3.1.10 Transnational Comparative SWOT Results

CERE – Center of Excellence for Renewable Energy, Energy Efficiency and Environment

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Legal disclaimer:

CENTRAL EUROPE PROGRAMME

CENTRAL EUROPE is a European Union program that encourages cooperation among the countries of Central Europe to improve innovation, accessibility and the environment and to enhance the competitiveness and attractiveness of their cities and regions.
CENTRAL EUROPE invests €231 million to provide funding to transnational cooperation projects involving public and private organizations from Austria, the Czech Republic, Germany, Hungary, Italy, Poland, the Slovak Republic and Slovenia. The program is financed by the European Regional Development Fund and runs from 2007 to 2013.

About VISNOVA

The CHALLENGE of VISNOVA pursuits an integrated approach which addresses both the supply (provision of sustainable energy) and demand site (efficient use). Based on best practices collection, transferred and tested in pilot measures (both pre-investment and small investment), included to regional energy development plans adopted with a political vote, financial resources from national programmes will be explored and responsibilities for the plans' implementation assigned.

Thus, the VIS NOVA partners aim to integrate a concept of energy autonomy based on renewable sources and energy efficiency into regional development policies, public authorities in rural regions need adequate planning instruments to avoid isolated approaches that fail to unfold the full potentials for territorial cohesion, competitiveness and employment. Furthermore, public authorities lack profound knowledge about the transferability of European good practices and have poor access to cutting-edge innovations in intelligent energies.

The overall OBJECTIVE of VISNOVA is to cover in the medium and long term up to 100% of the territory's energy demand by energy being produced off regional resources. Sustainability and a secured supply shall be turned into a location factor; the possibility to determine prices can be exploited as a new incentive to promote economic development. Moreover, regional added value and hence employment in the energy sector is strengthened.

With other words, the aim is to integrate instruments to promote energy efficiency ("Energy Efficiency Plan") based on EU good practices, new technologies and transnational learning into regional development policies. The project therefore assists rural regions to plan and to take action to create new value added in the renewable energy sector, to secure local energy supply, to improve energy efficiency performances, to strengthen their competitiveness as locations for economic activities, and to promote territorial cohesion comprehensively.

Furthermore, pilot investments and feasibility assessments subject to transnational peer review test and demonstrate new means to exploit endogenous energy sources in a sustainable way and enhance their efficiency.

Already existing energy/regional development agencies (usually those participating in the project) will assume the competency of a regional sustainable energy centre to master the energy development plans' medium and long-term implementation.

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List of Abbreviations

ERDF	- European Regional Development Fund
CE	- Central Europe
RES	- Renewables energy sources
NUTS	- Nomenclature of territorial units for statistics
GNI	- Gross national income
GDP	- Gross domestic product
GRP	- Gross regional product
CHPs	- Combined heat and power units
NGLs	- Natural Gas Liquids
RE	- Renewable energy
PV	- Photovoltaics

1. Executive Summary

With the increasing challenges of climate change, depletion of fossil fuel resources and population growth, the search for better, cleaner and more efficient technologies to produce, distribute and use energy is becoming more and more critical. In addition to the growth in global energy use (50% expected by 2020), it is not likely that energy will remain easily affordable to all who need it.

It is vital in terms of energy research and development in the entire world in general and Europe in particular to provide renewable energy options by making energy services available without huge or excessive costs, to reduce oil and natural gas dependence and to mitigate to climate change by developing competitive renewable energy technologies.

All the countries share these concerns and compete together to find the new renewable energy technologies applicable to their own market (from regional to national level), ensuring them with technological advantages and economic benefits.

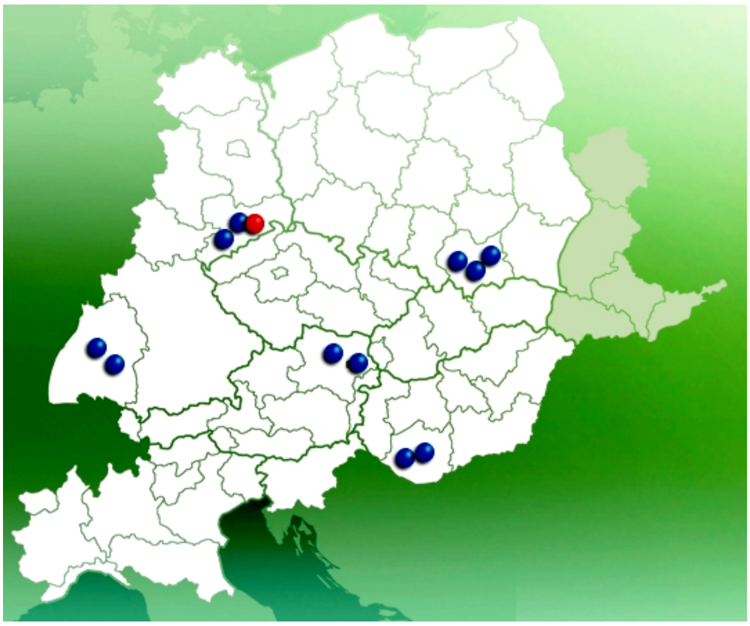


Figure 1 VisNova Project Partnership Map

This report was conceived in order to summarise, analyze (in a comparative way) and provide the results gathered from the SWOT analysis of the five urban regions performed at regional level by the consortium partners (Table 1), meaning that was an identification of the advantages (strengths) and disadvantages (weaknesses), as well as an analysis of the opportunities and threats.

L.A.U.	NUTS 3	NUTS 2	NUTS 1	Country
Tullnerfeld West	Wiener Umland/Nordteil	Lower Austria	Eastern Austria	Austria
Schwäbisch Hall	Schwäbisch Hall	Stuttgart	Baden-Württemberg	Germany
Nordsachsen	Nordsachsen	Nordsachsen	Sachsen	Germany
Szekszard	Tolna	South-Transdanubia	Transdanubia	Hungary
Gorlice	Nowosadecki	Małopolskie	Poludniowy	Poland

Table 1 Region performing SWOT analysis

The various advantages, disadvantages, opportunities, and threats of the five regions were grouped in 5 clases: demographic, socio-economic, energetic infrastructure, energy consumption and finally, renewable energy potential.

2. Regional Profiles results

Knowing what's going on with demographic changes and movements helps us planning the demand for energy usage as well as labour issues tight to this matter. Thus, the analyzed demographic indicators were as follows:

2.1. Demography

In terms of areas, the analyzed regions are quite the same size (with exception of Tullnerfeld West region, which has an area less than half of the total average and Tolna region, having an area almost two times more than total average [1594 km^2]).

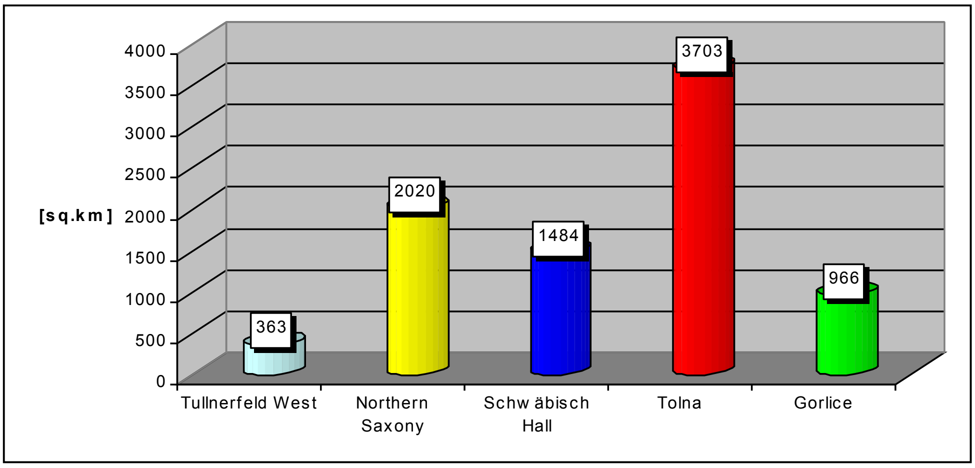


Figure 2 Regional areas [km^2]

Compared with the country surface, it can be observed that we have quite the same situation, the regions representing around 0,5% of their entire national area.

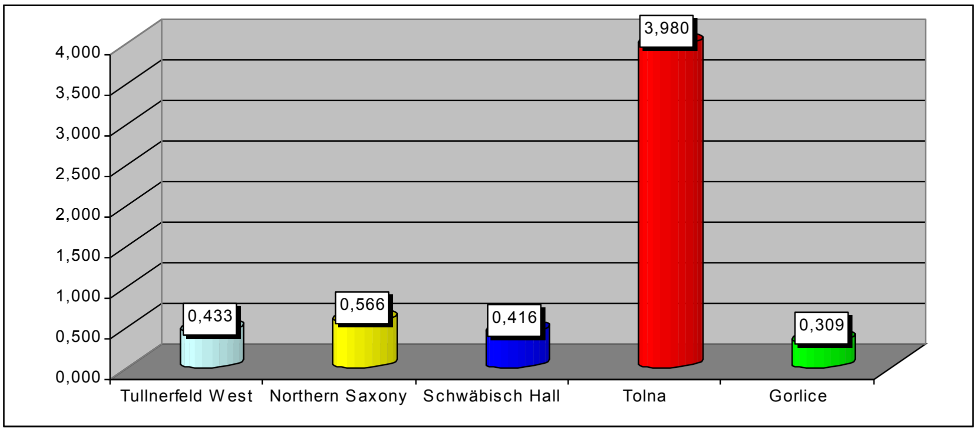


Figure 3 Percentage of entire national area

Regarding population evolution in the last two decades, Tullnerfeld West, Schwäbisch Hall and Gorlice regions have general population stability, in time which Northern Saxony and Tolna regions manifest a decreasing population number.

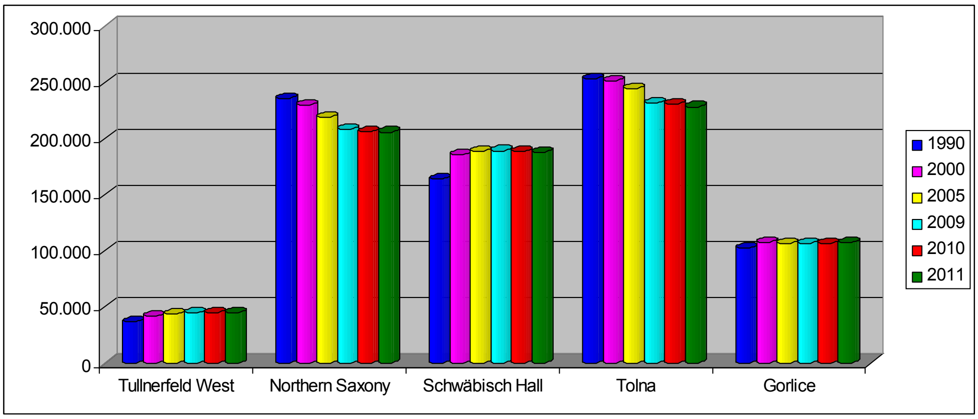


Figure 4 Population evolutions at regional level

The same quite stabile situation can be observed also at NUTS 3 regional level.

