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PROSPECT2030

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A.T2.2 State of the art energy report

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PROSPECT2030

Interreg CENTRAL EUROPE

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1. EXECUTIVE SUMMARY

The Eco-Energy-Land (EEL), as the participating region in Austria, is an association of 19 municipalities on local administrative unit (LAU) level. In order to be consistent in data and comparable to the partner regions, the data and informations are presented for the whole NUTS 2 level region, where the EEL is embedded, which is "Burgenland".

The EEL with approx. 18.100 inhabitants lies in southern Burgenland, in the districts of Güssing, Jennersdorf and Oberwart, approx. 160 km from Vienna, in the middle of the Weinidylle Nature Park. The total area of the region is 395 km², of which almost half is forest, the most important resource in this region.

The EEL characterized as a peripher, low industrialized region with still a strong focus on agriculture (~ 20% of enterprises), with a decrease of population. The municipalities in the EEL pursue the same goal, namely to counteract the outflow of capital, to strengthen the regional economy of the border region, to create jobs and to maintain and improve the quality of life in the region. Measures to achieve these objectives include renewable energy, tourism, mobility, education and nature conservation.

Municipalities are small, with less than 2000 inhabitants in average, and consist mainly of scattered settlements. Only 10% of the inhabitants are having their workplace also in the home municipality, around 40% are working within the region and 50% have to commute outside the region to reach their worplaces.

Industry is not very represented. The enterprises, acting in the economy are small structured, 95% of them are employing less than 20 employees, the average size of staff is 3-5 persons per company

Regarding infrastructure, electricity grids and road network are well developed, but there is no gas grid and no rail network on site.

Due to the lack of respective infrastructure, the energy demand of the EEL is characterized by a traditionally high rate of biomass based heatings for buildings, be it central heating systems or district heat connections.

The total energy demand of the EEL is estimated to a value of 547.266 MWh/a.

The total energy generation in the EEL in electricity and heat plants amounts to 134.263 MWh/a, thereof 20% electricity and 80% heat.

The supply mix for the EEL is characterized by a high rate of self-supply. Around 75% of the consumed heat is supplied by renewables from within the region, in the form of (automated) wood heating or biomass based district heat. Also 35% of the required electricity is produced within the region, all from renewable sources. Currently, there is no supply of transport fuel from within the region. The total self-supply rate in the EEL (all forms of energy) is 39%.

The amount of CO_2 emissions of the EEL, based on energy consumption, is estimated to an amount of app. 98.000 tons per year.

The use of primary solid biomass for energy generation has been the key technology in the EEL for the past decades. Due to the changing framework conditions regarding the utilization of biomass for energy generation, some of the technologies are no more viable, although there is a development potential to use them as bio-refineries or simply for waste treatment.

In order to develop an area covering supply on this concept, the activities in solar energy generation and energy storage, as well as smart energy distribution are considered to be a promising way towards the realization of a carbon-free region.

2. INTRODUCTION

Introductory note:

The Eco-Energy-Land (EEL), as the participating region in Austria, is an association of 19 municipalities on local administrative unit (LAU) level. In order to be consistent in data and comparable to the partner regions, the data and informations are presented for the whole NUTS 2 level region, where the EEL is embedded, which is "Burgenland". Specific characteristics of the EEL are given in the paragraphs titled: "Particularities"

2.1. General description of the region

2.1.1 Geographical situation

The EEL is situated in the south-east of Austria, within the federal province Burgenland.

Fig. 1

Burgenland is the easternmost and least populous state of Austria. It consists of two statutory cities and seven rural districts, with in total 171 municipalities. It is 166 km long from north to south but much narrower from west to east. The region is part of the Centrope Project.

Burgenland is the seventh largest of Austria's nine states, or Bundesländer, at 3.962 km2 . The highest point in the province is on the Geschriebenstein, whose summit is 884 metres above sea level, the lowest point (which is also the lowest point of Austria) at 114 metres is in the municipal area of Apetlon.

Burgenland borders the Austrian state of Steiermark to the southwest, and the state of Niederösterreich to the northwest. To the east it borders Hungary (Vas County and Győr-Moson-Sopron County). In the extreme north and south there are short borders with Slovakia (Bratislava Region) and Slovenia (Mura Statistical Region) respectively.

Burgenland and Hungary share the Neusiedler See (Hungarian: Fertő tó), a lake known for its reeds and shallowness, as well as its mild climate throughout the year. The Neusiedler See is Austria's largest lake, and widely part of the eponymous national park.

The EEL with approx. 18.100 inhabitants lies in southern Burgenland, in the districts of Güssing, Jennersdorf and Oberwart, approx. 160 km from Vienna, in the middle of the Weinidylle Nature Park. The total area of the region is 395 km^2, of which almost half is forest, the most important resource in this region.

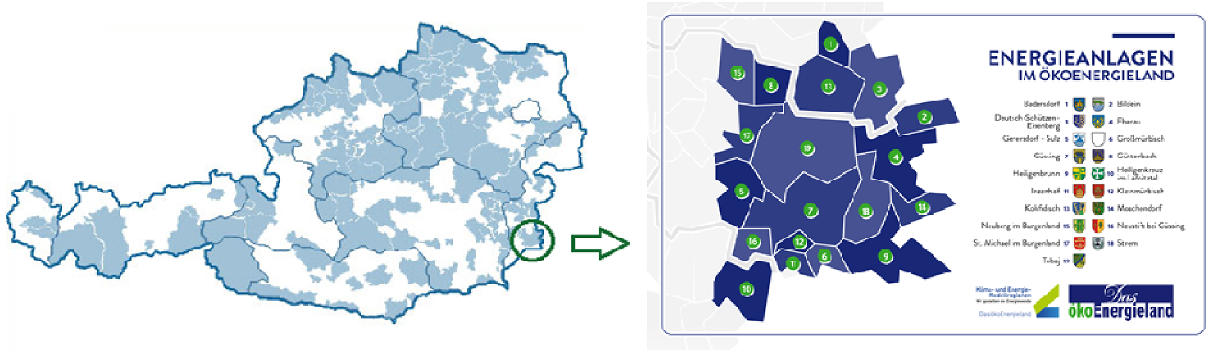

Fig. 2

2.1.2 Settlement structure

Burgenland´s population density is low. The indicator is 74 inhabitants / km². There are no urban areas. The biggest municipality is Eisenstadt with around 15.000 inhabitants. It is also the capital of Burgenland where the regional government and the main administration bodies are located. It's about 130 kilometers from the EEL.

Table 1 is giving an overview on the settlement structure of Burgenland.

Settlement structure	National	Regional
Area (km²)	83.879,0	3.961,8
Population (thousands)	8.858,8	293,4
Number of municipalities (total)	2.098	171
Municipalities with inhabitants (number)		
> 1.000.000		-
500.000 to <= 1.000.000		-
100.000 to < 500.000		-
50.000 to < 100.000		-
10.000 to < 50.000		1
5.000 to < 10.000		4
1.000 to < 5.000		110
< 1.000		56

Table 1

The main character of the settlements is the small-village-type. About two thirds of the municipalities are inhabited by 1.000 to 5.000 inhabitants, one third of the municipalities are even smaller, with less than 1.000 inhabitants.

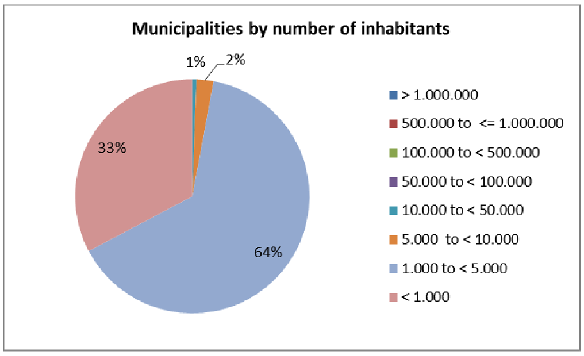

Fig. 3

Actually, also the structure of the 1.000 to 5.000 inhabitants municipalities is mainly built up by groups of small settlement units. Fig. gives an example of the municipality of Güssing and the incorporated settlements

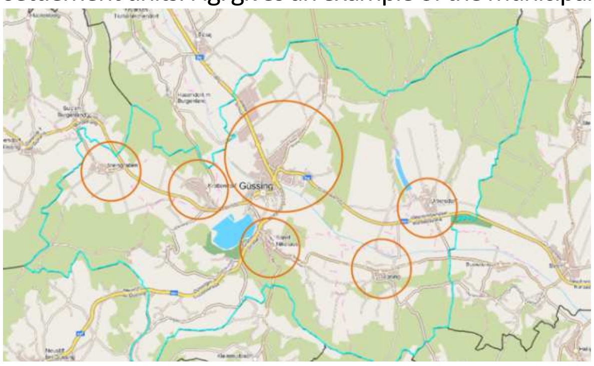

Fig. 4

2.1.3 Demographic structure and development

Population development:

Table 2 shows an increase in population on national as well as on regional level.

