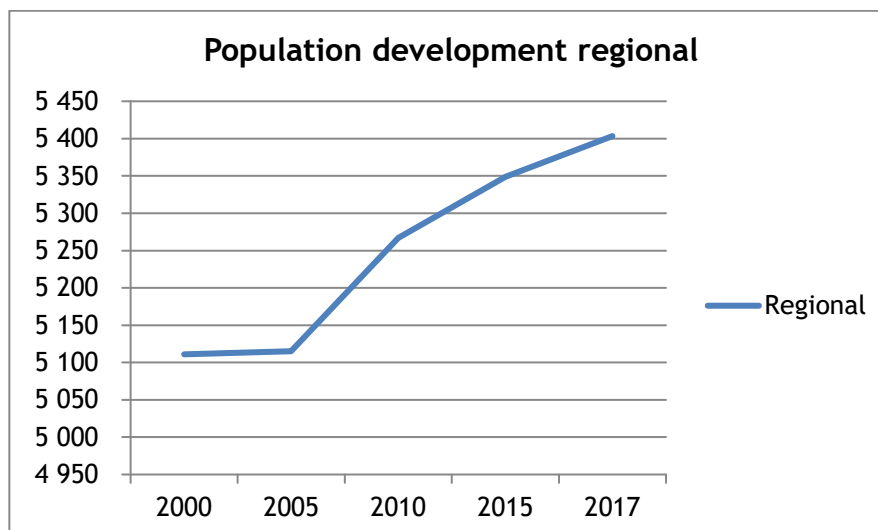
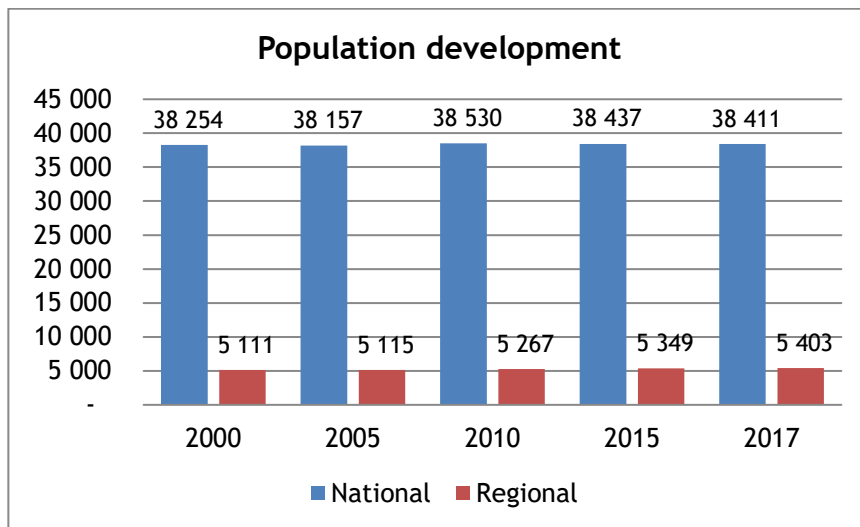


### 2.1.3 Demographic structure and development

#### ■ Population development

Charts below shows population development from 2000 to 2017 in Poland and also in Mazovia Voivodeship.



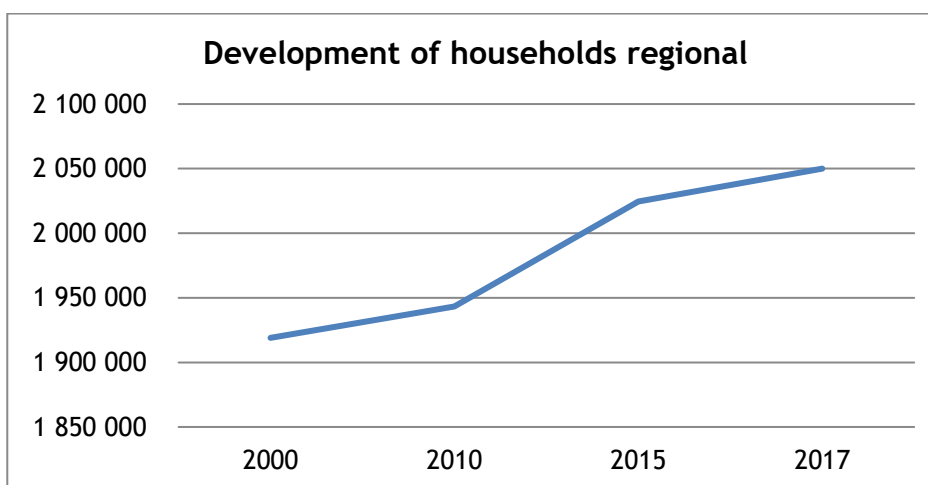
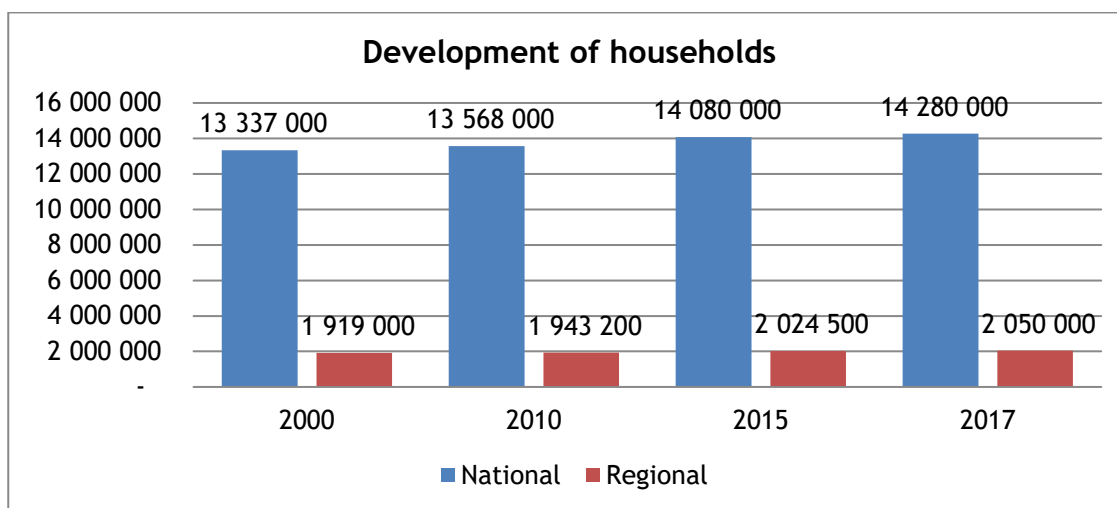


As shown by the data population development in Poland is mostly steady, but population of Mazovia Voivodeship increases every year. This can be caused by the fact of localization of capital city Warsaw in the Voivodeship with more jobs openings and higher salary possibilities.

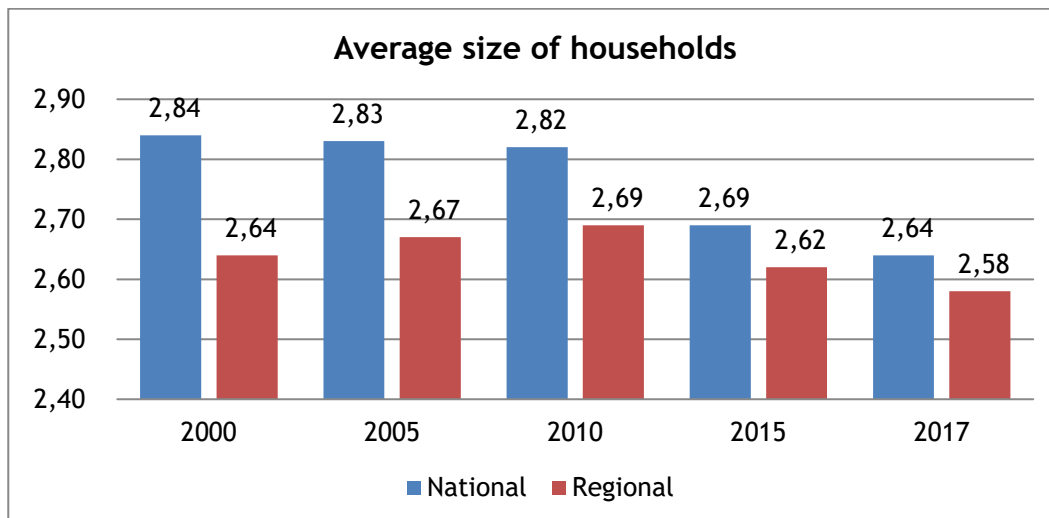


■ **Households**

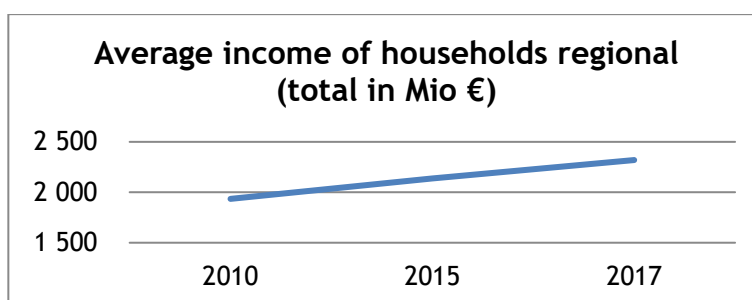
Charts below shows development of number of households from 2000 to 2017 in Poland and in Mazovia Voivodeship



On national, as well as on regional level, the number of households is increasing. Growth at national and regional level is around 6%. At the same time the size of households is decreasing – it is shown at the chart below. Currently, the average size of a household is 2,64 persons at national level and 2,58 persons at regional level.