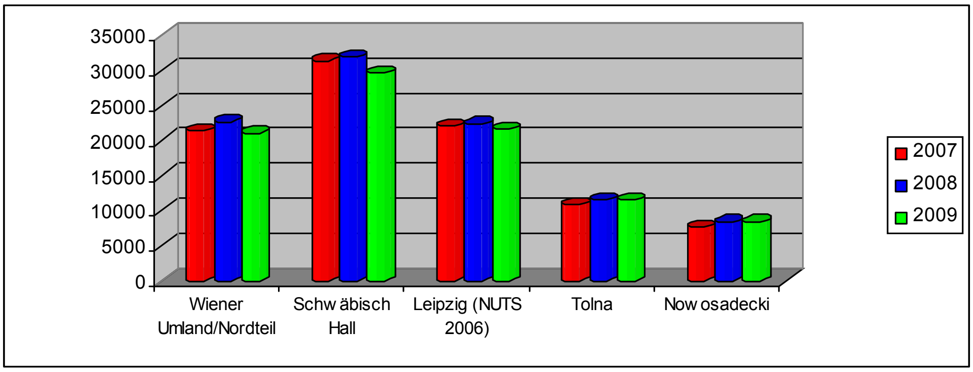


Figure 5 Population evolutions at regional level (NUTS 3)

In terms of last decade, demographic balance and crude rates for the same NUTS 3 level are in the same line with the ones presented at regional level.

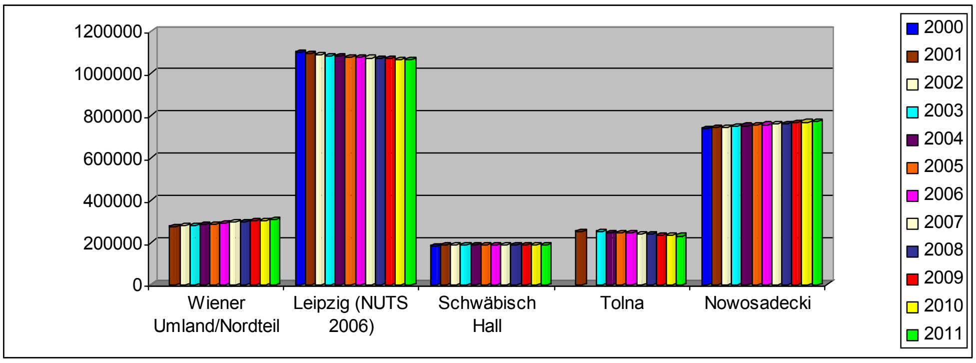


Figure 6 Demographic balance and crude rates (NUTS 3)

The following two figures present breakdowns of population repartitions by sex groups (abstract values and percentage).

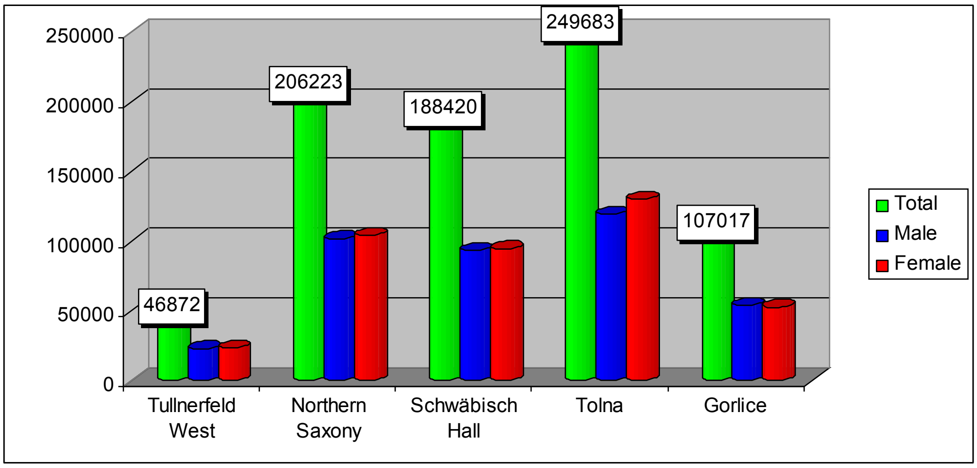


Figure 7 Population at regional level (by sex groups) abstract values

In terms of male-female repartition, it can be observed that all the present quite the same percentages, only Gorlice region having a higher male percentage.

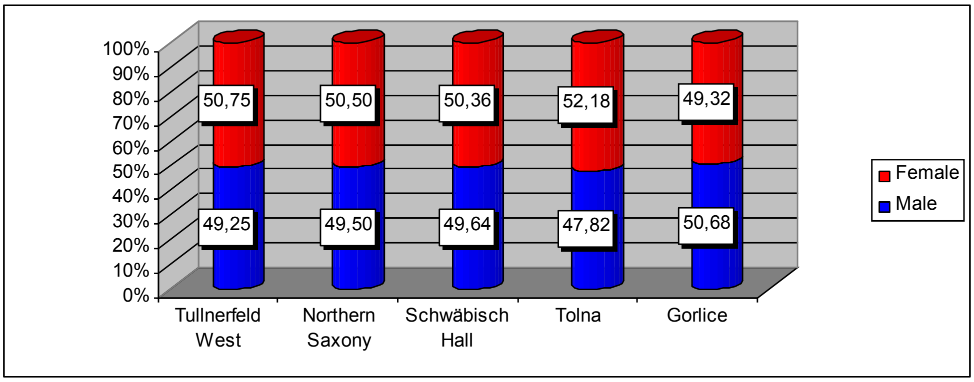


Figure 8 Population at regional level by sex groups [%]

The next two figures present population repartitions by age groups.

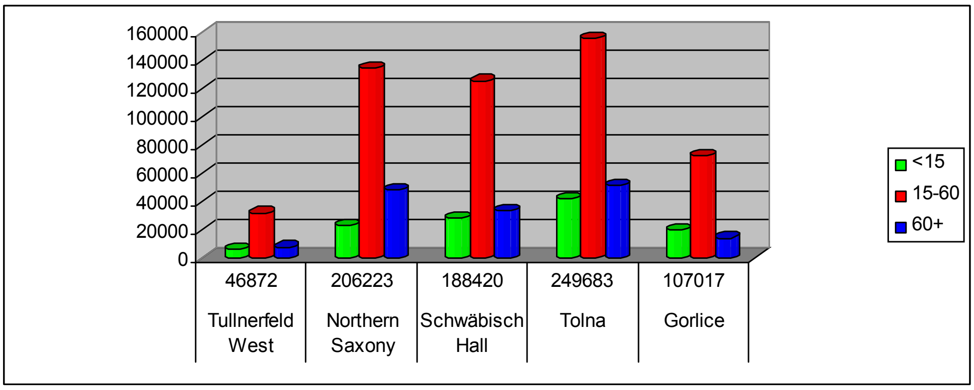


Figure 9 Breakdown of the population by the age groups abstract values

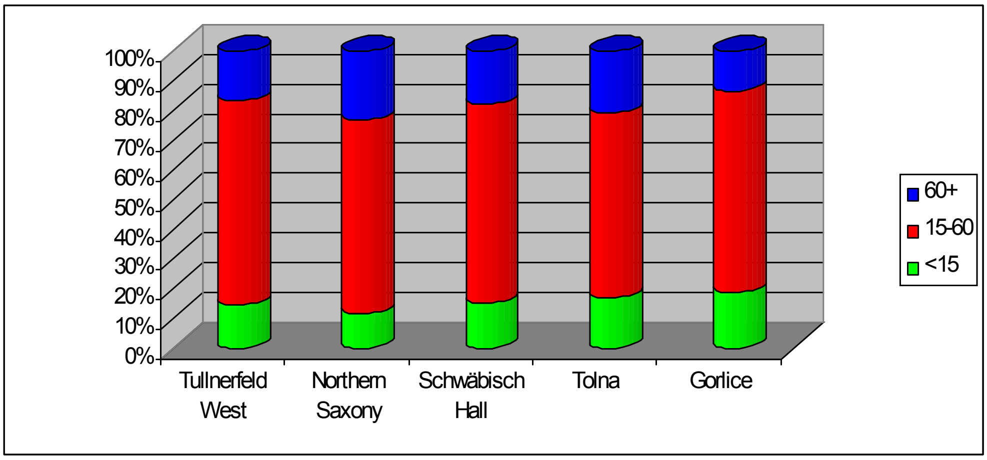


Figure 10 Breakdown of population by age groups at regional level [%]

Compared with the values at national level, only Tolna region manifest a lower percentage value for the active working population (age group between 15-60), all other regions having a higher value that national percentage, representing a real strength point for demographic indicators.

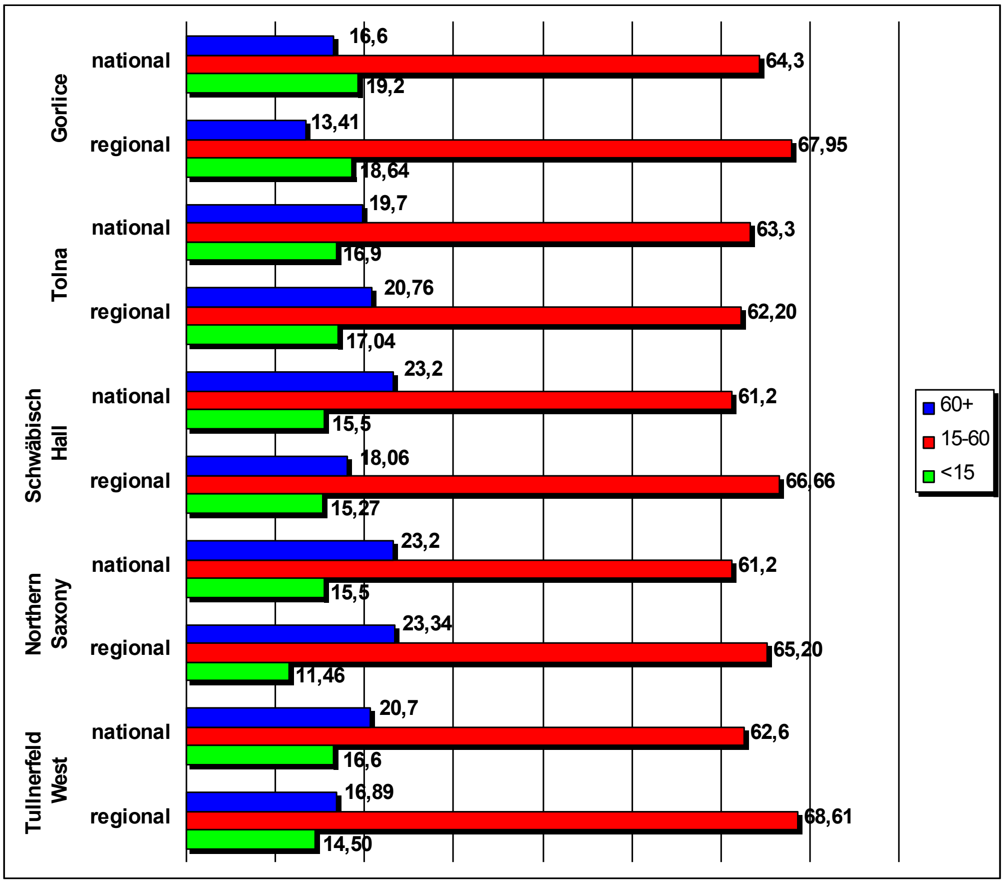


Figure 11 Population comparisons by age between regional and national level [%]

Regarding the human development index, the trend is positive for all five envisaged regions, constituting another strength point inside SWOT analysis.