Population development	National	Regional
2000	8.002.186	276.226
2005	8.201.359	278.032
2010	8.351.643	283.697
2015	8.584.926	288.356
2018	8.822.267	292.675

Table 2

However, the impression given by the table is misleading when putting the focus on the sub-regional development, because the population increase is mainly happening in the north of Burgenland, caused by its proximity to the urban agglomeration of Vienna. The southh of Burgenland, where the EEL is located is marked by a decrease in population, as can be seen from Fig. 5

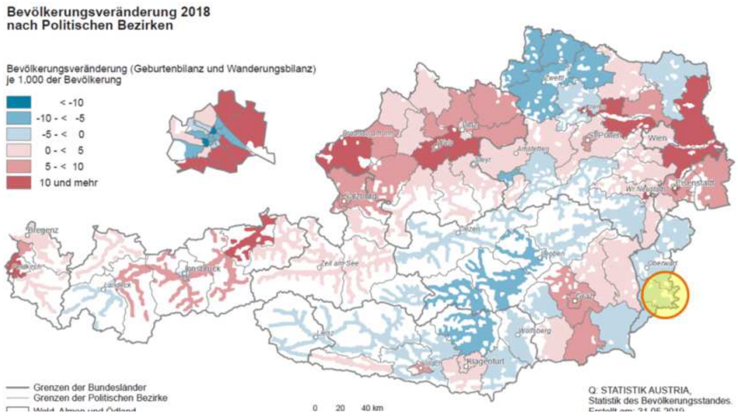

Fig. 5

Households:

On national, as well as on regional level, the numbert of households is increasing. Growth at national level is around 20%, at regional level around 25%. At the same time the size of households is decreasing. Currently, the average size of a household is 2,2 persons at national level and 2,3 persons at regional level.

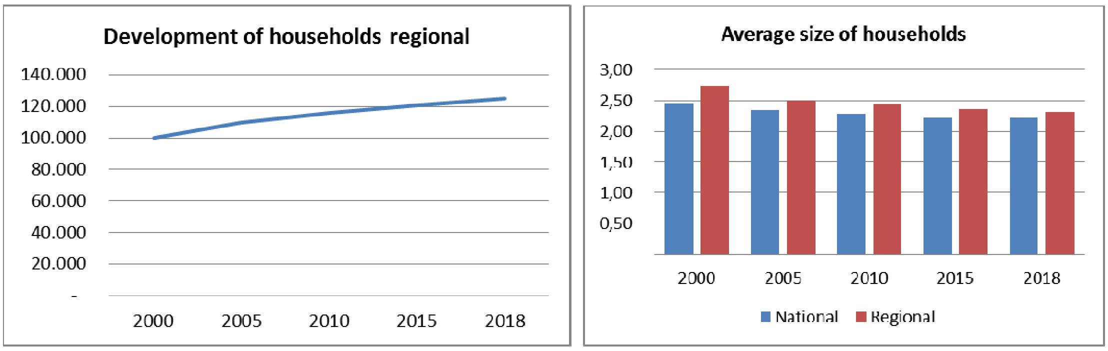

Fig. 6

Average income of households:

The average income of households has increased between 2000 and 2017 by 60% on national and by 72% on regional level. The increase in the consumer price index in the same time span is 38%. Thus, the real-income-growth amounts to around 34% for regional households. The statistical averag income is 55.900 €/ household*year.

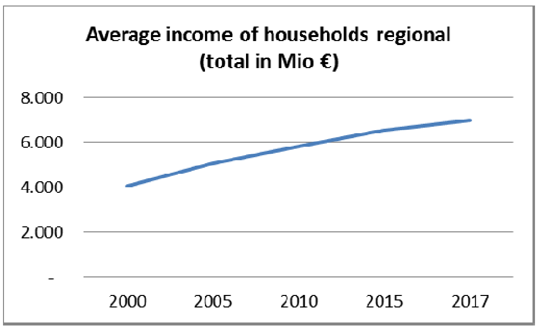

Fig. 7

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

The share of the regional economy in the national GDP is currently around 2,4%, which is little. It has slightly increased since the year 2000 (2,2%). Nevertheless, with regard to the intra-regional development, the increase in the time span from 2000 to 2017 has been 83%, while the performance on national level is showing an increase of 73%. The GDP per capita is currently is 28.000.- €, the absolute value is 8.750 million €.

The gross value added GVA is the measure of the value of goods and services produced in an area, industry or sector of an economy. Unlike the GDP, it is mostly available also for the sectors active in an area. Fig. 9 is giving a comparative overview on the GVA on national and regional level.

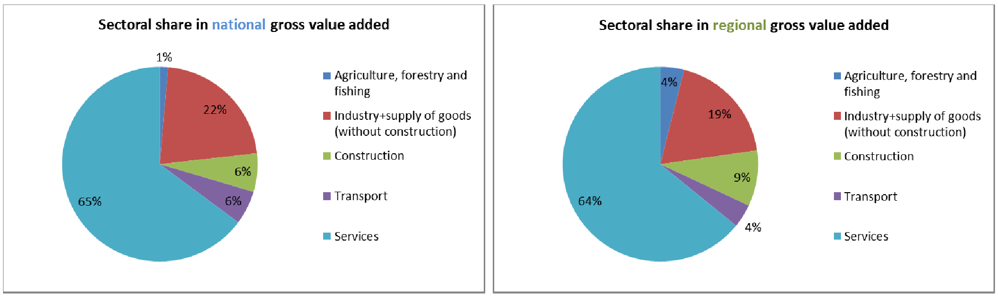

Fig. 8

An obvious fact is, that the agricultural sector, with a share of 4% in the regional GVA is still of a certain importance. The other sectors, with the exception of construction, are slightly less pronounced than at national level.

The rate of employees by sector is showing a similar distribution as the sectoral share in the GVA

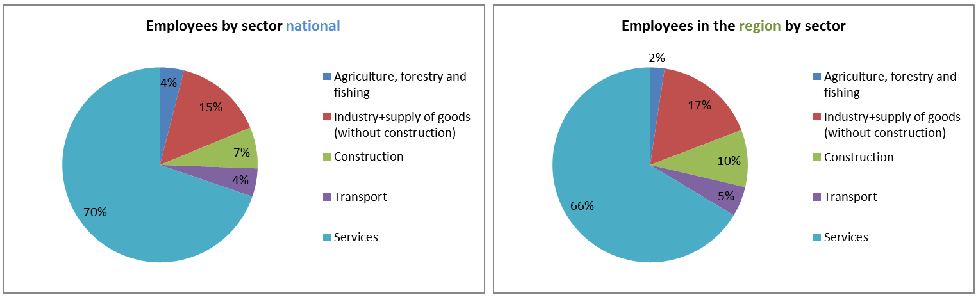

Fig. 9

Industry is not very represented in Burgenland. The enterprises, acting in the economy are small structured, 95% of them are employing less than 20 employees, the average size of staff is 3-5 persons per company. Only 84 out of 24.000 enetrprises are employing 100 or more employees, and these enterprises are mainly active in the public and private service sector.

2.1.5 Particularities of the region

The EEL is can be characterized as a peripher, low industrialized region with still a strong focus on agriculture (~ 20% of enetrprises), with a decrease of population. The municipalities in the EEL pursue the same goal, namely to counteract the outflow of capital, to strengthen the regional economy of the border region, to create jobs and to maintain and improve the quality of life in the region. Measures to achieve these objectives include renewable energy, tourism, mobility, education and nature conservation.

Municipalities are small, with less than 2000 inhabitants in average, and consist mainly of scattered settlements. Only 10% of the inhabitants are having their workplace also in the home municipality, around 40% are working within the region and 50% have to commute outside the region to reach their worplaces.