The average income of households has increased between 2010 and 2017 by about 17% on regional and by about 30% on national level.

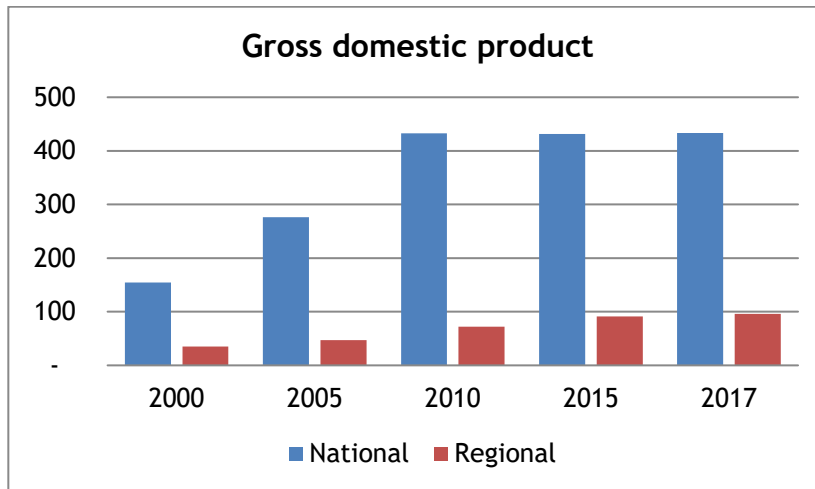


### 2.1.4 Regional economy

The regional economy is described here on the basis of three parameters:

- Gross domestic product (GDP)
- Gross value added (GVA)
- Number of employees

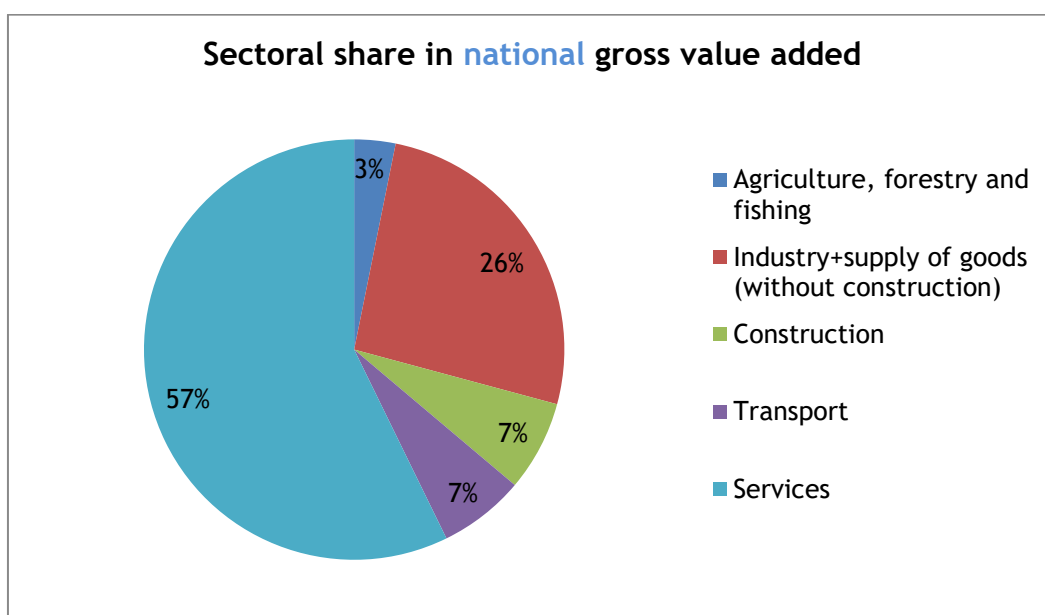
GDP is a measure for the economic strength of a territorial unit. It is a monetary measure of the market value of all the final goods and services produced in a specific time period. The charts below shows gross domestic product (GDP) from 2000 to 2017 in regional and national level.

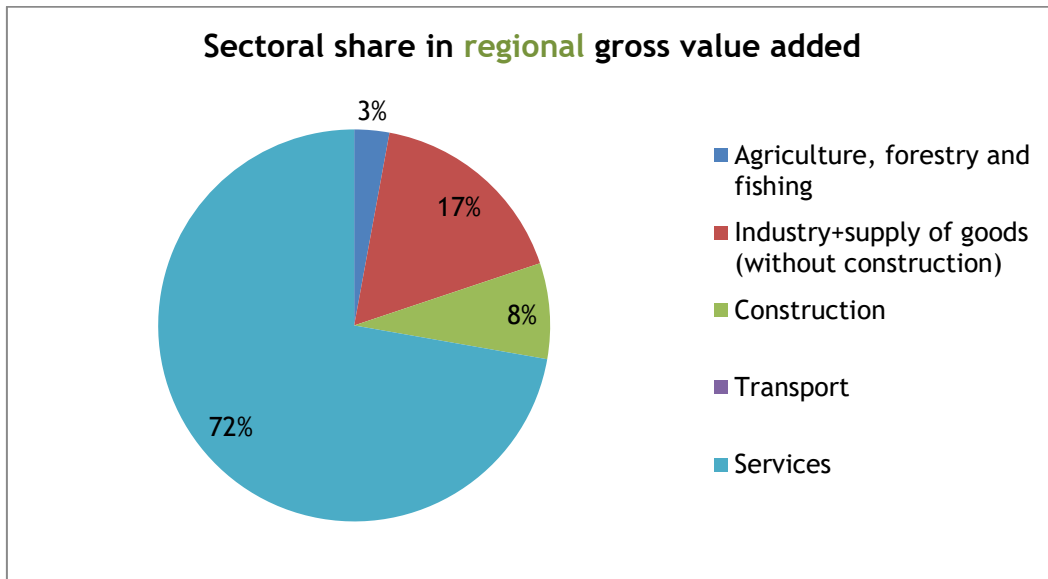


The share of the regional economy in the national GDP is increasing from 2000 till 2017 about 65% at national and regional level.

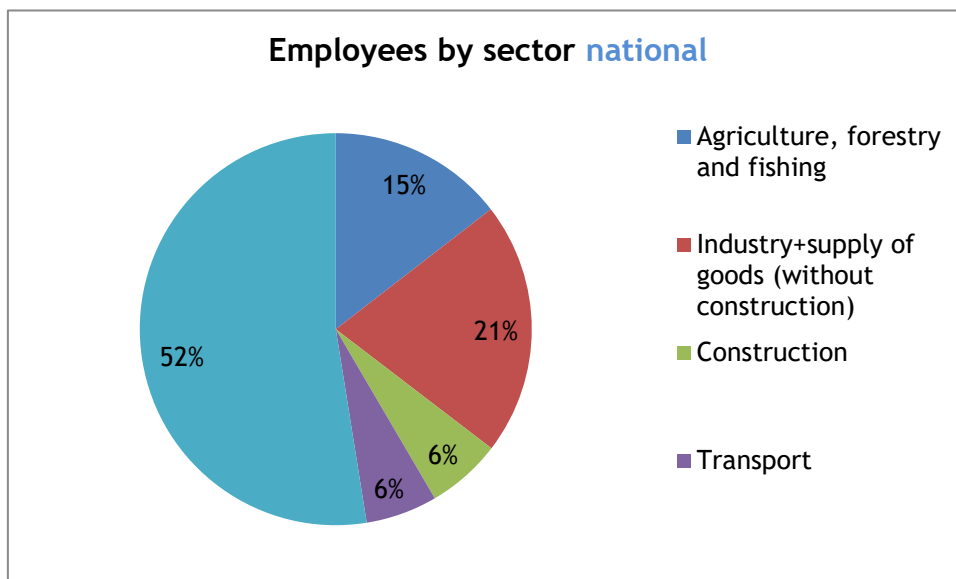
The GVA is an indicator for the economic performance of the sectors in an economy and part of the GDP calculation. GDP and GVA are linked to the energy consumption of the economy. Furthermore there is also a strong correlation between energy consumption, persons employed by sector and energy demand in lines of business. GVA and persons employed can also be used to do a calculator estimation of the energy demand of the sectors in a region, if no direct regional data on sectoral energy consumption are available GVA of Mazovia Voivodeship make up 15% of the total national GVA