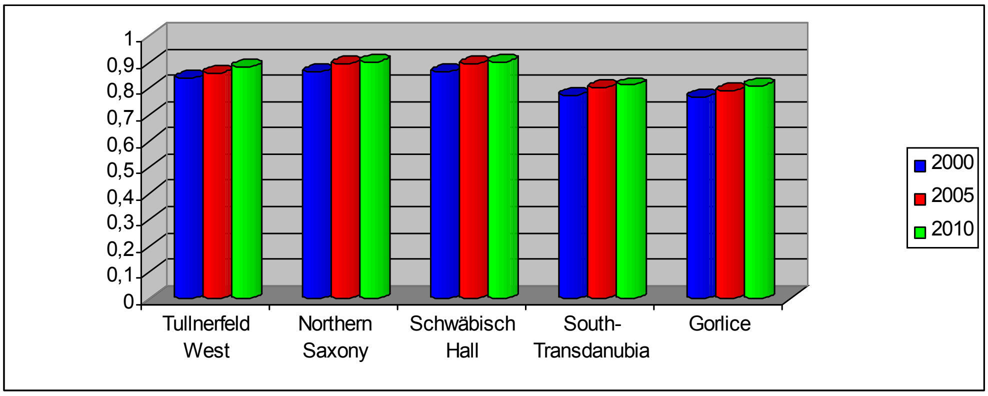


Figure 12 Human development indexes at regional level

Figure 13 highlights the population density values form the fifth regions compared in the same time with the country values.

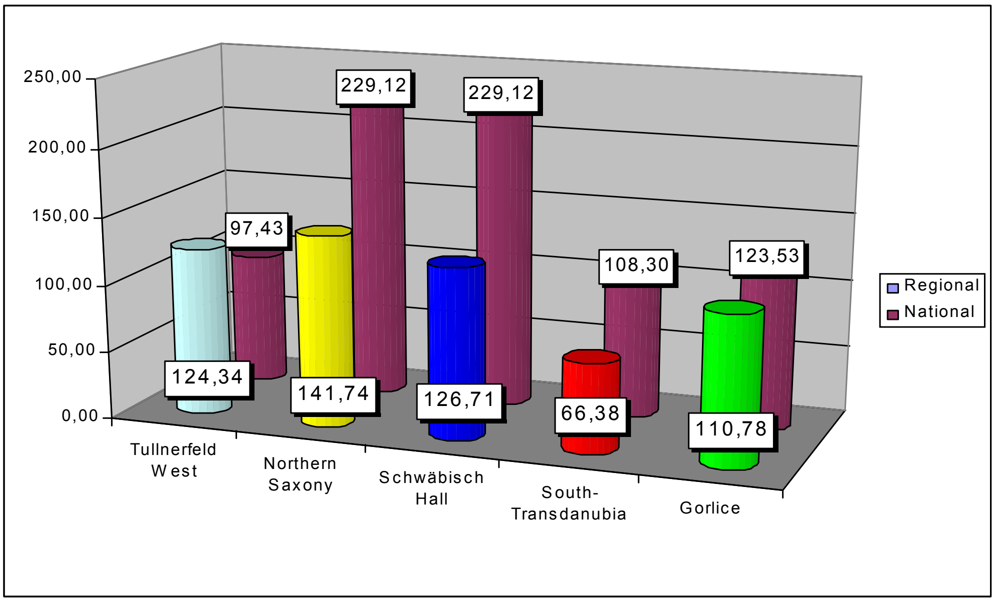


Figure 13 Comparison between regional and national population density [inh/km^2]

From this point of view, appears the largest difference between the regions. Thus, on one hand, Northern Saxony, Schwäbisch Hall and Tolna regions presents values much lower than the national density values (close to half), on the other hand Gorlice has a density close to national one and Tullnerfeld West region is characterised by a higher population density than national value. The average regional density value for our transnational zone is 113,99 inhabitants/km^2, in time which the national average density value is 157,49 inhabitants/km^2.

2.2. Socio - economy

GNI per capita evolution 2000 - 2009 at national level in Euros presents an ascending evolution for all countries.

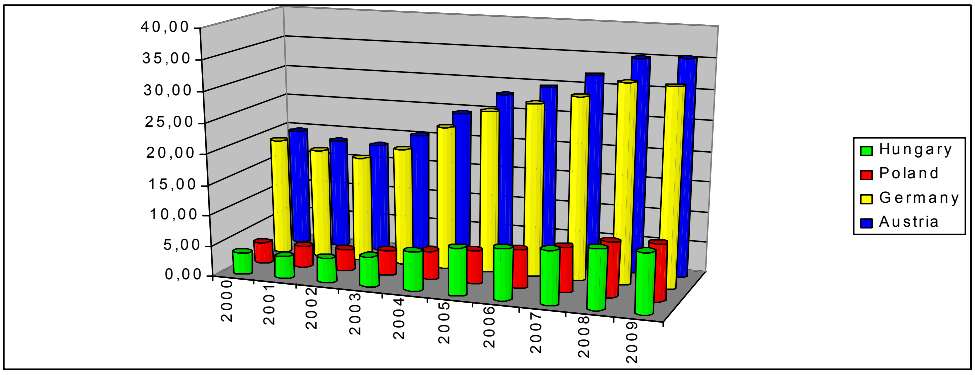


Figure 14 GNI per capita evolutions per country

GDP per Capita has a slight descending trend for Tullnerfeld West and Schwäbisch Hall regions in the last three years, while Tolna and Gorlice regions manifest a slight increasing evolution at NUTS 3 region level.

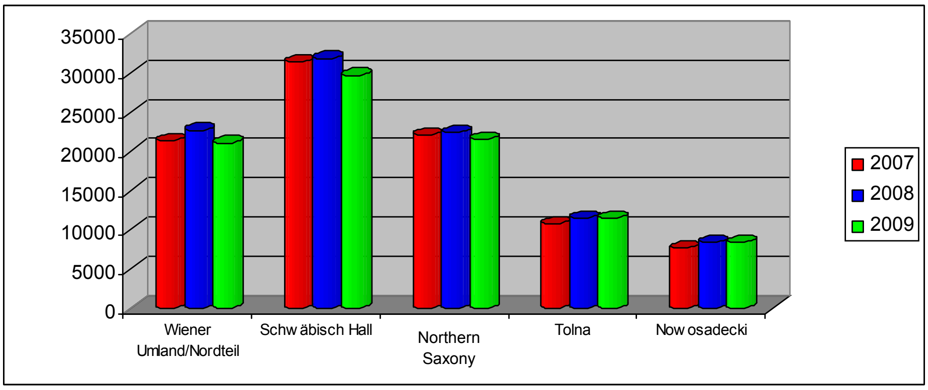


Figure 15 GDP at current market prices (NUTS 3 level)

Regarding the GRP by sector of activity, only Gorlice region has the highest value obtained from industrial sector, to all others regions being obtained from the services area.

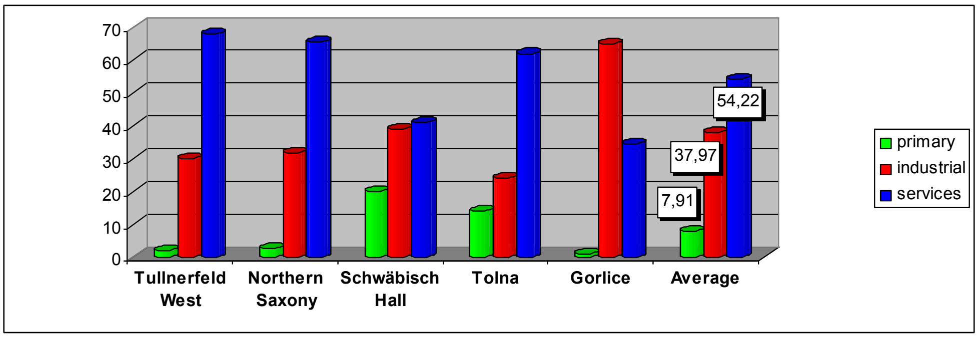


Figure 16 GRP by sector of activity [%]

As economical indicators, the unemployment rate is one of the most important ones, this indicator highlighting the general trend for working environment.

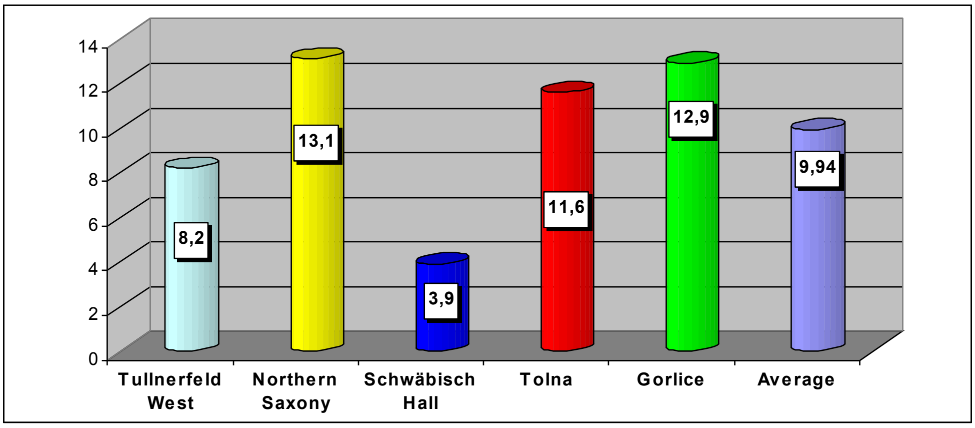


Figure 17 Unemployment rate

As showed in Figure 17, the lowest unemployment rate is found in Schwäbisch Hall region, owed to a service industry extraordinarily well developed, followed closely by Tullnerfeld West region (both under 10%). At the opposite pole, we find Northern Saxony, Gorlice and Tolna region, which despite is characterized by dynamic development, the industrial production and distribution being expanded by 15-20%. the level of unemployment is far above the national average.

3. Energetic infrastructure

Any kind of extraction of energy products from natural sources to a usable form is called primary production. Primary production takes place when the natural sources are exploited, for example in coal mines, crude oil fields, hydro power plants or fabrication of biofuels. Transformation of energy from one form to another, like electricity or heat generation in thermal power plants or coke production in coke ovens is not primary production.
Thus, the national values for the total production of primary energy are depictured in the figure below.

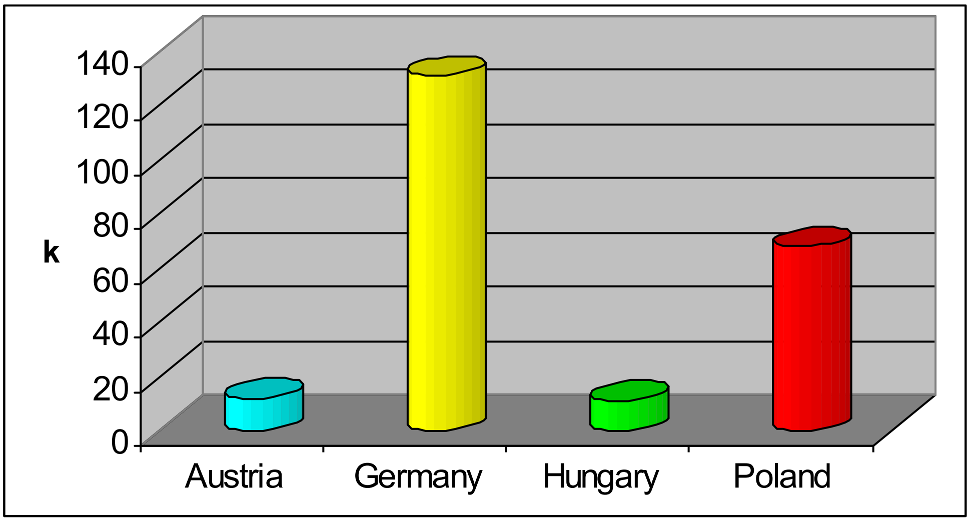


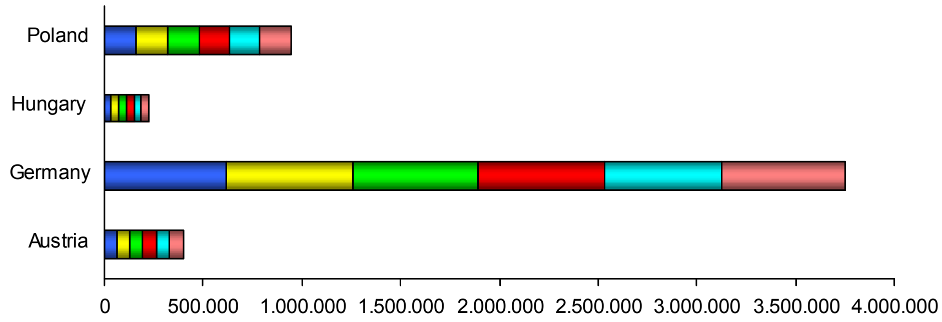
Figure 18 Total production of primary energy 2010 [1000 to of oil equivalent]

3.1. Electric system

What we find is that, while overall consumption increased by approximately 58% from 1990 to 2010, the primary sector, which throughout Lower Austria is traditionally dominated by agricultural production, remained relatively stagnant, with end energy usage growing 5,4%. Private households, whose energy requirements peaked in the middle of the 1990s, during those two decades increased their energy consumption by 17% - it must be noted, however, that the population growth in Lower Austria during that time was not even half as high as in Tullnerfeld West - 9% compared to 22,5% - which leaves one assuming a significantly higher increase for our region. The largest relative increase can be found in the services sector, which also includes public services and administration.