3. Infrastructure

3.1. Energy related infrastructure

3.1.1 Electricity grid infrastructure

On transmission Grid level the TSO is the Austrian Power Grid AG, which is operating the 380 kV grid (marked in green in Fig.: 11).
On the distribution grid level, there are two grid operators (DSOs):

- Energie Güssing GmbH
- Netz Burgenland GmbH

The bigger DSO is Netz Burgenland, which is operatin almost the whole electricity distribution system. Energie Güssing is operating the grids in Güssing and in Strem.

Thus, both DSOs are active in in the EEL . The grids are connected via the electricity substation in Güssing.

Fig. 10

3.1.2 Gas grid infrastructure

There is only one gas grid operator in the region, which is the Netz Burgenland Erdgas GmbH. As can be seen in Fig 12, there is no natural gas grid in the EEL, except in the southernmost municipality Heiligenkreuz. A particularity is the app. 6 km long biogas-pipeline, connecting the biogas facility in Tobaj and the two district heat systems of Dt. Tschantschendorf and St. Michael, where CHP units are combusting the biogas, feeding the excess heat in the respective local district heat systems.

Fig. 11

3.1.3 District heat infrastructure

Due to the strong promotion of biomass heating plants in the 1990s and early 2000s, Austria is rich in biomass based district heating systems. In Burgenland there are 53 district heat systems, 11 of them are located in the EEL, which was an innovation center for the energetic biomass utilization in the last three decades. Fig 13 is giving an overview on the location of district heating systems in Austria, highlighting Burgenland and the EEL.

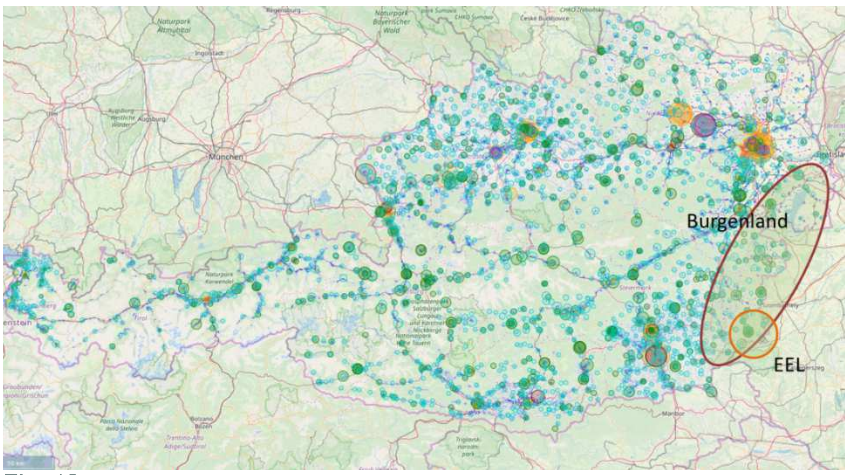

Fig. 12

Fig 14 shows the location of the 11 district heat systems in the EEL itself. All of them are originally based on biomass combustion, four of them are also using the excess heat of CHP units.

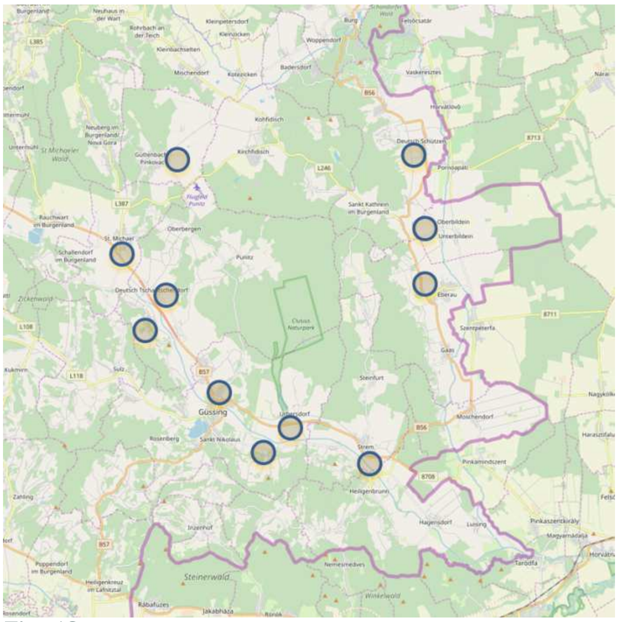

Fig. 13

3.2. Mobility and transport related infrastructure

3.2.1 Rail network

Due to the proximity of the north of Burgenland, and the amount of daily commuters to the agglommeration, the rail network is well developed. The further south one gets, the less dense also the rail development is. In the three southmost districts there is almost no rail network. The only one in the district of Oberwart is only used for freight transport. In the district of Güssing there is no railway at all and in the district of Jennerdorf, there is only the connection between Graz and Szombathely (Hungary). In the municipality of Heiligenkreuz, there is the only rail connection within the EEL.

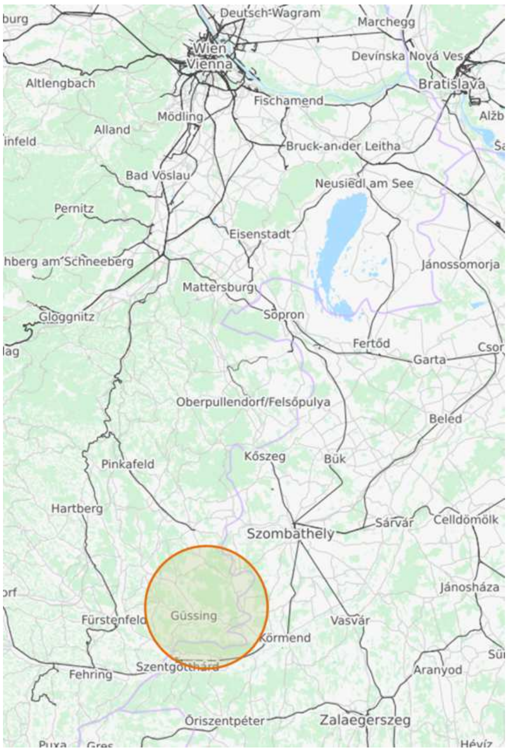

Fig. 14

3.2.2 Road network

Like the rail network, also the road network in the region is developed better in the north of Burgenland, than it is in the south, due to the proximity of the agglommeration of Vienna. Of the four motorway connections in Burgenland there are three in the north (A3, A4, A6) and only one in the south (A2). Two existing expressways (S31, S4) are connecting the north with the middle part of the region at a length of 50 km. For the rest there is a relatively dense network of higher-level roads connecting the districts and higher ranking municipalities. The EEL is mainly accessed by lower-ranking roads.

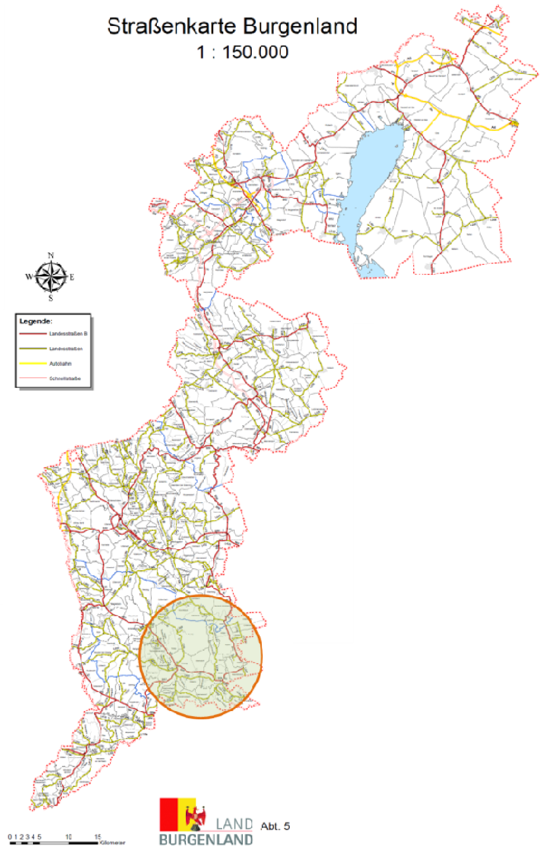

Fig. 15

3.2.3 Aviation and waterways infrastructure

There is neither an aviation- nor a waterways infrastructure in the whole region of Burgenland.

3.3. Particularities of regional infrastructure

As already noted in the previous paragraphs, the density of infrastructure is highest in the north of Burgenland and lowest in the south. The only exception is the distribution of district heat grids which is higher in the south, than in the north (27 out of 53).