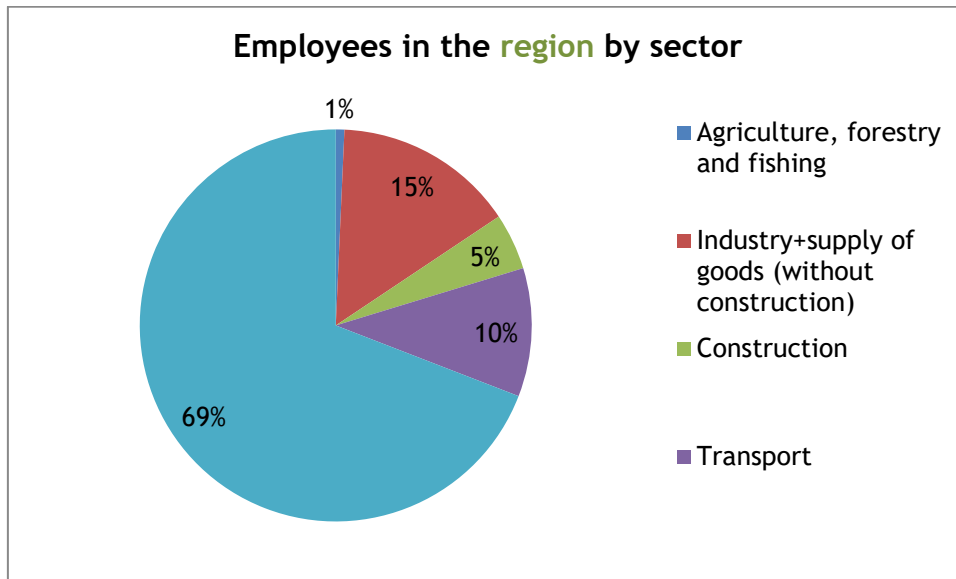
Charts below are giving a comparative overview on the GVA on national and regional level. The most influent sector is services both at national and regional level with slight majority at regional level. The second sector is Industry with around 20 % of total GVA





The rate of employees by sector is showing a similar distribution as the sectoral share in the GVA, which is shown at the charts below.





### 2.1.5 Particularities of the region

Mazovia is one of the most economically developed regions in Poland. Warsaw drives the economy of Mazovia but constantly increasing role of a western Warsaw subregions is noticeable. 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 and high pace of growth of the economy. 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. Mazovian Voivodeship has one of the lowest unemployment rate region in the country.

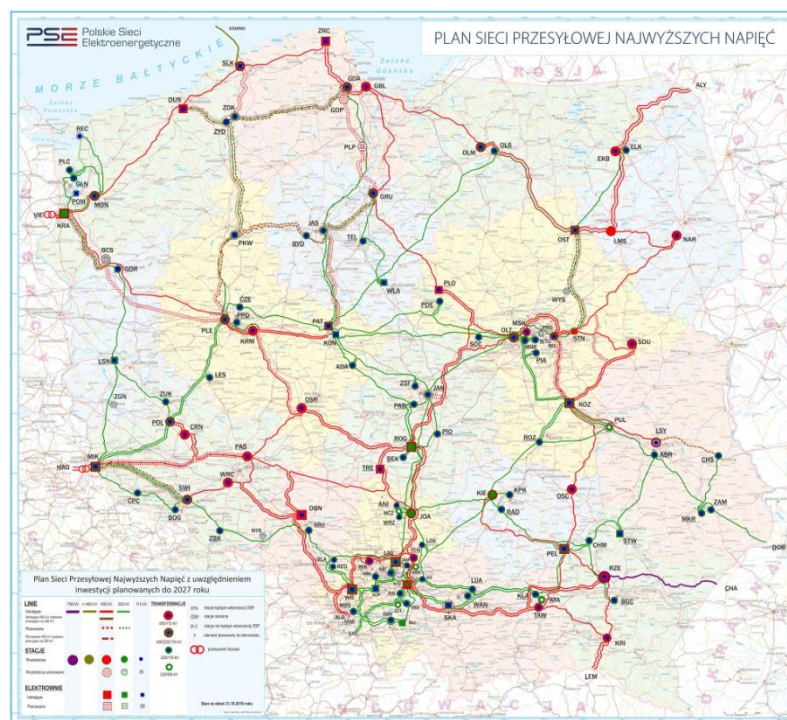


### 3. Infrastructure

#### 3.1. Energy related infrastructure

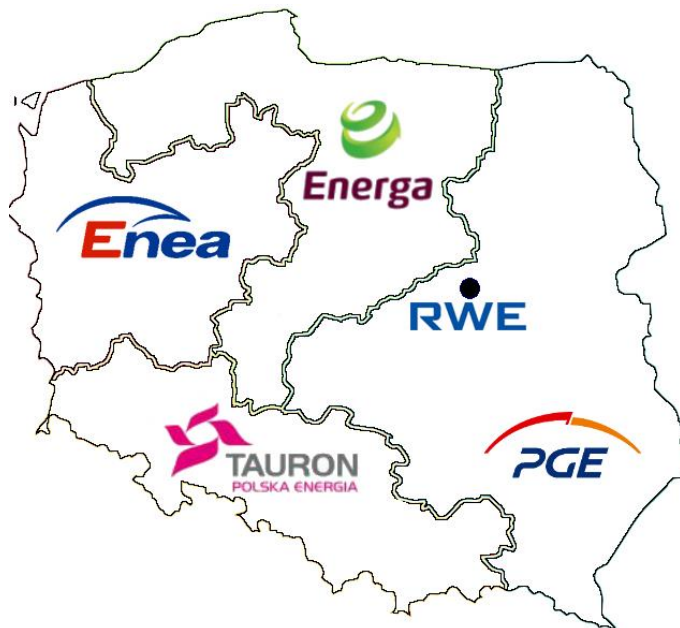
##### 3.1.1 Electricity grid infrastructure

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) Plan of the highest voltage power grid is presented below:



Source: Source: <http://dobryprad.pl/dostawcy/prad/tradycyjni/energa>

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.

### 3.1.2 Gas grid infrastructure

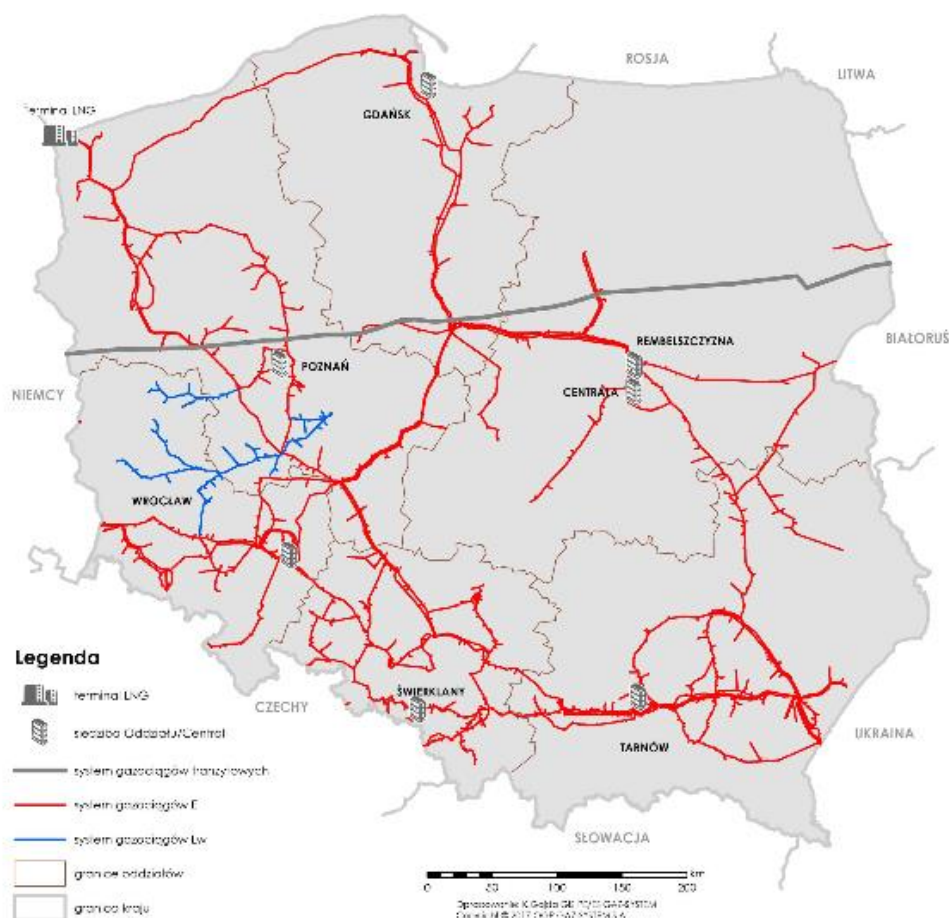
In the Mazovian voivodeship no natural gas mines are connected to the transmission and distribution pipeline system. This means that the entire supply of natural gas in Mazovia comes from the gas transmission system, fed by imported gas, or by gas from domestic production –located in different part of 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 <math><0.5 - 1.6 \text{ MPa}></math>, medium pressure <math><0.01 - 0.5 \text{ MPa}></math>, low pressure - below <math><10 \text{ kPa}></math>.
- 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 Gas transmission system map is presented below:





Source: [http://www.gaz-system.pl/fileadmin/centrum\\_prasowe/wydawnictwa/PL/Raport\\_roczny\\_GAZ-SYSTEM\\_2016.pdf](http://www.gaz-system.pl/fileadmin/centrum_prasowe/wydawnictwa/PL/Raport_roczny_GAZ-SYSTEM_2016.pdf)

### 3.1.3 District heat infrastructure

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.



## 3.2. Mobility and transport related infrastructure

### 3.2.1 Rail network

In 2017 at the end of the year in Mazovia Voivodship the length of rail network was estimated on the level of was 1713 km



Source <https://www.mazovia.pl/transport-publiczny/transport-kolejowy/linie-kolejowe/>

### 3.2.2 Road network

In 2017 at the end of the year in Mazovia Voivodship the length of public roads with the hard surface was 36210 km. Urban roads accounted for 19.7%, and rural roads accounted for 80.3% of all public roads with hard surface. Map of higher level road network in the region is presented below:



*Source: <http://www.siskom.waw.pl/drogi-wojewodzkie.htm>*

### 3.2.3 Aviation and waterways infrastructure

There is no data available

### 3.3. Particularities of regional infrastructure

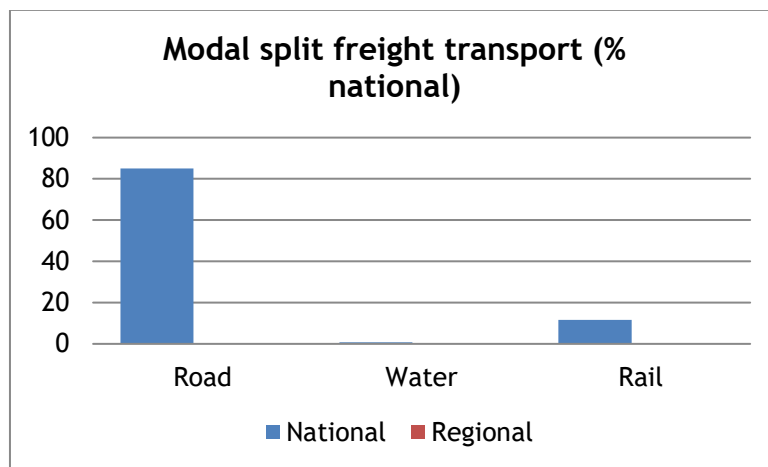
Economically, the Mazovian Voivodeship is full of contrasts. There are typically agricultural areas here, as well as regions with strong industrialization. It is important to mention that Mazovian Voivodeship is the first Polish region to leave the least-developed regions category in the EU classification (i.e. regions where the GDP does not exceed 75% of the EU average) and was included in the more developed regions.



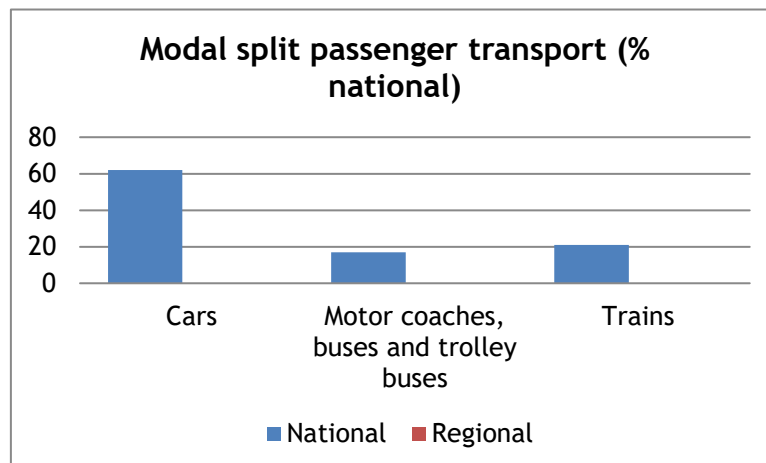
## 4. Transport

### 4.1. Basic data and modal split

Regarding the modal split in passenger and freight transport, there are only data available on national, but not on regional level. Nevertheless it is supposed, that the regional data for Mazovia Voivodeship, regarding road and rail transport is not so much different from the national one. Air and waterway transport are not applicable, because of the lack of a respective infrastructure.



In the chart below it is seen that the main focus in passenger transport is on cars, with 62% on national level.



### 4.2. Road transport

Data regarding road transport are available on national and regional in general idea, but they are not very detailed.

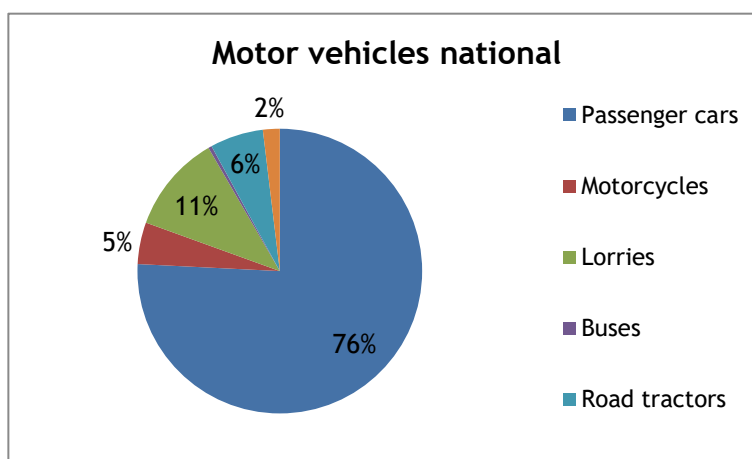


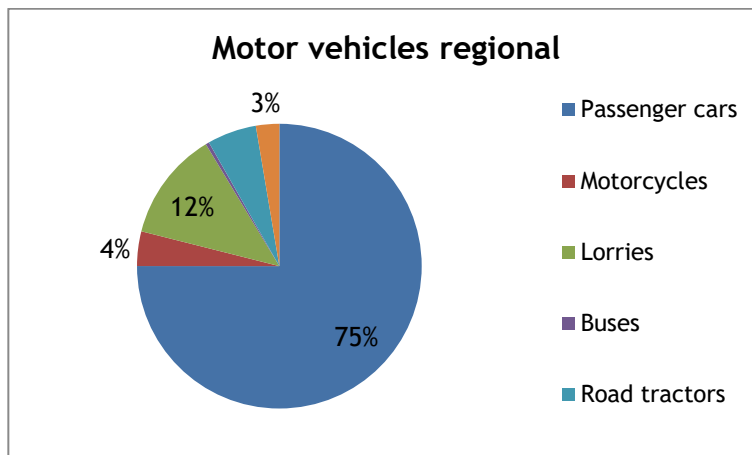
#### 4.2.1 Motor vehicles by type and fuel

The stock of motor vehicles in Mazovia Voivodeship is currently app. 4 500 000 vehicles. This is a share of around 16% of the total number of vehicles on national level. Table below is giving an overview on the number of motor vehicles by type.

Motor vehicles by type	National	Regional
Passenger cars	21 675 388	3 329 784
Motorcycles	1 355 625	174 309
Lorries	3 179 655	551 574
Buses	113 139	17 588
Road tractors	1 732 017	248 225
Other motor vehicles	545 213	117 698
<b>Total</b>	<b>28 601 037</b>	<b>4439178</b>

The distribution on regional level is similar to the one on national level.