In recent years the structure of energy supply has changed considerably in Germany. Within a few years the share of renewable energy sources has strongly increased and thus amounted to approx. 17 % of the total power generation in 2010. In addition large generating units will be disconnected due to the nuclear phase-out. More flexible electricity generation plants such as modern and highly efficient gas power plants as well as decentralized small CHPs (combined heat and power units) producing electricity and heat at the same time through the cogeneration of heat and electricity, will become increasingly important. This development reflecting a decentralization of energy supply will increase even more in Germany in the future.

Regarding the purchasing power the Northern Saxony district, like all districts in Eastern Germany, lags behind the German level with 83.1% and even behind the Saxon average of 83.6%. Both districts in Saxony-Anhalt Anhalt-Bitterfeld (80.0%) and Wittenberg (80.2) show an even lower purchasing power. This should be considered, for example, with reference to the potential of heating system modernization by private organisations.



	Austria	Germany	Hungary	Poland
2010	71.127	627.918	37.371	157.657
2009	69.088	592.464	35.908	151.720
2008	66.877	637.232	40.025	155.305
2007	64.757	637.100	39.960	159.348
2006	64.499	636.761	35.859	161.742
2005	66.409	620.574	35.756	156.936

Figure 19 Total gross electricity generation 2005-2010 [GWh]

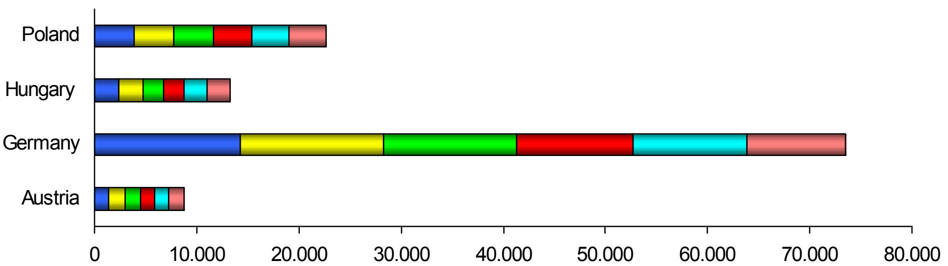
Electricity for the Gorlice District is supplied by the national grid governed by two electricity companies: Polskie Sieci Energetyczne - Południe SA. and Polskie Sieci Energetyczne - Wschód S.A. In the area of the District there are not any electric lines of voltage of 220 kV and higher than that.

The distribution system in the region is managed mainly by the company TAURON Dystrybucja Ltd. Kraków Branch, apart from the City and Community of Biecz as well as Lipinki Community which are supplied by PGE Dystrybucja Ltd – Rzeszów Branch (some villages lying at the boundaries of these Districts are supplied from the lines owned by TAURON Dystrybucja S.A.)

Total gross electricity generation covers gross electricity generation in all types of power plants. The gross electricity generation at the plant level is defined as the electricity measured at the outlet of the main transformers, i.e. the consumption of electricity in the plant auxiliaries and in transformers are included.

3.2. Gas system

Dry marketable production, measured after purification and extraction of NGLs (Natural Gas Liquids) and sulphur is considered as primary production. It does not include quantities re-injected, extraction losses, or quantities vented and flared. It includes quantities used within the natural gas industry, in gas extraction, pipeline systems and processing plants.



	Austria	Germany	Hungary	Poland
2010	1.486	9.694	2.235	3.693
2009	1.433	11.116	2.287	3.678
2008	1.317	11.314	2.006	3.690
2007	1.589	13.094	2.005	3.897
2006	1.564	14.052	2.382	3.880
2005	1.404	14.224	2.331	3.884

Figure 20 Primary production of natural gas 2005-2010 [1000 to of oil equivalent]

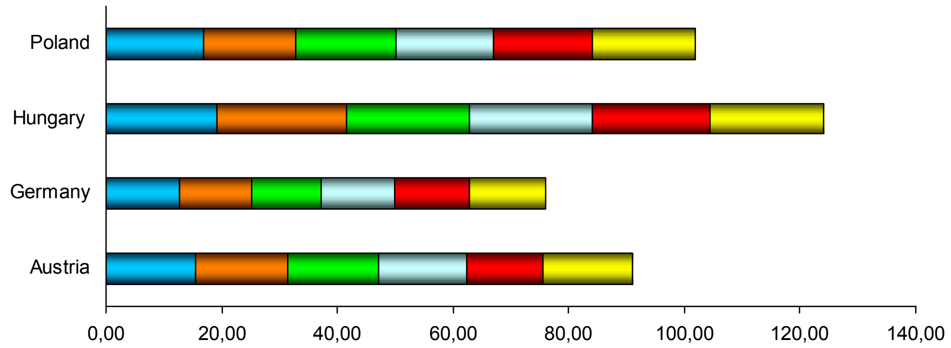
3.3. Thermal energy supply

The living space per inhabitant in Northern Saxony is at 38.6 m^2/inhabitant and in the municipalities in Saxony-Anhalt at 43.0 m^2/inhabitant. In consideration of the projected demographic change in the region a further increase of the population-related living space over the next few years is expected.

District heating networks and the corresponding heat generation plants are being operated by the Stadtwerke Schawbisch Hall AG and the Stadtwerke Crailsheim GmbH in the district of Schwäbisch Hall. Especially in the field of biogas plants more decentralized small heating networks are currently being developed.

The supply of thermal energy in the area of Gorlice directly depends on a density of the local population, which concentrates in urban areas and is sparser in rural ones. The demand for thermal energy in the District is satisfied by: the city central heating system, Local heating systems and domestic boiler rooms. The District heating system is operated by E-Star Heat and Power Plant Gorlice Ltd. (the area of the city). The production of thermal energy together with electricity is its basic productive activity. In the area of the Gorlice District, E-Star Ltd. is the only licensed producer of thermal energy. Scattered local boiler houses, satisfying a demand for energy of more than one consumer, are located close to the buildings to which they supply thermal energy. They are owned by industrial plants, businesses, housing associations or local councils.

Combined heat and power (CHP) or cogeneration is a technology used to improve energy efficiency through the generation of heat and power in the same plant, generally using a gas turbine with heat recovery. Thus, the national statistics are presented below.



	Austria	Germany	Hungary	Poland
2010	15,40	13,20	19,60	17,60
2009	13,20	13,00	20,50	17,20
2008	15,30	12,50	21,10	16,90
2007	15,60	12,20	21,40	17,30
2006	16,10	12,50	22,40	16,00
2005	15,40	12,60	19,10	16,80

Figure 21 Combined heat and power generation at national level

4. Energy consumption

The renewable energy market developments we have seen in the last years justify this confidence. In 2010, more renewable electricity capacity was installed in the EU than ever before. While 13,3 GW were installed in 2008, and 17,3 GW in 2009, a record 22,6 GW was installed last year.

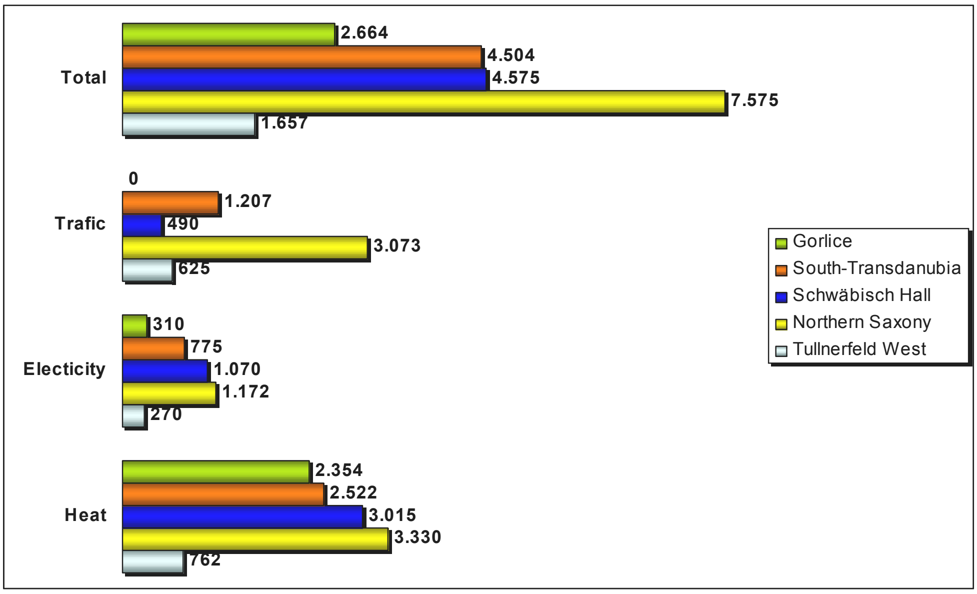


Figure 22 Total energy consumption 2010 [abstract values]

Market development clearly surpassed expectations and exist the confidence that the same will happen in the years to come given that the right framework conditions are put in place. According to the latest Eurostat, RES represented 10.23% of final energy consumption in 2008.

National	Value	**Region**	Value
AUSTRIA [km²]	**83871**	**Tullnerfeld West**	**360**
Energy production [ktoe/year]	**10902**	Energy production [ktoe/year]	**1657**
GERMANY [km²]	**357022**	**Schwäbisch-Hall**	**1484**
Energy production [ktoe/year]	**137032**	Energy production [ktoe/year]	**4575**
GERMANY [km²]	**357022**	**Northern Saxony**	**2020**
Energy production [ktoe/year]	**137032**	Energy production [ktoe/year]	**7575**
HUNGARY [km²]	**93028**	**South-Transdanubia**	**14169**
Energy production [ktoe/year]	**10225**	Energy production [ktoe/year]	**4504**
POLAND [km²]	**312685**	**Gorlice**	**966**
Energy production [ktoe/year]	**72646**	Energy production [ktoe/year]	**2664**

Table 2 Yearly energy production at national and regional level

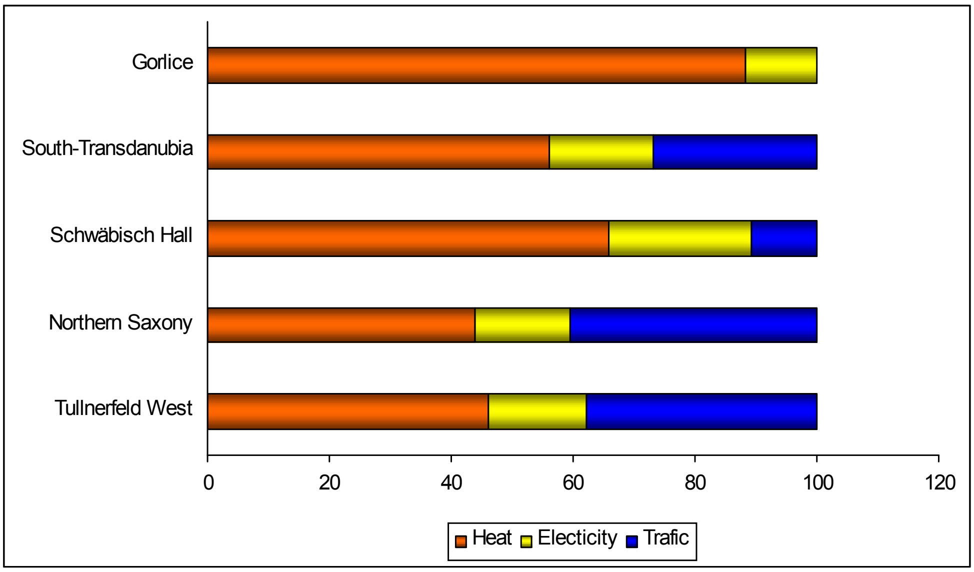


Figure 23 Total energy consumption 2010 [%]

It is obvious that in all five regions the main area of energy consumption is hold by heating sector. The traffic sector detains a higher value than electricity consumption only in Schwäbisch Hall region, in all the others electrical consume being situated on the second level in terms of energy consume.