Regarding infrastructure the situation of the EEL can still be defined as extreme periphery.

This is caused by the former situation in the immediate vicinity of the iron curtain, which was a reason for absence of noteworthy industry. The status of a Target -1 area for almost two decades have meliorated the situation, but the infrastructural backlog could not be fully made up, however.

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 Burgenland, regarding road and rail transport are not so much different from the national ones. Air and waterway transport are not applicable, because of the lack of a respective infrastructure. As regards the EEL, as far as the EEL is concerned, only transport by road, for passengers as well as freight, is possible anyway.

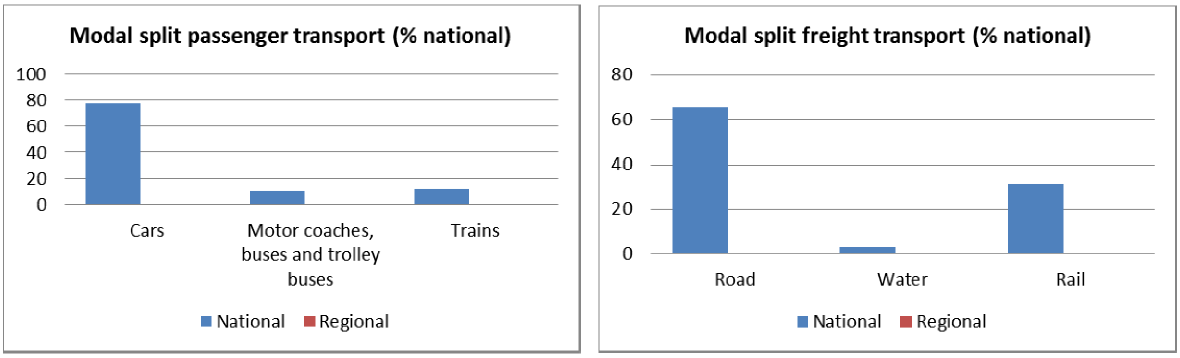

Fig. 16

As can be seen in Fig 17, the main focus in passenger transport is on cars, with a share of app. 80% on national level. For the EEL this share is far beyond 90%, because public transport regards mainly school bus rides. For freight transport the modal split is 100% road transport.

4.2. Road transport

Data regarding road transport are available on national and regional, but not on sub-regional level. It is supposed, that the data regarding the EEL are corresponding to the regional data of Burgenland.

4.2.1 Motor vehicles by type and fuel

The stock of motor vehicles in Burgenland is currently app. 145.500 vehicles. This is a share of 3,6% of the total number of vehicles on national level. Regarding the general fuel usage in the motor vehicles (such as e.g. the use of electricity or natural gas for transporting goods, electric motorcycles etc.) there are, currently, no data available. Table 3 is giving an overview on the number of motor vehicles by type.

Motor vehicles by type	National	Regional
Passenger cars	*4.978.852*	*192.756*
Motorcycles	*811.358*	*32.180*
Lorries	*476.327*	*19.148*
Buses	*10.037*	*327*
Road tractors	*464.429*	*1.044*
Other motor vehicles	*963.627*	*70.777*
Total	*6.741.003*	*245.455*

Table 3

Fig is illustrating the contents of Table 3:

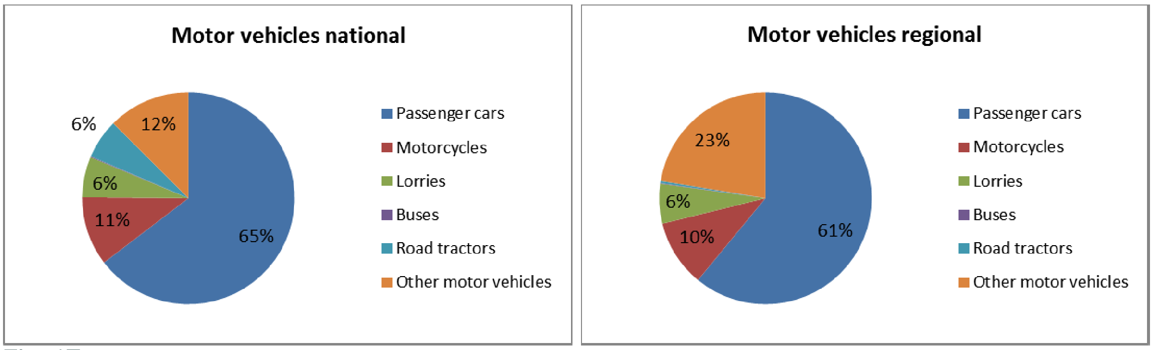

Fig. 17

The distribution on regional level is similar to the one on national level, with the difference, that automotive machines (e.g. in agriculture) are more represented in rural regions than in the average national level

4.2.2 Passenger cars by fuel, kilometre and fuel performance

The amount of passenger cars in the region Burgenland corresponds to a share of 4% of the total fleet of passenger cars in austria. The per capita figure on national level is 0,56 and on regional level 0,66 cars per capita. Based on these figures, the amount of passenger cars in the EEL can be estimated to a number of about 12.000. The distribution of cars by fuel is supposed to be equal to the total regional distribution. Table 4 is giving an overview on the passenger cars by fuel on national and regional level.

Passenger cars by fuel (number)	*National*	*Regional*	*Average km/car*a*	*Average Consumption (l/100 km; or kWh/100 km)*

Petrol	*2.133.470*	*78.976*	*10.722*	*7,2*
Petrol-flex fuel	*5.769*	*76*		
Diesel	*2.776.332*	*112.340*	*14.745*	*6,6*
Electric	*20.831*	*338*	*14.674*	*14,9*
Liquefied petroleum gas	*2*	-		
Natural gas	*2.365*	*65*	*14.957*	*69,1*
Petrol / Liquefied petroleum gas (bivalent)	*333*	*3*		
Petrol / natural gas (bivalent)	*3.177*	*76*		
Petrol / electric (hybrid)	*34.086*	*684*	*10.483*	*5,1*
Diesel / electric (hybrid)	*2.463*	*48*	*13.069*	*5,7*
Hydrogen / fuel cell	*24*	-		
Total	***4.978.852***	***192.606***		

Table 4

Because of the little share of the regional passenger car fleet in the national basic stock, a graphic overview is given only on regional level by Fig:

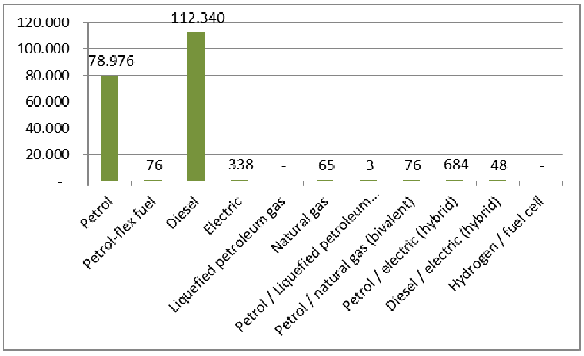

Fig. 18

4.2.3 Passenger- and tonnes kilometres

As the modal split gives an impression of the share of use of means of transport, passenger and tonnes kilometres are providing imformation on the intensity of the use. On regional level, there is no information on this issue available. Fig. visualizes the information available on national level.

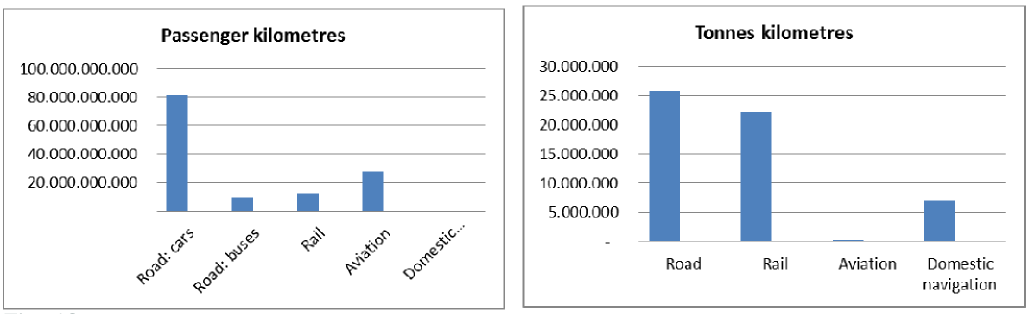

Fig. 19

4.2.4 Particularities

For the EEL, the above information can only be seen as a framework

4.3. Rail transport

4.3.1 Passenger and tonnes kilometres

The respective information is already coimprised 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. Fig 20 is visualizing the development on national level

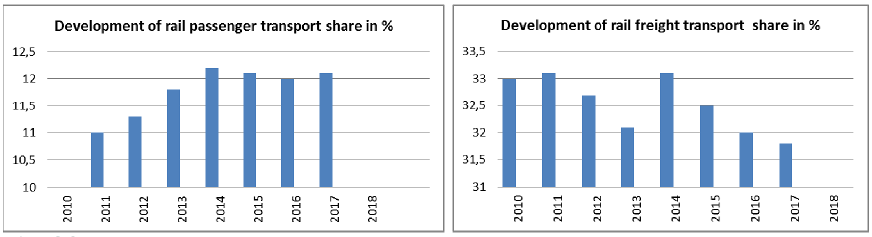

Fig. 20

4.3.3 Particularities

For the EEL, the issue of rail transport is not applicable.