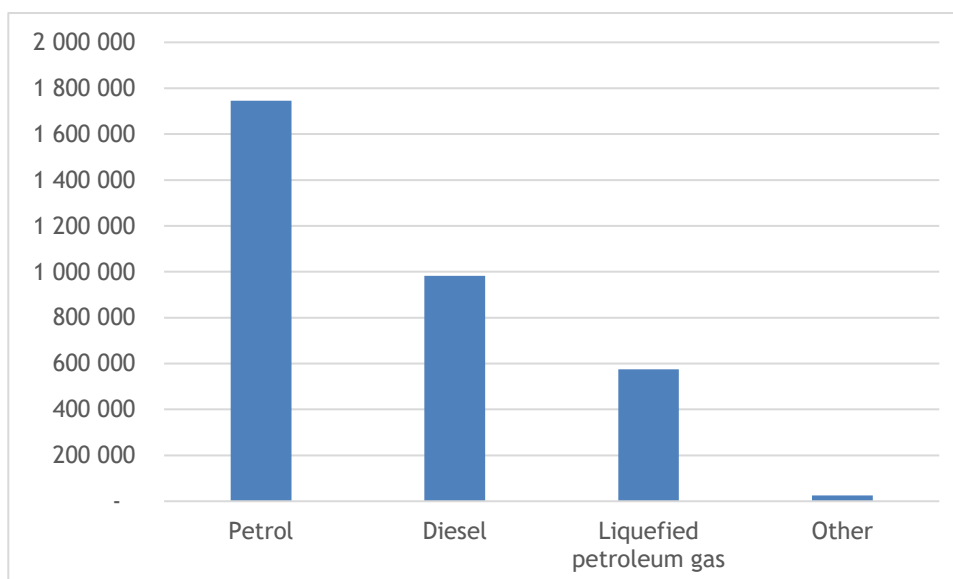


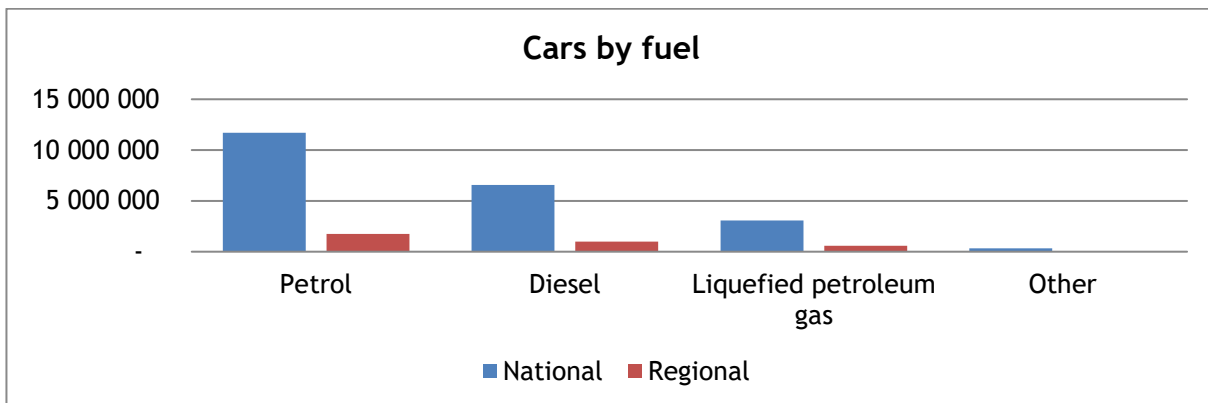


#### 4.2.2 Passenger cars by fuel, kilometre and fuel performance

The amount of passenger cars in the Mazovia Region corresponds to a share of 15% of the total fleet of passenger cars in Poland. The per capita figure on national level is 0,56 and on regional level 0,62 cars per capita. Table and chart below are giving an overview on the passenger cars by fuel on national and regional level.

Passenger cars by fuel (number)	National	Regional
Petrol	11 694 188	1 745 566
Diesel	6 554 145	983 049
Liquefied petroleum gas	3 082 548	575 686
Other	344 507	25 483
<b>Total</b>	<b>21 675 388</b>	<b>3 329 784</b>





#### 4.2.3 Passenger- and tonnes kilometres

There is no such information available

#### 4.2.4 Particularities

On regional level, there is no such information available

### 4.3. Rail transport

#### 4.3.1 Passenger and tonnes kilometres

The respective information is already comprised in the paragraph 4.2.3 above

#### 4.3.2 Development of passenger and goods transports

On regional level, there is no such information available

#### 4.3.3 Particularities

On regional level, there is no such information available

### 4.4. Air and waterway transport

On regional level, there is no such information available

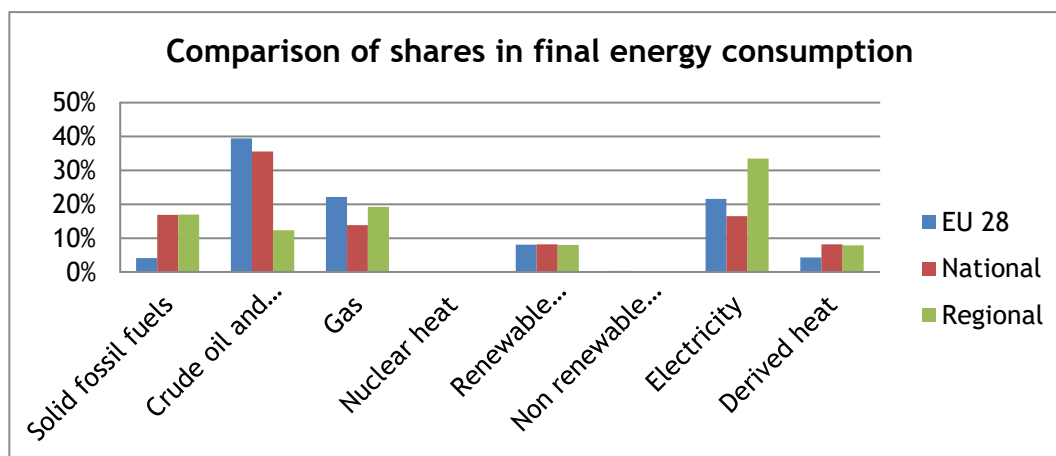




## 5. Energy status

### 5.1. Energy in the European and national context

Chart below is giving an overview on the shares of basic energy carriers in the European, National and Regional final energy consumption.



The following paragraphs are containing graphs regarding the main parameters of the respective simplified energy balances. The abbreviations in the graphs need to be read as follows:

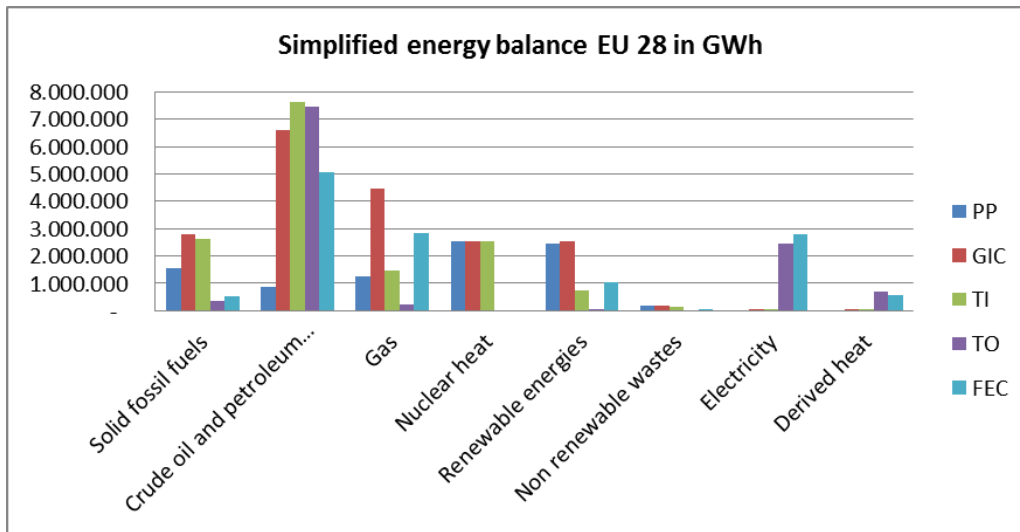
- PP: Primary production (blue bar)
- GC: Gross consumption (red bar)
- TI: Transformation input (green bar)
- TO: Transformation output (violet bar)
- FEC: Final energy consumption (light blue bar)

#### 5.1.1. Simplified energy balance of EU 28

Chart below is showing the simplified energy balance of the EU 28. It shows, that the Union is highly dependent on imports of crude oil and petroleum products, natural gas and solid fossil fuels.