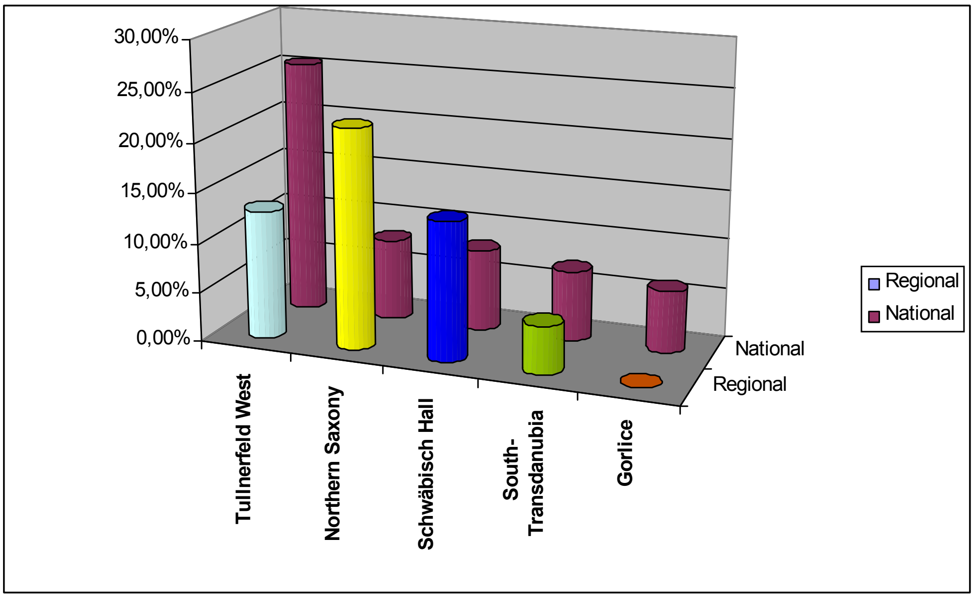


Figure 24 Regional and national RES shares of final energy consumption [2009]

Figure 24 highlight that the two german regions part of the project consortia, namely Northern Saxony and Schwäbisch Hall, dispose of higher level of renewable energy sources share found in the total energy consumption than the national average.

4.1. Heating

According to Eurostat, the share of RES in heating and cooling reached about 11,9% in 2008 with biomass representing 11,4% of heat consumption, geothermal 0,3% and solar thermal 0,2%.

The number of residential buildings in the Northern Saxony district is 50.314 and in the municipalities of the Düben Heath in Saxony-Anhalt it is 14.950. In Northern Saxony single-family houses dominate with a number of 41.591 compared to 8.436 multiple dwellings (as of 2008). A similar situation prevails in SaxonyAnhalt, where the distribution was estimated from available data: 13.486 single-family houses and 1.498 multiple dwellings.

The main heating systems being used in the district of Schwäbisch Hall are oil-fired heating systems representing the largest share with 41 %, followed by natural gas with 22 % and the supply via district heat representing 17 %. The use of wood, woodchips and pellets is comparatively high with 12 %, as well as electric heating with a share of 6 %.

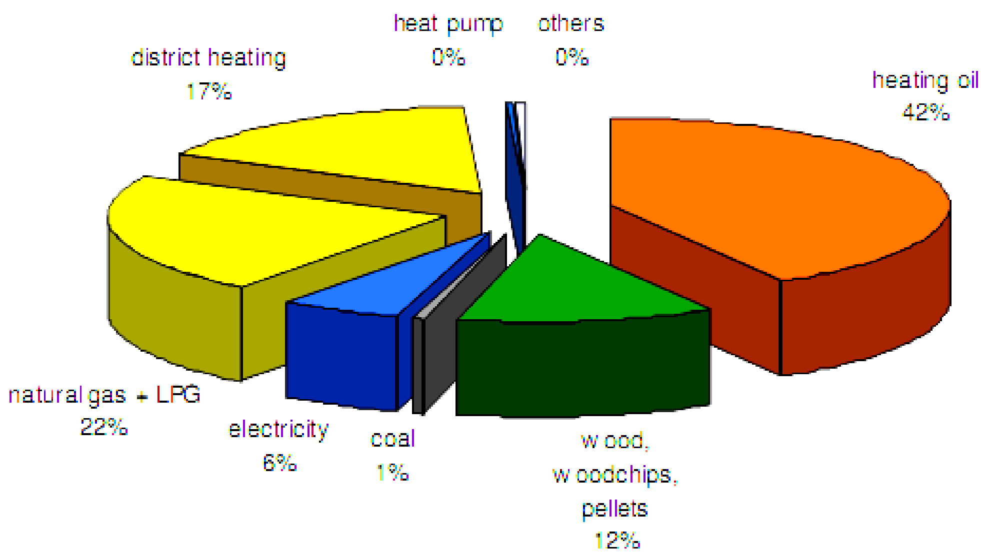


Figure 25 Shares of heating systems in Schwäbisch Hall

For the other participating regions, informations about heating network at regional level were not available.

4.2. Electricity

Renewables produced 19,9% of Europe's electricity consumption in 2009. Hydropower contributed the largest share with 11,6%, followed by wind with 4,2%, biomass with 3,5%, and solar power with 0,4%. Renewable electricity's share of newly installed capacity increased from 57% in 2008 to 62% in 2010.

For example, the number of electricity consumers in the District of Gorlice supplied by TAURON Distribution Ltd. amounts to 29578, and energy consumption reaches the figure of 143819,77 MWh a year (data from 2010). According to PGE Distribution Ltd. Rzeszów branch, the total number of electricity consumers in the city and community of Biecz is currently equal to 7700. The consumers living in the area mentioned above, fed from medium and low-voltage lines, consume about 22,3 GWh a year (in 2010 it was about 18,3 GWh). Machine Factory "Glinik" Ltd. Generates about 40 MWh of energy, while E-Star Thermal-Electro Power Station Gorlice – 8616 MWh.

Altogether there are about 37278 consumers in the District of Gorlice and energy consumption reaches the figure of about 206236 MWh a year (data from 2010). The households comprise the largest proportion of energy consumers(88% - according to GUS data and the main suppliers operating in the District) and they use the largest quantity of electric energy. An average consumption of it in the group of private households amounts to 2088,3 kWh per head and it is lower than the province's and country's one.

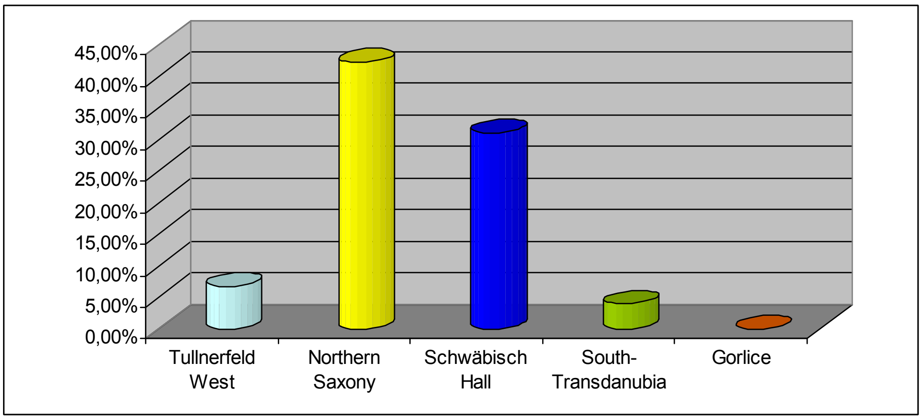


Figure 26 RES within electricity consumption

For the other not mentioned regions there was not possible to find so detailed and particular informations at regional level.

4.3. Transport

The share of renewable in transport amounted to 3.5% of the gross final energy demand in the transport sector in 2008 according to Eurostat. Biodiesel represented 2.7%, bioethanol 0.6% and other liquid biofuels 0.2%.

In Tullnerfeld West region, the main driver for increased energy consumption is transportation, featuring the highest absolute and second highest relative increase, and accounting for more than 38% of today's overall end energy consumption.

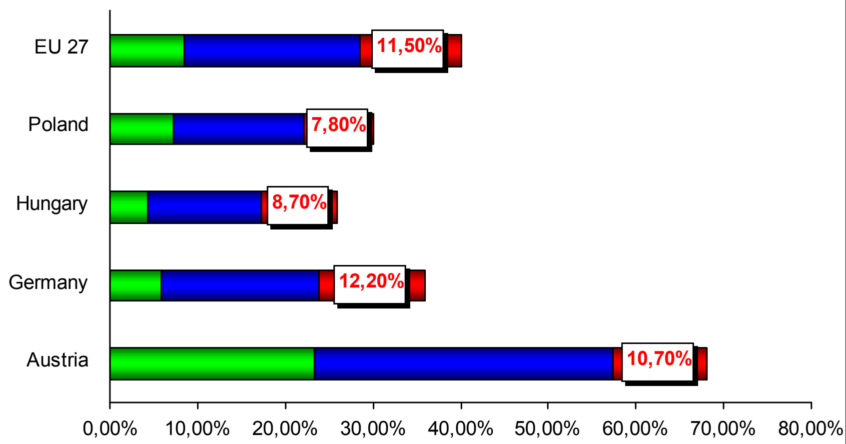
An essential share of energy consumption in rural areas is spent for mobility. It is necessary to differentiate between passenger and freight traffic. In freight service, traffic is strongly determined by the industries. In the Northern Saxony district the airport Leipzig/Halle and companies of the logistics industry, which are located close to the traffic hub Schkeuditz, are dominant.

In terms of energy consumed for transportation, regional specific data for Schwäbisch Hall, South Transdanubia and Gorlice regions were not available.

5. Potential for Renewable Energies

Renewable energy sources - RES are one of the main tools that have to lead European Union to the achievement of the energetic policy goals. Contribution deals with analysis of individual RES using. Attention is given to the description of the conveniences for RES. We have made prognosis of RES development to 2020 and we analyzed in details future development of RES.

In order to assess the amount and the value of RES technologies in European Union up to 2020, it is important to have a look at the current situation. World energy demand is projected to rise to 1000 EJ (EJ = 10^{18} J) or more by 2050 if economic growth continues its course of recent decades. Both reserve depletion and greenhouse gas emissions will necessitate a major shift from fossil fuels as the dominant energy source. Since nuclear power is now unlikely to increase its present modest share, renewable energy (RE) will have to provide for most energy in the future.