4.4. Air and waterway transport

The issues of this paragraph is not applicable for the region

5. Energy status

5.1. Energy in the European and national context

Fig 21 is giving an overview on the shares of basic energy carriers in the European, National and Regional final energy consumption. As can be seen, the regional final energy consumption is mirroring the infrastructure regarding energy supply and mobility

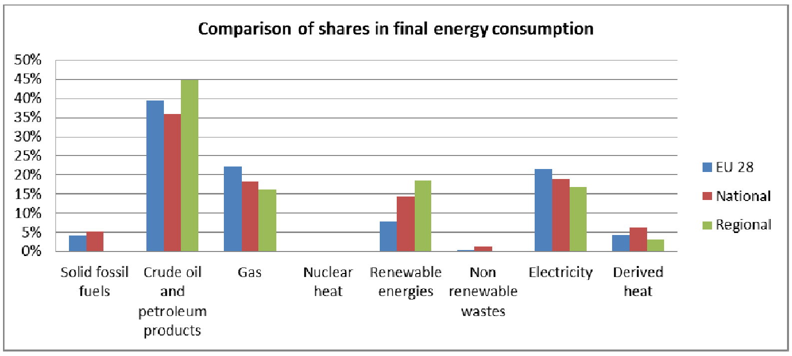

Fig. 21

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

Fig 22 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.

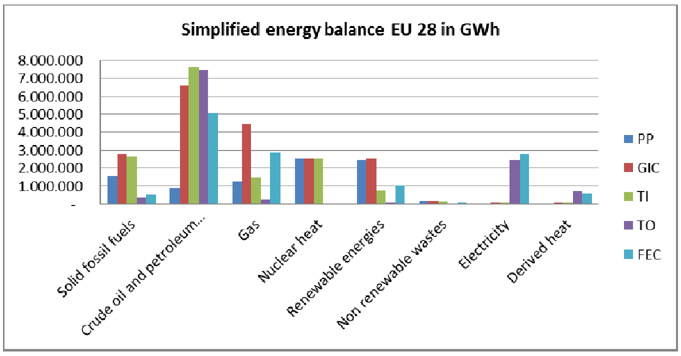

Fig. 22

5.1.2. Simplified national balance

Regarding solid fossils, natural gas and Crude oil products, the situation is similar to the one of the Union. A particularity of Austria is, that, on the basis of the 1978 Nuclear Non-Proliferation Act, there is no energy generation from nuclear heat. The utilization of renewable energies is higher than in the Union and equals the use of crude oil and petroleum products. Also their primary production is very high. A further particularity is, that around 70% of the final electricity consumption is not supplied by transformation of other energy carriers, but from direct generation from hydro-, wind- and solar power.

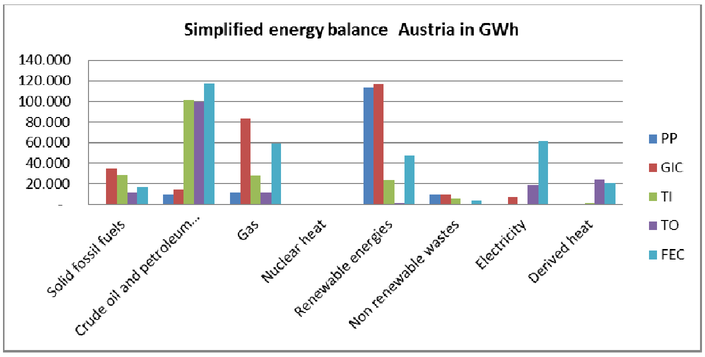

Fig. 23

5.1.3. National electricity fuel mix disclosure

Austria´s national fuel mix for electricity generation is characterized by a high amount of renewable sources, due to the richness in water and, in consequence, the utilization of hydropower. In 2016, only 16% of the generated electricity was from fossil sources. Although 43% of the final consumption is based on imports, the total share of renewable sources in consumed electricity is estimated to be aroud 65%.

Electricity fuel mix disclosure (national average)	%
Hydro	65,10
Tide, wave, ocean	-
Wind	10,60
Solar	1,30
Geothermal	-
Solid biofuels	4,70
Biogases (incl. sewage-gas)	2,10
Waste (renewable)	-
Liquid biofuels	-
Solid fossil	1,40
Liquid fossil	-
Gaseous fossil	14,80
Nuclear	-
Waste (not renewable)	-
Total	**100**

Table 5

Fig 24 is visualizing the contents of table 5:

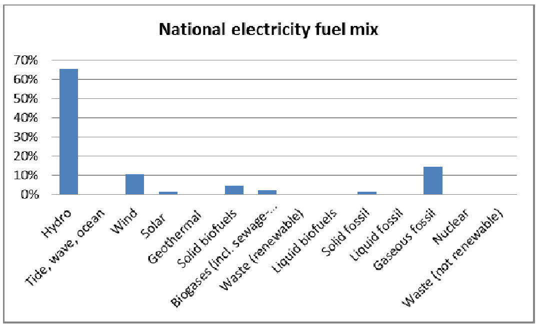

Fig. 24

5.1.4. Time series of national final energy consumption

Final energy consumption has increased by 44% between 1990 and 2016. There was a steep rise in consumption until 2005, followed by a lower increase and even a slight decrease until 2014. In the following two years the consumption was characterized by a slight increase again, as can be seen in fig. 25.

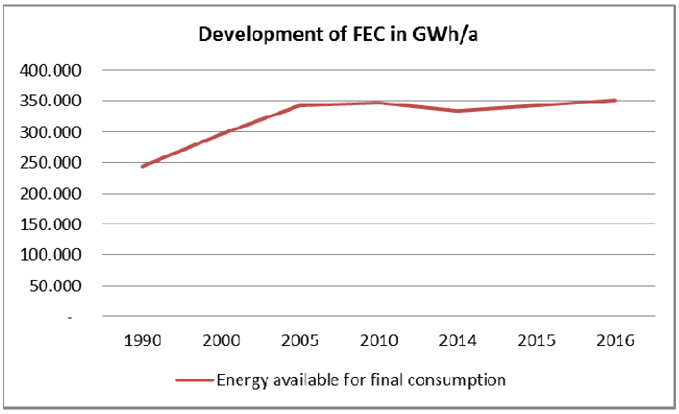

Fig. 25

Fig 26 is giving a deeper insight into the main components of the consumption spectrum, showing in the graph to the left, that there is a constant increase in the share of renewables in the final consumption, as well as in the utilization of wastes, although the main part of final energy consumption is covered by non-renewables. The graph to the right shows, that the main part of used renewables is represented by solid biomass, followed by liquid biofuels and a small portion of other renewables, which are mainly wind and solar based (hydropower is factored in the category “electricity”, not in “renewables”)

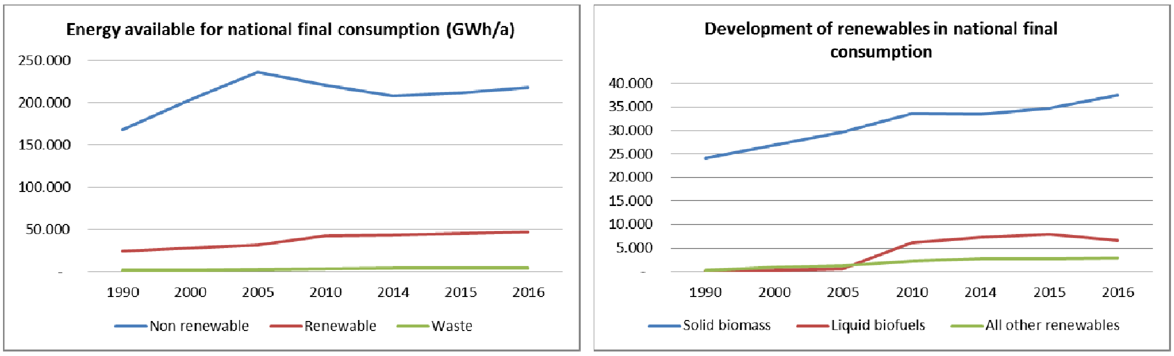

Fig. 26

Fig. 27 is tracing the development of efficiency in transformation processes and in distribution in the period from 1990 to 2016. While the efficiency in transformation has increased from 85% to almost 89%, the efficiency in energy distribution has decreased, which is reflected in the fact that average distribution losses have risen from app. 1,5% in 1990 to 2,2% in 2016.