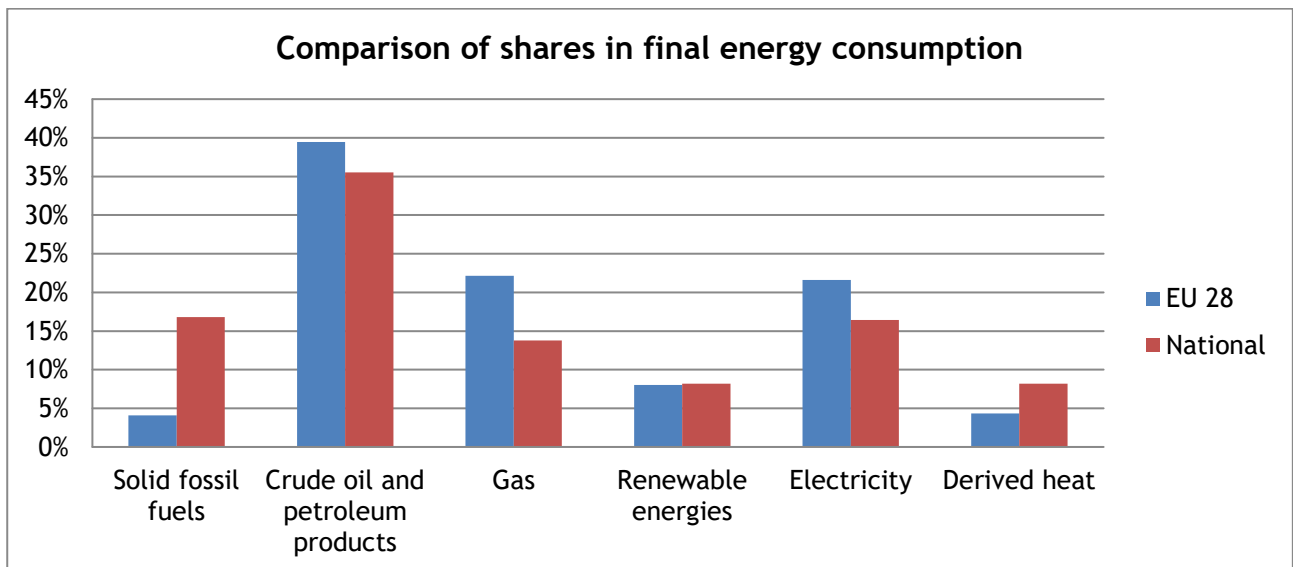
Regarding nuclear heat and non-renewable wastes, the consumption, respectively the transformation output thereof, in the form of electricity and, to a small part, also derived heat) equals the primary production. The demand of renewable energies is almost covered by the primary production.

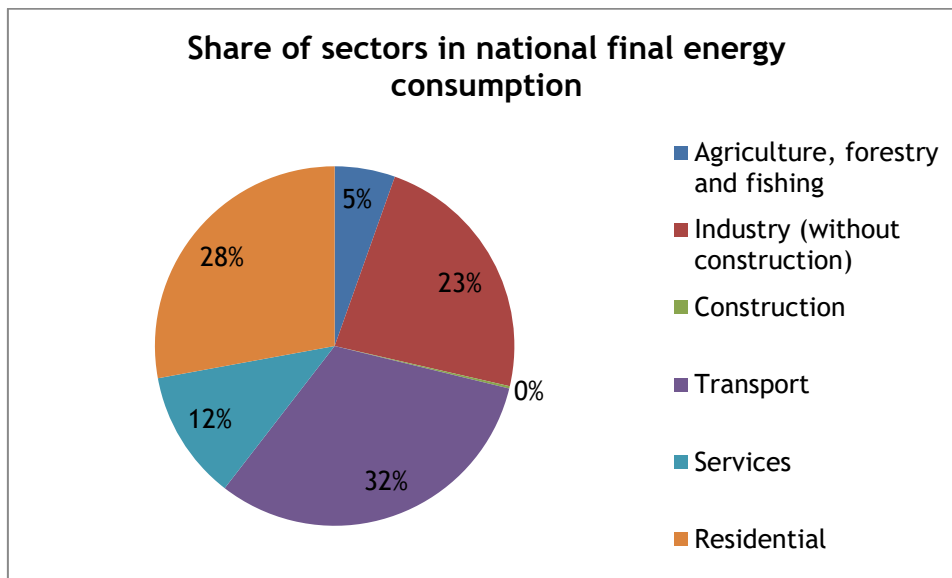




### 5.1.2. Simplified national balance

Regarding solid fossils Poland have higher than UE share in final energy consumption. In case of natural gas and Crude oil products indicator is lower. When it comes to renewable energy the situation is similar to the one of the Union.

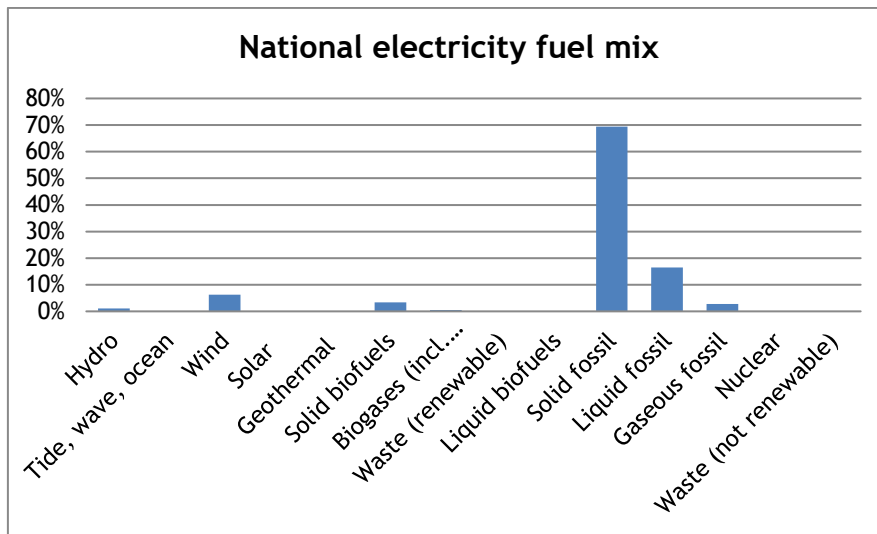




### 5.1.3. National electricity fuel mix disclosure

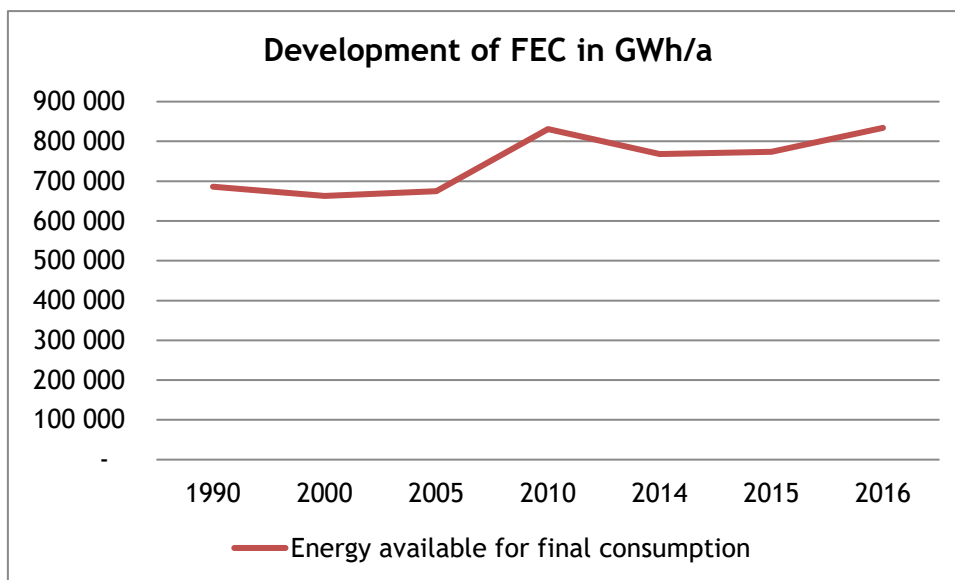
Poland's national fuel mix for electricity generation is characterized by a high amount of solid fossil sources, due to the facts of wide mining history as well as large coal reserves. In Poland there is 11% share of renewable sources.