	Austria	Germany	Hungary	Poland	EU 27
% increase required	10,70%	12,20%	8,70%	7,80%	11,50%
2020 RES Target	34%	18%	13%	15%	20%
RES in 2005	23,30%	5,80%	4,30%	7,20%	8,50%

RES in 2005 2020 RES Target % increase required

Figure 27 RES for 2020 at national level

We find that when the energy costs of energy are considered, it is unlikely that RE can provide anywhere near a 1000 EJ by 2050. We further show that the overall technical potential for RE will fall if climate change continues. We conclude that the global shift to RE will have to be accompanied by large reductions in overall energy use for environmental sustainability.

http://groups.google.com/group/energy-discussion

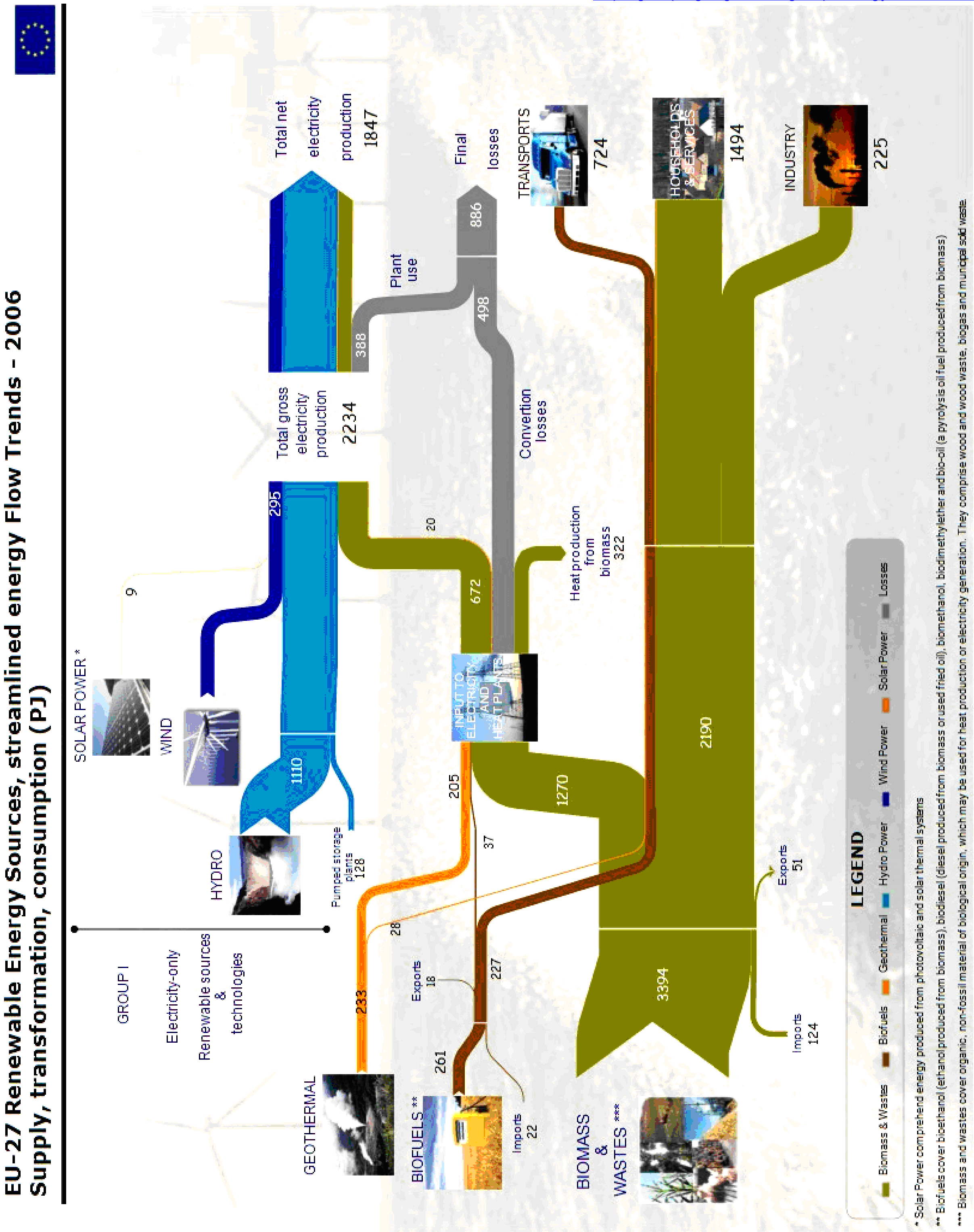


Figure 28 Diagram for European renewable energy sources (RES) energy flows

The natural sources of renewable energies on earth are extremely large and offer in principle a multiple of the global energy consumption. The technical potential as well as the feasible potential is shown in Figure 29. However, the supply of energy from renewables varies considerably depending on the geographic position. For instance, the maximum potential for using solar thermal power stations is located along the equator between the latitudes 20 and 40.

Source: BMU (2011): Erneuerbare Energien Innovationen fr eine nachhaltige Energiezukunft

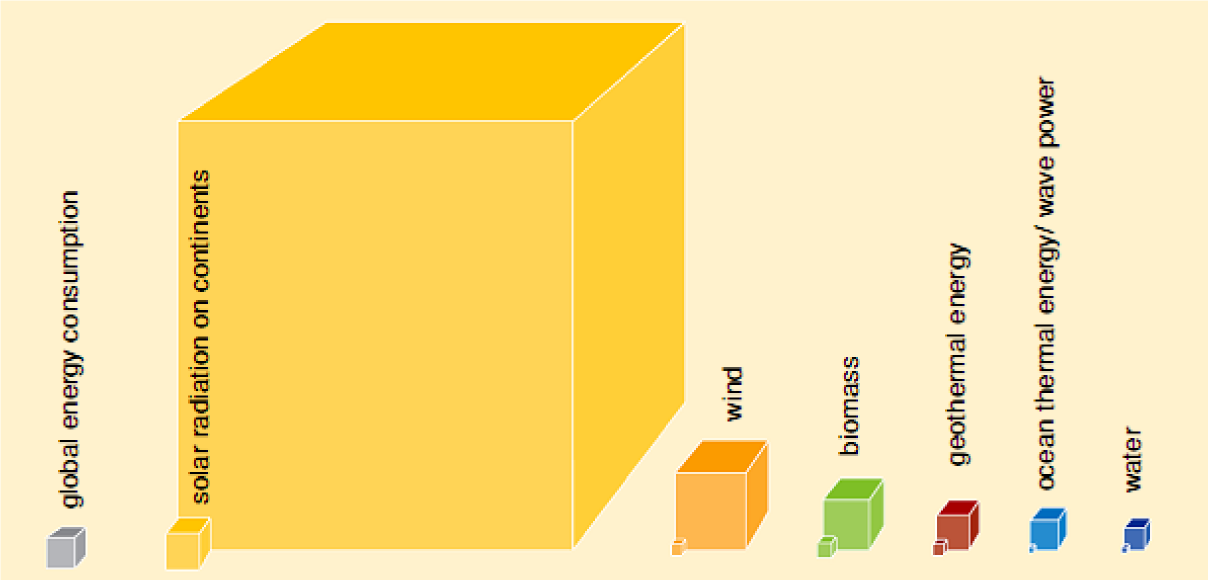


Figure 29 Worldwide sources of renewable energies

5.1. Biomass

The use of biomass energy is currently increasing, both for the application of heat, e.g., by means of CHP, as well as for transport fuels and electricity, e.g. by means of co-firing. Biomass resources are available from large range of different feedstock. Here we distinguish dedicated energy crops and residues from agriculture, forestry, food industry and waste. The category energy crops includes short rotation forestry, the category residues is not further, due to lack of data. The primary biomass can be converted to all energy applications; heat, electricity and transport fuel.

For Tulnerfeld West region, biomass is the energy carrier with the greatest potential for energy generation from RES in the region - by a landslide, as it accounts for 56% of the overall potential. This seems even more striking since the presented numbers encompass only silvicultural and agricultural biomass as such produced for energy generation, but no organic by-products or wastes. Tullnerfeld-West furthermore has a decent potential for geothermal heat production; one should, however, keep in mind the uncertainties, if not impossibility, of assessing the economic viability of this RES in for a whole region in general rather than case specific.

If we refer to Northern Saxony district, there is a real potential for expansion given in animal production facilities owed to larger plants by farms, regional energy provider and investors. In terms of wood wastes, the residual wood in relation to the forest is limited along with development of street side wood, but the agroforestry systems are expandable. As barriers, there is definitely need for further expansion of the acceptance through the population and to secure the supply, along with a decrease of transportation costs because of expanding catchment area.

In Schwäbisch Hall region, with a share of more than 50 % of the total energy generated from renewable energies, biogenic energy sources are currently the most important ones. All in all, a sustainable forest management alone could open up an annual energy potential of about 110 GWh without any competition with the wood industry. An additional energy potential represents the use of untreated scrap wood. It includes scrap wood from industry and landscape conservation. In purely theoretical terms the district of Schwäbisch Hall has annually about 960 GWh in form of wood at its disposal. Due to the competition with sustainable management and other industries only 409 GWh can be used to produce energy. On average biomass plants reach an efficiency of about 85 %. In other words, 350 GWh of energy can be made available from the existing wood. The potentials for bioenergy generated from waste material can be estimated at about 131 GWh for electricity and about 118 GWh for thermal energy in the district of Schwäbisch Hall.

Due to its favourable agriculture, Southern Transdanubia has a higher than average biomass potential. Primary types of biomass products of forestry (main and by-products), tree processing, main products of agriculture (seeds, derivatives), agricultural by-products and waste (straw, stem, vines, processing by-products (sunflower hull, etc.) are abundantly found in the Southern Transdanubia region, as well as secondary biomasses (animal biomass and products) , meat (protein), different kinds of fat and other products (milk, eggs, etc.) , and last but not least, tertiary biomasses sources as retained substances after processing and utilising primary and secondary biomass (skin, other types of tissue, blood, manure, faeces, urine, food remains, cooking oil, etc.)

Coming to Gorlice Region, as sources for the biomass production are identified as forestry, wood processing industry and agriculture, with essential element of that theoretical potential of biomass of agricultural origin is straw. From these identified sources, the potential energy produced has as values as economic potential coming from forest biomass 326,0 TJ/year, from sawdust biomass for direct use on heating is ca. 10% of the technical potential meaning around 2.7 TJ/year and from straw biomass can be 5% of technical potential meaning 7.7 TJ/year.

5.2. Wind power energy

The use of wind power is increasing rapidly over time. Currently, there is about 74 GWe installed capacity over the world and a further increase is expected. The technical potential of wind on-shore depends on wind resources, land available for the installation of wind turbines and the amount and rated power of wind turbines installed per unit of land area (horizontal power density). A typical wind turbine for onshore production is at present around 2 MW of size and has a hub height of around 80 m. With increasing turbine sizes, the hub heights increase and apart from cost reduction, this also gives access to higher wind speeds.

If it comes about wind energy for Tullnerfeld West region, is a real paradox turned to its head. Legal and administrative obstacles in the form of protection zones, relatively low feed-in-tariffs, and, according to the experts interviewed, somewhat tedious approval procedures hinder its spread, and in the case of Tullnerfeld West region, combined with considerations on economic feasibility, factually limit it to just one area in the community.

Referring to Northern Saxony district, as priority and suitable areas appear to be Zaasch, Naundorf, Rackwitz or Jesewitz/Ablaß, remaining to identify further priority areas in the process of coordination between regional planning association and municipalities and further expansion of the acceptance through the population for implementation of wind energy plants. But we have to consider also that the regulations for wind turbines are very strict so we can consider that are no other possible areas.