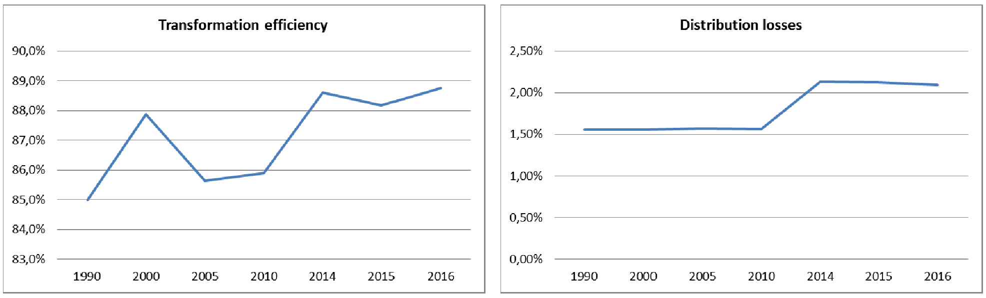

Fig. 27

5.1.5. Energy prices - status quo and development 2005 to 2017

Electricity prices, in Austria, are less volatile than the prices for natural gas. While the gas prices fluctuate within a range of ±10 € around the average value of about 70 €/MWh, the electricity price for households is relatively stable at a value of app. 200 €/MWh since 2010, as depicted in fig. 28

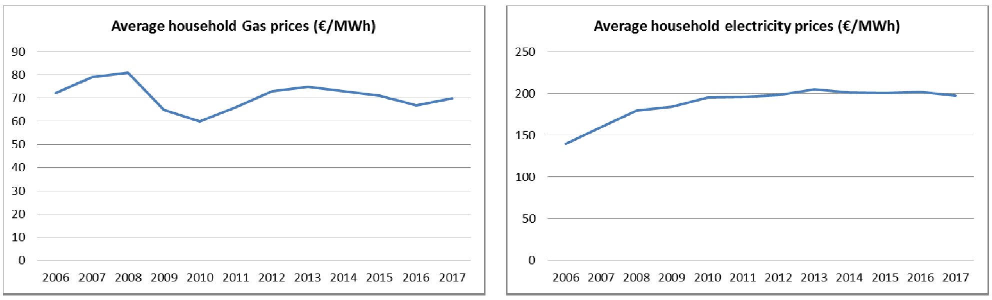

Fig. 28

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.

Electricity:

The wholesale price for electricity is currently 50 €/MWh. The working price average is 64 €/MWh in industry and 120 €/MWh for households and other sectors. Taxes and levies are additionally 30% for industry and 39% for households.

Natural gas:

Regarding natural gas, the wholesale price is at 12,5 €/MWh. The working price average for industry is 24 €/MWh and for households and other sectors 51 €/MWh. Taxes and levies are additionally 20% for industry and 27% for households and other sectors.

District heat:

The working prices for district heat are between 25 and 50 €/MWh in the industrial sector and 50 to 80 €/MWh for all other sectors. Customer end prices are between 30 and 60 €/MWh for industry and 65 to 110 €/MWh for all other sectors. Taxes and levies are 16 to 20%, depending on the quantity ratio of hot water supply (sales tax:10%) and space heating supply (sales tax: 20%).

Oil and petroleum products:

Table 6 is giving an overview at the current prices (in €cent/kWh) of the most common oil- and petroleum products. As can be seen, the taxation of transport fuel is higher than for fuels for stationary combustion.

Oil and petroleum products					
Final consumption (€ cent/kWh)	Net price	Customer end price (incl. taxes and levies)	Share of taxes and levies	Energy content	
Petrol	6,02	14,75	59%	8,1	kWh/l
Diesel	5,21	11,33	54%	9,8	kWh/l
Heating oil	4,69	6,94	32%	9,8	kWh/l
LPG	6,50	10,70	39%	12,8	kWh/kg

Table 6

Electricity and gas grid injection tariffs

Injection tariffs are bound to contracts regarding renewable energies. If there is no such contract, the remuneration for injection is based on the wholesale price. In Austria, currently, there are only injection tariffs for electricity, not for gas. The tariffs are also dependent on the type of generation as well as on the amount of energy fed into the grid.

Electricity grid injection tariffs renewables	€/MWh
Hydro	25 - 128,7
Tide, wave, ocean	n.a.
Wind	81,2
Solar photovoltaic	76,7
Solar thermal	n.a.
Geothermal	72,2
Solid biofuels	82,2 - 215,6
Liquid biofuels	54
Biogases	189,7
Renewable municipal waste	46,6 - 56

Table 7

5.2. Regional energy demand

The regional energy demand is calculated on the basis of the analysis of effective energy by fuel and sector for the Austrian NUTS 2 regions, as annually published by Statistik Austria. These reports are usually, like the national and the EUROSTAT data, 3 years in behind. Thus, it is based on official statistics.

The energy demand of the EEL is based on own calculatory estimations, derived from the official statistics.

5.2.1. Regional energy demand by fuel and sector

Table 8 is showing the final energy consumption in the Burgenland region for 2016. The total amount is app. 9.600 GWh. The share of the regional consumption is only 3% of the total national final consumption. The largest share is accounted for by crude oil and petroleum products, followed by renewables, electricity and natural gas.

The share of renewables in the total final consumption is 19% and mainly located in the residential sector, due to the richness of the region in forests and the utilization of the forestal biomass in central- and district heating systems. This fact is also co-responsible for the, in fact, total share of 35% of renewables, if electricity and heat from CHP processes as well as electricity generation from wind and solar power, going into the final consumption, are considered.

Estimation of regional energy demnand (GWh)	Total	Solid fossil fuels	Crude oil and petroleum products	Gas	Renewable energies	Non renewable wastes	Electricity	Derived heat
2016								
Final energy consumption	**9.581**	**17**	**4.302**	**1.554**	**1.785**	**6**	**1.620**	**297**
Agriculture, forestry and fishing	329	-	187	8	82	-	51	1
Industry (without construction), energy, water sewage etc	1.831	-	44	686	357	6	639	99
Construction	124	-	66	28	5	-	23	2
Transport	3.755	-	3.479	7	254	-	15	-
Services	568	-	44	95	62	-	244	123
Residential	2.974	17	482	730	1.027	-	646	73

Table 8

The final consumption by fuel and share is visualized in fig. 29

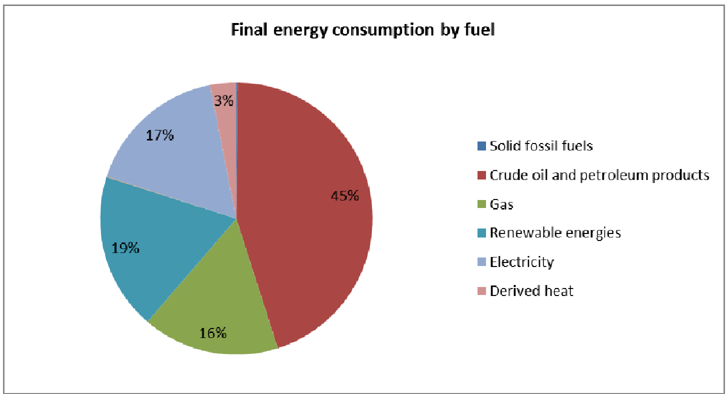

Fig. 29

A graphic overview on the total final consumption by sectors is given in fig 30. The largest share is accounted for by the traffic and transport sector (39%), followed by the residential sector (31%). The share of industry in total final consumption is just 19%.