Electricity fuel mix disclosure (national average)	%
Hydro	1,06
Tide, wave, ocean	-
Wind	6,24
Solar	0,06
Geothermal	-
Solid biofuels	3,42
Biogases (incl. sewage-gas)	0,51
Waste (renewable)	0,01
Liquid biofuels	-
Solid fossil	69,40
Liquid fossil	16,50
Gaseous fossil	2,80
Nuclear	-
Waste (not renewable)	-
<b>Total</b>	<b>100</b>
<b>Renewable</b>	<b>11,30</b>
<b>Non renewable</b>	<b>88,70</b>

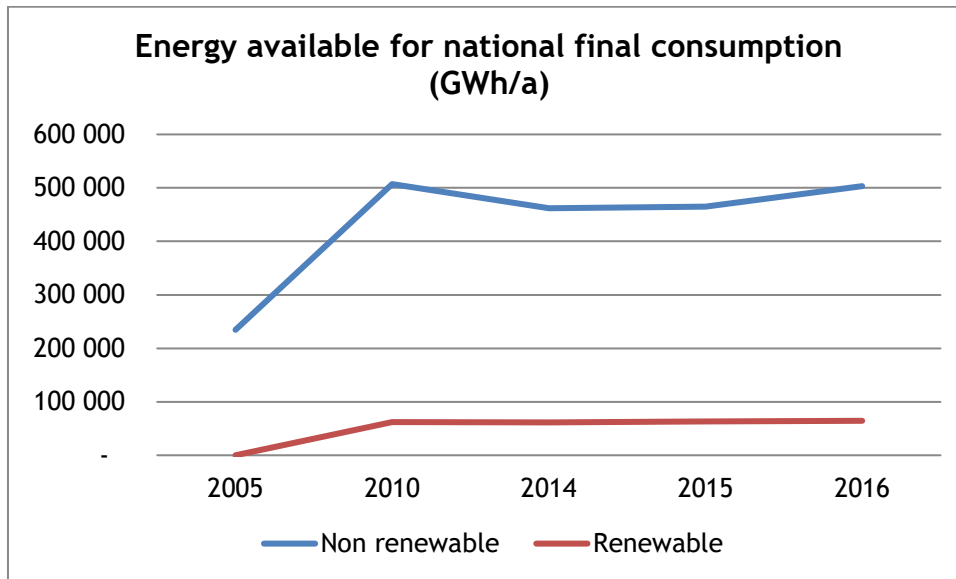


#### 5.1.4. Time series of national final energy consumption

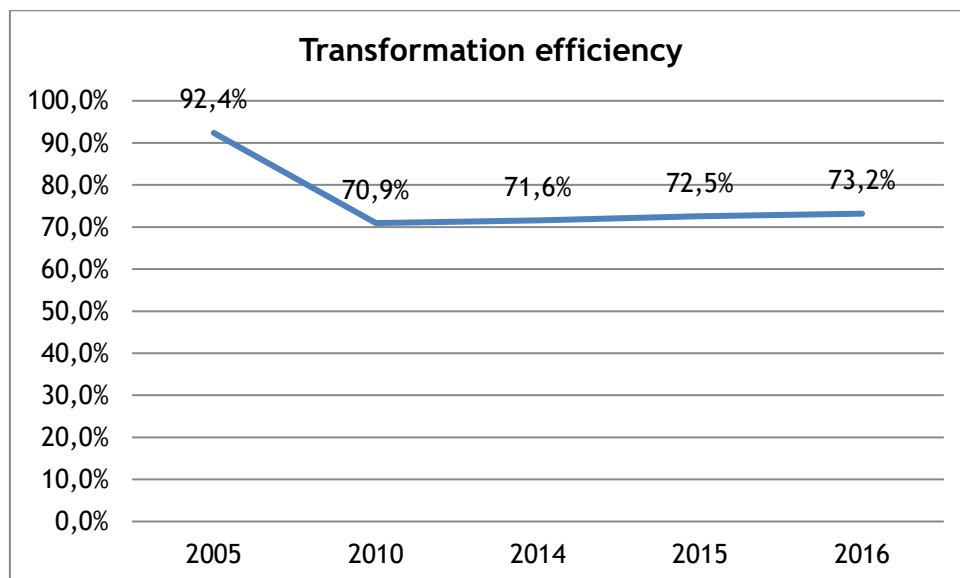
Final energy consumption has increased by 17% between 1990 and 2016. There was a clear downward trend until 2005, in the following years a significant increase in consumption began until 2010, where it fell again so that in 2016 start a slow increase in consumption., as can be seen in chart below

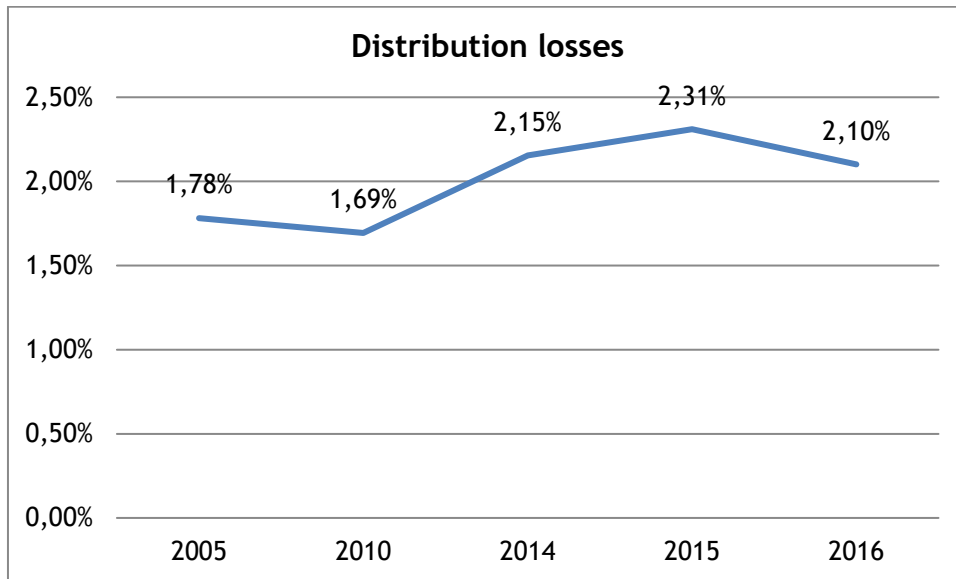


Charts below are giving a deeper insight into the main components of the consumption spectrum, showing, that there was a increase in the share of renewable in the final consumption between 2005-2010 to reach slight stability in years 2010-2016, although the main part of final energy consumption was always covered by non-renewables.



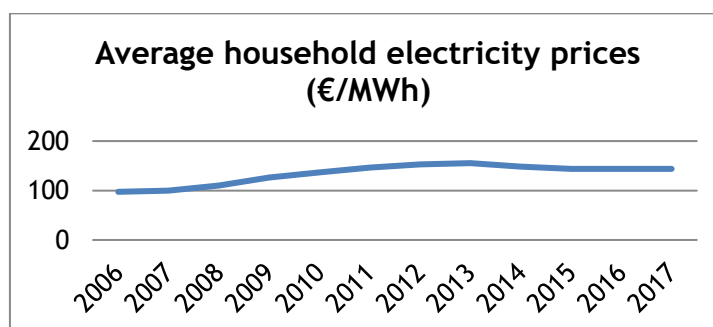
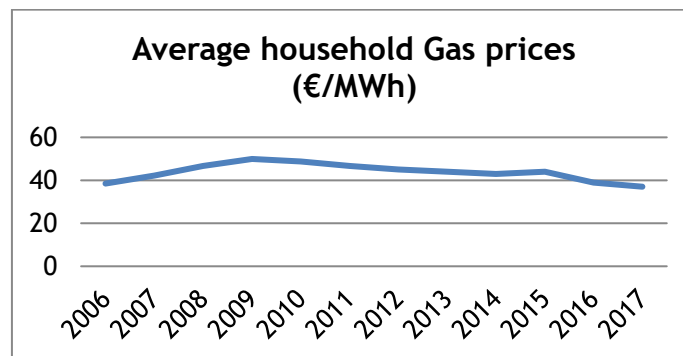
Charts below tracing the development of efficiency in transformation processes and in distribution in the period from 2005 to 2016. Efficiency in transformation has decreased from 92% to almost 73%. Distribution losses have risen from app. 1,8% in 2005 to 2,1% in 2016.





### 5.1.5. Energy prices - status quo and and development 2005 to ... (latest available)

Gas prices fluctuate within a range of  $\pm 12$  € around the average value of about 40-50 €/MWh, the electricity price for households fluctuate within a range of  $\pm 20$  € at a value of app. 145 €/MWh since 2010, as depicted in charts below:





The prices levels for natural gas and electricity in the industrial sector are remarkably lower than in the residential one. In contrary, the prices for the agricultural and the service sector do not differ very much from the household prices, neither for gas nor for electricity.