Approximately half of the area of the district of Schwäbisch Hall complies with this requirement. Furthermore, only areas not being used as urbanised zones are possible sites for the use of wind energy. In addition, a minimum distance of about 800 m away from residential buildings has to be kept for immission control reasons. As the district of Schwäbisch Hall is rather sparsely populated, there are still quite a few areas suitable to be used for wind energy. Presently 20 wind turbines with a total power output of 27,75 MW are installed in the district. By repowering these 20 wind turbines, an output of 2,5 MW per turbine would be reached thus opening up a potential with a capacity of 50 MW. This corresponds to an additional potential of about 28 GWh per year. However, for a possible repowering the special site conditions for wind energy have to be considered.

South-Transdanubian region, even dispose of an avery high potential due to its very richness in natural and agricultural values, unfortunately, the regulatory background of wind turbines is not solved at the moment.

It appears that the Gorlice District is located where the wind speed is between 3 to 3.5 m/s which means that is located in zone III - the conditions advantageous from the point of view of the wind power generation. Taking in consideration the efficiency of the conversion of wind energy for electricity (40%) and constraints arising, inter alia, with the determinants of natural condition (forests), the forms of nature protection, spatial planning, etc. As a very rough practical estimation, it was evaluate that the area under wind turbines is equal to the area of agricultural land (43% of the area of the District). Reducing the total area of the agricultural land by 42% due to their legal protection (protected areas plus their buffer zones) and additionally 10% safety factor presumes constraints from other reasons, it results an economic potential of wind power energy of 21 456,71 TJ/year.

5.3. Solar energy

The potential of solar energy for heating purposes is virtually endless. The mostly used application is passive use in the built environment, the use of solar energy for drying agricultural products and the use of solar water heating. It is difficult and not relevant to assess the total technical potential, as this is mainly limited by the demand for heat. Because of this, the technical potential is not assessed in the literature.

The total currently installed PV capacity is limited compared to other renewable energy sources as hydropower or wind. However, the technical potential of solar PV is large as per unit of area the output of solar PV is relatively high compared to other renewable energy sources. The technical potential depends on the land area available and the solar irradiation.

The potential for solar energy is slightly above average in a national context for Tulnerfeld West region, which is good news considering the infrequent, but generous subsidies one can acquire for both solar thermal- and photovoltaic-installations. Yet, there is a paradox situation that, while collector surfaces are rapidly expanding throughout Austria, they only account for a marginal share of renewable energy generated.

In Northern Saxony, speaking about solar energy potential, the area has a high potential for expansion and increase the value of already functional solar installations, time in which can be identified best conversion areas for photovoltaics panels' installation and finding the suitable building-integrated solutions. Also, in terms of solar panels for hot water production, heating and cooling, exists the real possibility to use of roof and building surfaces, especially in single-family houses.

In the district of Schwäbisch Hall there is presently 1.870 ha of mere roof areas available. Not all of these areas though are suitable for the use of photovoltaics. This may be due to the lack of adequate bearing capacity. In addition only parts of the buildings are facing south. As gable roofs are the most common type of roof in the district, only half of the south facing buildings roof area can be used. Thus, only a share of 10 % of these roof areas is technically available for the use of solar energy. This corresponds to a roof area of 1.869.824 m^2. The potential would be 172 GWh for photovoltaics and 150 GWh for solar thermal systems on the roof areas available in the district of Schwäbisch Hall.

According to calculations of the Hungarian Academy of Sciences, solar energy potential in Hungary is 48,815 PJ, where this region represents 7,44 PJ. In the next decade, according to estimations, the available surface for solar collector installation will rise to 32 million km^2 nationwide, which means 4,88 million km^2 in this Southern Transdanubia region. Regarding PV panels, surveys regarding available surface estimate that there is a net area of 4051,48 km that can be used for solar panel installation, which means a capacity of 405.158,06 MW on a nation-wide scale. Annual energy production can be $486x10^3$ kWh/year, or 1749 PJ /year, resulting 266,46 PJ in the Southern Transdanubia region.

It was assumed for Gorlice region that from economic as well as technical and organization point of view solar installation is reasonable for only 30% of buildings (due to their technical condition and exposure to the sun). So, the economic potential of solar energy use as heating is 64,9 TJ/year. Given the degree of complications of the technical, organizational-related construction and connection to the transmission network but at the same time provided a significant increase in interest of State supporting this technology was adopted that economic potential of solar energy for electricity production is equal to 10% of technical potential, meaning 142,56 TJ/year.

5.4. Hydro power energy

Hydropower is by far the largest renewable energy source currently used. It is generated by mechanical conversion of the potential energy of water in high elevations. The availability of hydropower depends therefore on local and geographical factors as the availability of water and the height difference for runoff water. Various studies have indicated the technical potential of hydropower at a regional level.

Thus, returning to Tulnerfeld West SWOT analysis, a very puzzling fact is that in region, region traversed by Danube, there would be no potential for water power.

Northern Saxony area presents, like Tulnerfeld West no potential for expansion due to the current legislation, remaining to consider the possibility of alternative possibility of use.

The district of Schwäbisch Hall is almost entirely located in the river basin of the Neckar. The most important flowing waters are the rivers Kocher and Jagst. Due to the traditional use of water power in this region, 88 hydroplants already exist. Thus, there is hardly any potential for new hydropower plants. Partly, transverse structures not being used anymore can be activated for water power utilization. Yet, the modernization of existing plants, the so-called repowering, offers the greatest potential. On the whole, the utilization of water power constitutes an additional potential of 19 GWh for the district of Schwäbisch Hall. Together with the 19 GWh per year already available now, a doubling of the energy from hydropower would be possible.

For Southern Transdanubia region, since the region's two main rivers, namely the Danube and the Drava flow on the boarder of the region, which are also within the territory of Danube - Drava National Park, so the exploitation of the hydro energy is not possible. The production of hydro energy is only possible on our smaller rivers (Kapos and Sió) with lower performance than 10MW. By calculating with this the performance can be in case of ideal discharge development (50%) 0.02GWh/year.

In the Gorlice District, there are two rivers that can be seen from the point of view of their potential of hydro power: Ropa and Biała. Their hydroenergetic estimated theoretical potential of hydro power these 2 river is 94608 kWh/year i.e. 0,34 TJ/year. It was assumed based on literature the technical potential is equal 50% of theoretical potential, i.e. 0,17 TJ/year. Economic potential of hydro power was estimated as 10% technical potential because of restriction on construction of new dams and small hydro power in the protected areas, relatively low hydro power potential of these two rivers in comparison to other rivers in Małopolska, long and complicated procedures related to building consent and high investment costs. So, the economic regional hydro power potential represents 0,02 TJ/year.

5.5. Geothermal energy

In comparison to most other renewable resources, geothermal energy has the advantage that the source is consistently available without any restriction. Depending on the temperature of each system, the subsequent geothermal energy utilisation can be divided into two main sectors - direct use and electricity generation. For direct use, e.g. space heating/ cooling, industrial use or balneology, low temperature resources are sufficient. These can be found in many countries at shallow depths. As a consequence of the easy accessibility many countries benefit from this source. However, most of the direct use is only interesting if the resources are situ- ated close to the application. Long distance transportation is an alternative solution, which can be handled with good isolation material.

A potential well used can be identified in Northern Saxony, proved by the multitude of functional installations. Nevertheless, a development of potential further expandable has to be taken in consideration, a potential which has to include new efficient solutions for building renovation, fact which is not well included in the present days.

Sales for heat pumps have increased considerably in the past few years in the district Schwäbisch Hall, fact highlighted on the basis of the number of installed heat pumps. In 2010 349 heat pumps were registered, doubled than 2006. With a share of 57 % of the heat pumps installed, brine/water heat pumps are presently of the utmost importance. Overall, the potential for heat pumps in the field of residential buildings amounts to about 800 GWh, whereof only approx. 5,5 GWh are being exploited at present. However, it has to be borne in mind that it will not be possible to cover 100 % of the heat demand as especially in winter the efficiency of the heat pumps is very low due to the cold temperatures of the heat sources. Therefore, an additional heating source is usually necessary. Nevertheless, the potential for heat pumps with a total of about 1.350 GWh is enormous.

The Southern Transdanubian Region together with the Southern Great Plain contributes significantly to Hungary's energy capacity. The estimated geological wealth for the Southern Transdanubian region is 75000PJ/year.

Analysis of literature data and analysis of deep-drillings near Gorlice carried out indicates the possibility of use existing geothermal water for heating purposes and for recreation. Treating deep geothermal the source of heat for heating buildings, account should be taken of any investment for not only getting water but a new infrastructure for the distribution of heat. Regardless of the source of financing of the investment cost of depreciation is the element that affects the tariff for heat. In view of the above, for the purposes of the SWOT analysis performed for the region, it was assumed there is no economic potential of deep geothermal energy in Gorlice District.

Yet, assessing the economic potential of shallow geothermal energy and used by the heat pump it was assumed for the purposes of the analysis, that the installation of heat pumps only new residential buildings constructed after 2000, assuming that only 5% of them will be equipped with heat pumps, results a potential of shallow geothermal energy of 26,5 TJ/year.

6. Comparative SWOT analysis

In the current economic crisis it is essential to unleash intrinsic economic potentials. Creative industries “which have their origin in individual creativity, skill and talent and which have a potential for wealth and job creation through the generation and exploitation of energy sources” are decisive in advancing towards the knowledge-based economy.

The challenges for creative industry actors are high (low capital endowment, poor networking, low external visibility). Especially medium-sized cities need to enhance capacities to identify and develop the sector’s potentials. That goes hand in hand with a lack of transnational comparable data on the impact of creative industries for economic growth. At the same time a lobby for creative industry needs to be strengthened.

- **Demografic**

Strengths
beneficial demographic development, no loss of population in working age, good living environment (renovated village and city centers, good developed road network, good technical), multi-cultural population structure, cultivation of tradition and strong civic commitment, proximity to the major regional center
Weaknesses
rising unemployment rate, social inequality, uncontrolled immigration flows, low quality labour force, small population size
Opportunities
use emigrants to boost cooperation with other countries and cities, to establish economic and other links, to learn from succes stories and gain knowhow, become a multi-cultural city
Threats
inability to learn and adjust efficiently to the new conditions, receive population from rural areas or from other countries, lose high productive population (skilled, young, educated)

* **Socio-economic**

Strengths
potent economy with the regional urban centers, link to scientific state of the art and driver of it's application, fast growing business, low cost of living (price of goods, housing cost), favourable business climate, low cost of labour
Weaknesses
low public acceptance of renewable energy sources, and, accordingly, no large RE power plants, limited accessibility to international markets, unfavourable business climate, collapse of industry (closed down factories)
Opportunities
usage of EU funds, attraction of FDI in services, banking and commerce
Threats
global financial crisis potentially affecting power plant, reduction of inward funding and remittances from expatriates, failure of economic policies and economic recession

* **Energetic infrastructure**

Strengths
production and energetic usage in the same place, solution for energetic self - sufficiency, good usage rate of biomass, high popularity and installation rate of PV and solar
Weaknesses
fragmented production - large number of small farms, no water power plants (possible), although rivers crosses the regions, public facilities needs improved energy efficiency
Opportunities
existence of experimental projects for renewable energy sources use, diminished dependence on energy import, reduce environmental stress
Threats
sometimes arbitrary and lengthy approval procedures for small plants, environmental risks of certain energy producing methods, failure in energy crop production and utilisation, leading to great expenses of unused crop storage

- **Energy consumption**

Strengths
high share of buildings built after 1980 in total building stock, widespread upgrading windows and loft insulation
Weaknesses
geothermal energy mostly an afterthought, no instruments to counter socio economic split in affordability of both RE-installation and EE-measures
Opportunities
subsidies forresidential buildings linked to heating requirement, biomass & biogas, the mainstay of regional RE generation, are local points of subsidy programs
Threats
lack of coordination between regions, low feed-in-tariffs for wind energy

- **Renewable energy potential**

Strengths
intercommunal cooperation on matters of energy, waste & water management, active private individuals engaging in governance processes on energy policies on the local level, existence of private financing models benefiting especially insulation and sanitation of private homes, numerous regional best practice - cases with both solar power and biomass / biogas
Weaknesses
lack of cooperation between political authorities and enterprises lack of private persons involvement in most of energy policy coordination, strained budget situation in the communities
Opportunities
clear vision & goal definitions with regards to RE from higher administrative levels, several subsidies for RE and environmental protection from federal and nation state, high interest of young people on RES matters, global trend of being friendly for environment, decreasing costs of RES infrastructures (e.g. PV, solar collectors)
Threats
failure of economic policies and economic recession, low usage of EU funds, lack of subsidies, considering RES infrastructure in positive while being subsidize only

The SWOT analysis was performed to formulate a transnational sustainable energy strategy in order to mobilize and utilize the community resources on the one hand and municipal corporation's resources on the other. It has allowed the introduction of a participatory approach for better collaboration between the community, municipal and regional corporations. With this SWOT analysis, efforts were made to explore the ways and means of converting the possible 'threats' into 'opportunities' and changing the 'weaknesses' into 'strengths'.