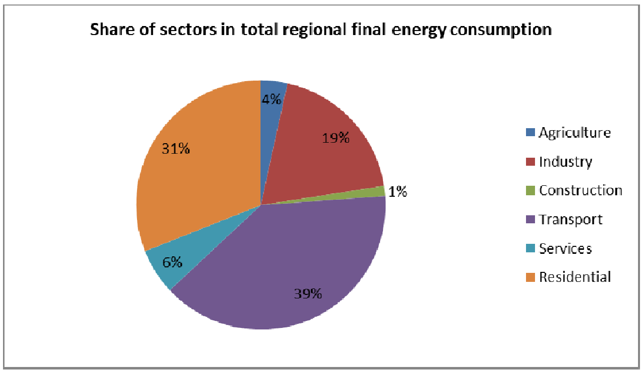

Fig. 30

The distribution of renewable and non renewable energy within the respective sectors is visualized in fig 30.

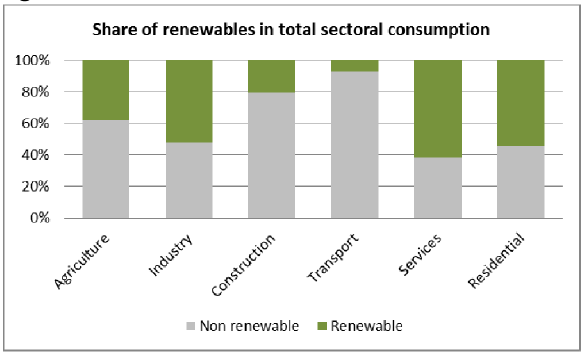

Fig. 31

5.2.2. Regional particularities of energy demand and energy demand of the EEL

Due to the lack of respective infrastructure, the energy demand of the EEL is characterized by a traditionally high rate of biomass based heatings for buildings, be it central heating systems or district heat connections.

The current energy demand is based on the use of key figures derived from general national/regional energy statistics.

The total energy demand of the EEL is estimated to a value of 547.266 MWh/a and is roughly structured as presented in table 9:

Sector	*Heat*	*Electricity*	*Transport fuel*	*Sector Sum*
Households	195.799	30.837	-	***226.636***
Industry and service sector	71.192	37.366	-	***108.558***
Public services and admisnistration	17.864	8.021	-	***25.885***
Transport	-	-	154.261	***154.261***
Agriculture	11.700	3.176	17.049	***31.925***
Total	***296.556***	***79.400***	***171.310***	**547.266**

Table 9

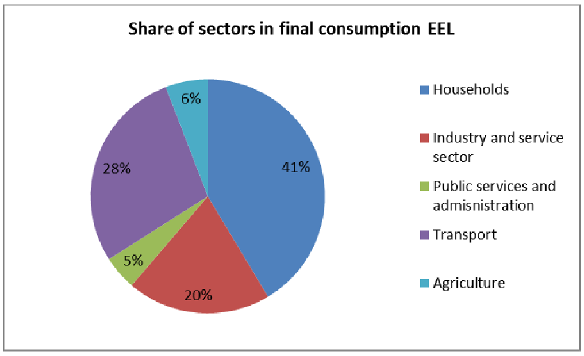

Fig. 32

5.3. Regional energy supply

Like the regional energy demand, the supply is also shown on Burgenland level and on EEL level.

5.3.1. Regional generation by source, capacity and output

Table 10 is showing the energy generation in Burgenland from electricity- and district-heat-plants The total energy generation from these plants is around 2.561 GWh, of which the biggest part is electricity

Source	Electric capacity installed	Electricity MWh/a	Supply share electricity	Heat capacity installed	Derived heat MWh/a	Supply share heat
Solid biomass (residues)	1	6.500	0,3%	7	44.800	17,4%
Hydro	2	6.080	0,3%	-	-	
Tide, wave, ocean	-	-		-	-	
Wind	1.020	2.040.000	88,6%	-	-	
Solar photovoltaic	30	25.886	1,1%	-	-	
Solar thermal	-	-		1	1.052	0,4%
Geothermal (deep)	-	-		-	-	
Primary solid biofuels	31	156.000	6,8%	89	127.550	49,5%
Biogases (incl. sewage-gas)	8	52.000	2,3%	-	54.440	21,1%
Waste (renewable)	2	10.000	0,4%	-	-	
Biogasoline	-	-		-	-	
Biodiesel	-	-		-	-	
Liquid biomass (e.g. black liquor etc.)	-	-		-	-	
Ambient heat (heat pumps)	-	-		-	-	
Solid fossil	-	-		-	-	
Liquid fossil	2	6.400	0,3%	-	-	
Gaseous fossil	-	-		20	30.000	11,6%
Waste (notren.)	-	-		-	-	
Total	**1.096**	**2.302.866**		**117**	**257.842**	**100,0%**
thereof non renewable	*2*	*6.400*	*0,3%*	*20*	*30.000*	*11,6%*
thereof renewable	*1.094*	*2.296.466*	*99,7%*	*97*	*227.842*	*88,4%*

Table 10

The main contents of the table are visualized in fig 33.

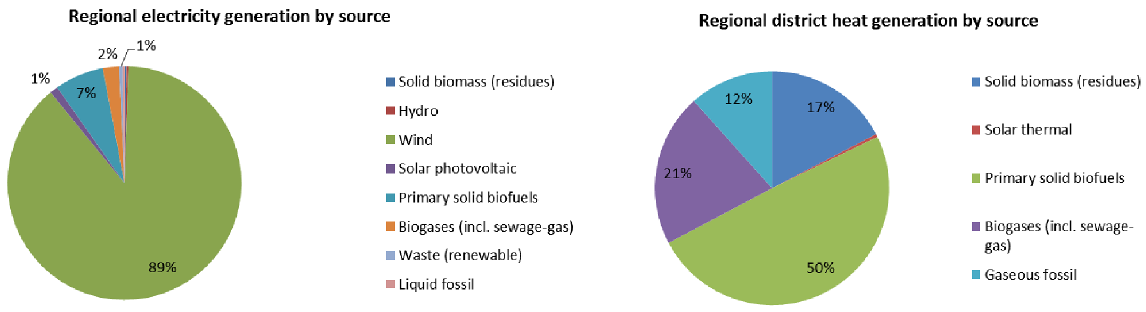

Fig. 33

Furthermore, around 1.031 GWh of fuel in the form of solid Biomass, mainly from forestry are produced. The total amount of generated energy and fuel is 3.592 GWh/a.

Energy generation in the EEL

The total energy generation in the EEL in electricity and heat plants amounts to 134.263 MWh/a, thereof 20% electricity and 80% heat. It is presented in detailed form in table 11. All generated energy is from renewable sources.

Energy generation in the EEL	Electricity			Heat		
	Capacity MW	MWh	Plants	Capacity MW	MWh	Plants
Solid biomass (residues)	1,3	6.500	1	7	44.800	1
Hydro	0,24	960	3			
Solar photovoltaic	2,23	2.453	76			
Solar thermal				0,5	550	3
Primary solid biofuels				22	51.000	13
Biogases	2,5	17.500	4	1,5	10.500	4

Table 11

5.3.2. Supply mix

The supply mix for the EEL is characterized by a high rate of self-supply. Around 75% of the consumed heat is supplied by renewables from within the region, in the form of (automated) wood heating or biomass based district heat. Also 35% of the required electricity is produced within the region, all from renewable sources. Currently, there is no supply of transport fuel from within the region. The total self-supply rate in the EEL (all forms of energy) is 39%.

5.3.3. Energy storage

Data regarding energy storage are only available on national and on Burgenland (NUTS 2) level. The data presented in table are related to 2017. In the EEL there is only one battery storage with 25 kWh capacity known, but there is a planning for a grid bound 1 MWh storage by the regional DSO.

Energy storage	National		Regional	
	Number	Installed capacity (MWh)	Number	Installed capacity (MWh)
Battery storage	4.000	27	80	0,4
Pumped hydro storage	51	8.930.700	-	-
Power-to-gas	-	-	-	-
Compressed air storage	-	-	-	-
Other	-	-	-	-
Total	4.051	8.930.727	80	0,4

Table 12

5.3.4. Regional key technologies for supply

Regarding key technologies, there must be a distinction between the NUTS 2 region and the EEL as a micro-region on LAU basis. The main key technology on NUTS 2 level is wind power, since there are optimal conditions for this technology in the north of Burgenland. These conditions are not given in the south. The key technology for the south for the last three decades was biomass, mainly from forestry.