District heat:

Prices for 1 GJ of energy from the municipal network vary depending on whether or not the sources producing heat work in cogeneration. Units that generate both electricity and useful heat have lower prices. In this case, the average price in Poland in 2017 was 8.40 € / GJ. In a situation where a heating plant produces heat without cogeneration, bills will be higher in most regions. The average heat price in the Mazovian Voivodeship is around 7.30 € / GJ

Oil and petroleum products:

Table below is giving an overview at the current prices (in € /l) of the most common oil- and petroleum products.

Oil and petroleum products	
Final consumption (€/l)	Customer end price
<b>Petrol</b>	1,18
<b>Diesel</b>	1,23
<b>Heating oil</b>	0,8
<b>LPG</b>	0,46

## 5.2. Regional energy demand

Data on energy demand on regional level are very limited. There is a lot of data on national level but when it comes to Mazovian voivodeshop data are collected only on general level there are no accurate statistics

### 5.2.1. Regional energy demand by fuel and sector

Table below is showing the official statistics on final energy consumption in the Mazovia Region region for 2016. The total amount is app. 22.612 GWh. The share of the regional consumption is around 7% of the total national final consumption. The share of renewables in the total final consumption is only 5%

Regional energy demand (GWh) - official statistics	Total	Renewable energies
<b>Final energy consumption</b>	<b>22612</b>	<b>1 173</b>
Agriculture, forestry and fishing	273	No data
Industry (without construction), energy, water sewage etc	8 832	No data
Construction	No data	No data

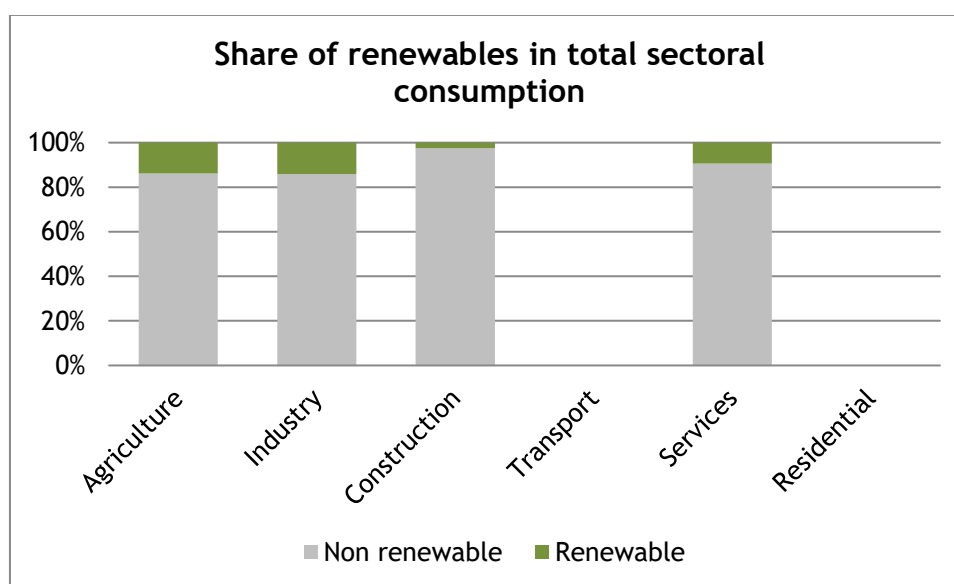


Transport	1 323	No data
Services	7 381	No data
Residential	4 803	No data

The estimated regional demand was calculated on the basis of effective energy by fuel and sector for the national official statistics. Unfortunately there was no relevant data to calculate the transport and residential sector.

Estimation of regional energy demand (GWh)	Total	Solid fossil fuels	Crude oil and petroleum products	Gas	Renewable energies	Electricity	Derived heat
<b>Final energy consumption</b>	<b>52 345</b>	<b>8 632</b>	<b>6 271</b>	<b>9 813</b>	<b>4 043</b>	<b>17 089</b>	<b>4 008</b>
Agriculture, forestry and fishing	7 225	1 791	4 085	67	966	276	39
Industry (without construction), energy, water sewage etc	22 014	5 087	939	5 468	2 265	6 164	954
Construction	48	63	109	79		74	19
Transport	1 323	No data	No data	No data	No data	No data	No data
Services	21 433	1 691	1 138	4 199	812	10 574	2 997
Residential	No data	No data	No data	No data	No data	No data	No data

The distribution of renewable and non renewable energy within the respective sectors is visualized in chart below:





## 5.3. Regional energy supply

### 5.3.1. Regional generation by source, capacity and output

On regional level, there is no such information available

### 5.3.2. Supply mix

The supply mix for the Mazovia Voivodeship is characterized by a high rate of self-supply, but it is important to mention that each year there is a warning that the energy security of the Warsaw agglomeration is seriously threatened. Analyses clearly indicate that the demand for electricity in the capital will grow and the infrastructure is insufficient

### 5.3.3. Energy storage

On regional level, there is no such information available

### 5.3.4. Regional key technologies for supply

The main key technology is wind power, since there are optimal conditions for this technology in the whole region. Unfortunately new law regulations in Poland are limiting development of this sector.

Another key technology is the utilization of biogas and biomass, mainly used for the co-generation of power and heat.

Furthermore, also photovoltaic systems are a key technology but mostly at smaller scale for residential buildings as there are not as good weather conditions for further developments.

Big unused potential reside in Vistula River for hydro power plants, but there is no developments in this sector.

## 5.4. Regional demand-supply balance and development potentials

### 5.4.1. Regional-self supply rate

Table below is showing the regional balance on energy demand. The table is missing data from residential and transport sector as there is no available sources.

Regional demand (MWh)	NREC	REC	Electricity	Heat	Sum of sector
Non-residential	24 716 527	4 043 115	17 089 394	4 008 429	49 857 463
Residential	No data	No data	No data	No data	No data
Transport	No data	No data	No data	No data	No data





#### 5.4.2. Energy efficiency potentials

The main efficiency potential can be found in the renovation of the residential and public buildings. The average time when the existing buildings were built 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.

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.

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. There are a lot of awareness campaigns to highlight the potential.

Furthermore, also energy distribution system could be renovated to decrease distribution losses.

#### 5.4.3. Resource potentials

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.

#### 5.4.4. Technology potentials

There is many possibilities for direct utilization of biomass, the utilization of biogas (from various resources) and the thermal gasification of organic waste, including the processing of the product gas (greening the gas). There is also still a big potential in the intensification of photovoltaic and electric storage in combination with heat-pumps, as well as in the electrification of the mobility sector.



## 6. CO2 Emissions

The table below shows CO2 emission on national and regional level. Unfortunately there was so regional data available on the sector of residential buildings and transport sector. The CO<sub>2</sub> emissions on national level are currently around 283,5 Million tons per year. The share of Mazovian Voivodeship on this national sum is 22,1 Million tons per year, that equals around 8%.

Estimation of CO2 emissions based on final energy demand in t/a	Solid fossil fuels	Crude oil and petroleum products	Gas	Electricity	Derived heat	Total emissions
Emission national total	48783517,83	77797663,9	23018049,5	112037896	21926690,3	283563817
Emissions national residential	26528233,53	1846088,05	8527813,8	24073227,8	14759726	75735089,2
Emission regional total	3032121,585	1661823,24	1982250,42	14098749,9	1298730,84	22073676
<b>Emission regional by sector:</b>						
Agriculture, forestry and fishing	629237,2955	1082476,62	13570,0285	227846,601	12696,7098	1965827,26
Industry (without construction), energy, water sewage etc	1786930,268	248948,546	1104575,46	5085642,16	309137,448	8535233,88
Construction	22032,68882	28935,5096	15955,7672	61332,5936	6021,74556	134278,305
Transport	No data	No data	No data	No data	No data	No data
Services	593921,3325	301462,568	848149,163	8723928,55	970874,936	11438336,5
Residential	No data	No data	No data	No data	No data	No data

## 7. Key figures and bottom line of the situation

The Mazovia voivodeship is a largely populated area, covered by 314 municipalities.

Regarding the GDP in Mazovia Region is estimated on the level of 24000 Mio€ and just in Warsaw Region 79300 Mio€.

The national final energy consumption in Poland is characterized by a low share of renewable sources with 11% in heat and electricity, and very high share of solid fossil fuels and crude oil and petroleum products.

On regional level the share of renewables is even lower with app. 5%

Regarding the energy storage situation, there are currently no data available.

The transport sector is characterized by the dominance of road traffic, there is no validate data on aviation transport.

The CO<sub>2</sub> emission estimates on the level of 22 mio. tonnes per year in general emissions with no available data on transport and residential building sector, so rationally this indicator will be much higher.



## 8. CONCLUSIONS

Mazovian Voivodeship is one of the largest energy consumers in Poland, produced mostly from conventional energy with very small share of renewables in energy mix. 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.