In the meantime the national (and also EU-) strategy has moved away from the utilization of biomass for energy supply. This resource has now to be placed into the bio-based industry sector and there are no more financial tools and measures available for direct energy utilization. The existing district heating plants will still continue to use this resources, but there is no prospect on the intensification of biomass technology, except in the utilization of the residues from the wood processing industry in place.

Another key technology is the utilization of biogas. In total there is a capacity of 420 m^3/h in place in the EEL, mainly used for the co-generation of power and heat, but there are also pilot projects for biogas upgrading and achieving natural-gas-quality.

Furthermore, also photovoltaic systems are a key technology. The balancing of production, storage and districution are currently an issue of a number of transnational research projects with direct involvement of the EEL in the form of pilots.

5.4. Regional demand-supply balance and development potentials

5.4.1. Regional balance and self-supply rates

Burgenland

Table 13 is showing the regional balance on NUTS 2 level. The balance is comparing the total generation with the respective sectoral demand (e.g.: total generated district heat with respective demand of the residential sector, etc,) . The last row "Total" is finally comparing the total generation with the total demand. As can be seen, there is a total surplus regarding electricity.

Regional balance (MWh) regarding:	NREC	REC	Electricity	Heat
Non-residential sectors (without transport)	- 1.164.000	**525.371**	**1.345.866**	**32.842**
Residential sector	- 1.229.000	**4.371**	**1.656.866**	**184.842**
Transport sector	- 3.486.000	- 254.000	**2.287.866**	**257.842**
Total	**- 5.879.000**	- **755.629**	**684.866**	- **40.158**

Table 13

The covering rate of the demand of renewables by own generation is 58%, of electricity 142% and of heat 87%. The total covering rate is 37%, it is also including the demand for transport fuel.

EcoEnergyLand

The balance of the EEL is based on own calculations regarding the demand and the inventory and generation capacity of the energy relevant facilities within the region. The complete energy generation of the power and heat plants is from renewable sources. Table 14 is showing the energy balance of the EEL.

Regional balance EEL regarding	Heat	Electricity	Transport	Sector
Non residential sector	6.094	- 12.197	- 17.049	-177.414
Residential sector	-88.949	5.529	-	51.300
Transport sector	-	-	-171.310	-171.310
Total	-189.706	-43.034	-171.310	-404.050

Table 14

The covering rates of the own generation regardsing the sectors is shown in table 15.

Supply covers demand of...	Heat	Electricity	Transport	Total
Residential sector	55%	118%	0%	63%
Non residential sector	106%	75%	0%	45%
Total	36%	46%	0%	26%

Table 15

5.4.2. Energy efficiency potentials

The main efficiency potential can be found in the renovation of the residential buildings, which account for around 93% of the existing building stock. These buildings are accounting for app. 65% of the total heat demand in the EEL.

Since there is no current data on the degree of renovation regarding the municipalities of the EEL, the data of general studies on the efficiency potential of buildings in Austria is used to estimate the potential in the EEL.

According to the estimations of the chamber of commerce, at least 80% of the building substance is in need of renovation. Depending from the year of construction, the potential of energy savings is between 30% and 67%. In general, an average increase of efficiency by 46% regarding building heating can be assumed. The potential for higher efficiency in electricity use in the residential sector, and thus energy savings, is estimated to be at a rate of 14% to 16%. For the non-residential sector, there are no values available.

Higher energy-efficiency in the transport sector depends on progress in electromobility. This progress, from the current point of view, is expected to be much slower than in urban areas.

5.4.3. Resource potentials

The previously established use of biomass cannot be expanded any further, due to the change in framework conditions. So the main resource potential is solar energy, together with (grass-) biomass from landscape management and also smaller amounts organic waste

5.4.4. Technology potentials

Although the possibilities for direct utilization of biomass are considerably reduced , the utilization of biogas (from various resources) and the thermal gasification of organic waste, including the processing of the product gas (greening the gas), can still be regarded as a technology potential, because a number of process pilots have been developed and tested in the region.

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 CO2 emissions on national level are currently around 56,8 Million tons per year. The share of Burgenland on this national sum is 1,6 Million tons per year, that equals 2,8%. An overview on the sectoral share on NUTS 2 level is given in fig. 34.

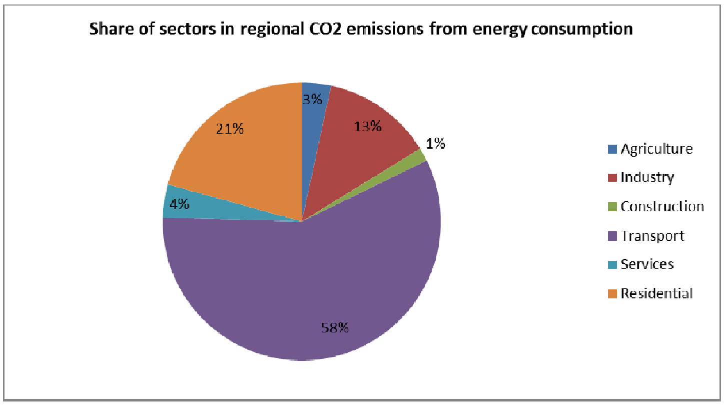

Fig. 34

The amount of CO2 emissions of the EEL is estimated to an amount of app. 98.000 tons per year, if the same calculation model is used as for the estimation of the emissions on Burgenland region level. It is distributed as shown in fig 35.

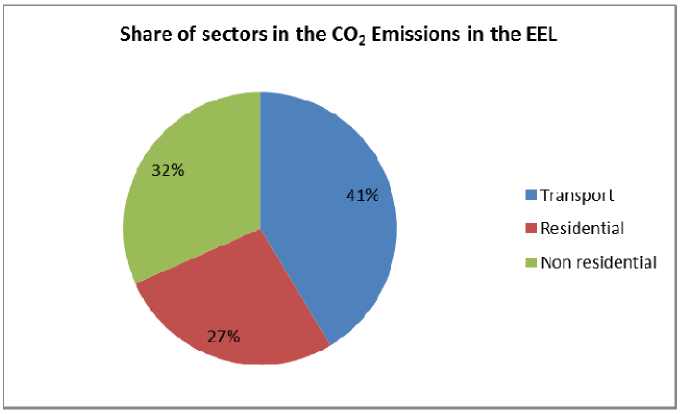

Fig. 35

7. Key figures and bottom line of the situation

The EcoEnergyLand (EEL) is a spasely populated area, covered by 19 municipalities, consisting of a number of small settlement units with mostly less than 1.000 inhabitants. The population is slowly decreasing, although a series of workplaces have been established in the last two decades.

Regarding the GDP, there are no figures on EEL level, only on national and NUTS 2 level.

On NUTS 2 level the share in the national GDP is only 2,4% as it is also in the GVA. The share of employees is 2,1% of the total number of employees on national level.

The national final energy consumption in Austria is characterized by a high share of renewable sources in heat and electricity, currently this share is 32,8% of the total national consumption. On regional level the share of renewables is currently 35%, in the EEL it is even at 37%.

The share of the residential sector in the total final energy consumption in the EEL is 41%.

All energy generated in power- or heat plants in the EEL is based on renewable resources. 36% of the heat demand and 46% of the electricity demand are supplied from within the region.

The per capita rate of generated energy within the EEL is 5,9 MWh/cap for heat and 2 MWh/cap for electricity.

Regarding the energy storage situation, there are currently no data available. Some small storage batteries are in place, the biggest one is a 25 kWh storage in the municipality of Strem.

The transport sector is characterized by the dominance of road traffic, due to the lack of rail, waterway or aviation infrastructure.

The CO_2 emission value per capita is 5,5 tonnes per year regarding the whole final consumption and 1,5 tonnes per year in the residential sector only.

8. CONCLUSIONS

The use of primary solid biomass for energy generation has been the key technology in the EEL for the past decades. In the research centers in Güssing, a series of conversion technologies have been developed and applied. Due to the changing framework conditions regarding the utilization of biomass for energy generation, some of the technologies are no more viable, although there is a development potential to use them as bio-refineries or simply for waste treatment.

Currently the development on European level is pointing into the direction of decentralized generation and distribution of energy based mainly on wind, photovoltaic, geothermy etc.

In order to develop an area covering supply on this concept, the activities in solar energy generation and energy storage, as well as smart energy distribution are considered to be a promising way towards the realization of a carbon-free region.