Since a SWOT analysis is always qualitative, it has the great opportunity to objectively demonstrate advantages and disadvantages of renewable energy sources. In contrast, qualitative studies are much more susceptible to manipulations, although this is often not the intention.

In conclusion, the present transnational SWOT analysis results shows pros and cons of RES form rural areas without judging them. It represents an objective base for discussing the best options for future renewable energy sources implementation. Such discussions shall be complemented by using results of additional quantitative studies, for example on costs, greenhouse gas emissions and energy balances.

7. Conclusions

A comparison of these RES potentials with current end energy consumption has one paint a sobering picture: The potential is only about a fifth of the end energy already used. Granted, as has been mentioned, we lack the biomass potentials of 2 communities, and find rather conservative estimations throughout the assessments. However, there is no way to bridge this gap statistically. What really would help is technical improvement in RES-plants, a reconsideration of certain energy-related policies, and increased efforts to boost energy efficiency. It is also against this background that a growing number of people endanger the very premise of economic growth; wherever the road will lead, it's certainly not a problem the region Tullnerfeld-West can solve it on its own.

In terms of power input, consequences for the network operator result from the development of solutions for the use of renewable energies (small-scale, peripheral locations), which have to be taken into account in Northern Saxony area. In the sparsely populated rural areas solutions have to be found that include a personal use of the generated heat and electricity. For developing the energy potential in the Northern Saxony district, important fields of actions were identified such as expansion of approaches in the municipalities in terms of a pioneering role (energy efficiency competitions, caretaker training, exchange of experience in energy management) Municipal housing companies and associations as actors in the housing stock - Moderation of developmental processes and exchange of experiences on best practice in terms of actions for energy efficiency. Regarding the field of action in developing the use of renewable energies, participation in the updating of the regional plan for locations wind energy, empowering or analysis of conversion areas as location for photovoltaic, offer land register roof surface on municipal property, continue and enhance the networking of actors such as public utilities, biogas plant operators, enterprises, municipalities and housing companies.

The comparison of the identified potential for renewable energies including the saving potential for heat and electricity are shown in graph 24. In case of the power requirement in 2010 the additional power needed for heat pumps has been added, and the hatched area shows the energy saving potential. Taking these potentials into account, 181 % of the power requirement and 123 % of the heat demand can be covered. Thus, it is possible to provide the district of Schwäbisch Hall with the required energy through the available potentials for renewable energies, not only fossil-free but also independently. While the potentials of some energy sources such as wood and biogas have already been close to being exhausted in 2010, other sources e.g. wind power or heat pumps are right at the beginning and still have an enormous growing potential to be exploited.

In order to spread the use of the renewable energy use to a wider range in Southern Transdanubia region, it is expedient to prefer the most proper green energy production. Taking into account the private, the business and the public administration sector's specific needs, structure and with the selection of the appropriate energy production technology these must be adjusted to the environmental, economic and political factors. In the case of the private sector the conscious energy use and efficiency have to be increased and the use of renewable energy can be done in a cost-effective way to produce electricity for heating and cooling. We have to strive to popularize the most common solar panels and photovoltaic systems and to extend the use of geothermic energy.

According to the gathered results from analysis of Gorlice Region and from the point of view of achievable quantative targets for increasing energy production from RES the most attractive are in order wind power, photovoltaic, solar thermal, forestry biomass and shallow geothermal. Less attractive or quite uninviting are straw, sawdust, hydro power and deep geothermal. The areas with the largest economic potential are heating modernization of buildings, energy management in buildings and modernization of heat sources. The other analysed methods of saving energy should also be popularized, despite being of lower potential. Thus, the proposal was to adopt as the leading all strategies related to improving energy efficiency, complemented by compatible strategies involving the production of renewable energy in the place of use (i.e. solar, photovoltaic, small wind turbines and heat pumps).

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9. Anexes

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	AUSTRIA	HUNGARY	POLAND	GERMANY
Population: (July 2012 est.)	**8.219.743**	**9.958.453**	**38.415.284**	**81.305.856**
country comparison to the world:	94	87	33	16
Age structure: (2012 est.)	**0-14 years**:			
	13.9% (male 583.162 / female 555.976)	**14.9%** (male 763.371 / female 717.490)	**14.6%** (male 2.892.701 / female 2.731.949)	**13.2%** (male 5.499.555 / female 5.216.066)
	15-64 years:			
	67.6% (male 2.789.570 / female 2.768.420)	**68%** (male 3.348.155 / female 3.425.896)	**71.3%** (male 13.636.461 / female 13.767.347)	**66.1%** (male 27.173.860 / female 26.587.068)
	65 years and over			
	18.5% (male 640.806 / female 881.809)	**17.1%** (male 632.346 / female 1.071.195)	**14%** (male 2.066.066 / female 3.320.760)	**20.7%** (male 7.273.915 / female 9.555.392)
Median age: (2012 est.)	**Total:**			
	43.4 years	**40.5 years**	**38.8 years**	**45.3 years**
	male: 42.3 years	male: 38.4 years	male: 37.2 years	male: 44.2 years
	female: 44.5 years	female: 43 years	female: 40.6 years	female: 46.3 years
Population growth rate: (2012 est.)	**0.026%**	**-0.184%**	**-0.075%**	**-0.2%**
country comparison to the world:	186	206	197	208
Birth rate: (2012 est.)	**Births** / 1,000 population			
	8.69	**9.49**	**9.96**	**8.33**
country comparison to the world:	214	202	196	218
Death rate: (July 2012 est.)	**Deaths** / 1,000 population			
	10.23	**12.7**	**10.24**	**11.04**
country comparison to the world:	47	24	46	37
Net migration rate: (2012 est.)	**Migrant(s)** / 1,000 population			
	1.79	**1.37**	**-0.47**	**0.71**
country comparison to the world:	41	46	139	59
Urbanization: (2010)	**Urban population -** % of total population			
	68%	**68%**	**61%**	**74%**
Rate of urbanization: (2010-15 est.)	**Annual rate of change**			
	0.6%	**0.3%**	**0.1%**	**0%**
Sex ratio: (2011 est.)	**At birth:** male(s) / female			
	1.05	**1.06**	**1.06**	**1.06**
	under 15 years: male(s) / female			
	1.05	**1.06**	**1.06**	**1.05**
	15-64 years: male(s) / female			
	1.01	**0.98**	**0.99**	**1.02**
	65 years and over: male(s) / female			
	0.73	**0.59**	**0.62**	**0.76**
	Total population: male(s) / female			
	0.95	**0.91**	**0.94**	**0.97**
Maternal mortality rate: (2010)	**Deaths** / 100,000 live births			
	4	**21**	**5**	**7**
country comparison to the world:	179	137	175	165
Infant mortality rate:	**Total** Deaths / 1,000 live births			
	4.26	**5.24**	**6.42**	**3.51**
country comparison to the world:	195	178	168	209

Infant mortality rate: (2012 est.)	**Male** Deaths / 1,000 live births			
	5.16	**5.5**	**7.12**	**3.81**
	Female Deaths / 1,000 live births			
	3.33	**4.96**	**5.67**	**3.19**
Life expectancy at birth: (2012 est.)	**Total population:**			
	79.91 years	**75.02** years	**76.25** years	**80.19** years
country comparison to the world:	33	93	78	28
Life expectancy at birth: (2012 est.)	**Male :**			
	77 years	**71.27** years	**72.31** years	**77.93** years
	Female :			
	82.97 years	**78.98** years	**80.43** years	**82.58** years
Total fertility rate: (2012 est.)	**Children** born / woman			
	1.41	**1.41**	**1.31**	**1.41**
country comparison to the world:	200	201	212	202

Table 3 Detailed demographic indicators at national level

source: UN Population Division

Countries and their population

	2012-07-01 est.	Area (km²)	Yearly population growth %	Population density (inh / km²)	Life expectancy (years)	Children born / woman	Urban / rural division			
							Urban		Rural	
							Nr	(%)	Nr	(%)
Austria	**8,428,915**	**83.858**	**0.164**	**97**	**79.65**	**1,39**	**5,665,972**	**67.6**	**2,721,519**	**32.4%**
Germany	**81,990,837**	**357.021**	**-0.203**	**233**	**79.41**	**1,42**	**60,598,356**	**73.8**	**21,458,419**	**26.2%**
Hungary	**9,949,589**	**93.030**	**-0.162**	**108**	**73.69**	**1,36**	**6,791,244**	**68.1**	**3,181,897**	**31.9%**
Poland	**38,317,090**	**312.685**	**0.042**	**124**	**75.85**	**1,29**	**23,187,195**	**61.0**	**14,850,899**	**39.0%**

Human Development Index

	1980	1990	2000	2005	2009	2010	2011
Austria	**0.740**	**0.790**	**0.839**	**0.860**	**0.879**	**0.883**	**0.885**
Germany	**0.730**	**0.795**	**0.864**	**0.895**	**0.900**	**0.903**	**0.905**
Hungary	**0.700**	**0.706**	**0.775**	**0.803**	**0.811**	**0.814**	**0.816**
Poland	**..**	**..**	**0.770**	**0.791**	**0.807**	**0.811**	**0.813**

Youngest and oldest countries for 2000 and 2050

	age groups 2000 in %			age groups 2050 in %		
	0-14	15-59	60+	0-14	15-59	60+
Austria	16.6	62.6	20.7	11.6	47.4	41.0
Germany	15.5	61.2	23.2	12.4	49.5	38.1
Hungary	16.9	63.3	19.7	14.4	49.4	36.2
Poland	19.2	64.3	16.6	15.7	48.7	35.6

Table 4 National demographic indicators summary

GNI per capita 2000 - 2009, Atlas Method (Current US $)										
	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Austria	**25,84**	**24,21**	**23,91**	**26,81**	**32,35**	**37,02**	**39,17**	**42,28**	**46,35**	**46,85**
Germany	**25,51**	**24,02**	**22,98**	**25,61**	**31**	**35,05**	**37,3**	**39,37**	**42,8**	**42,56**
Hungary	**4,7**	**4,85**	**5,3**	**6,62**	**8,6**	**10,25**	**11,02**	**11,65**	**12,8**	**12,98**
Poland	**4,59**	**4,67**	**4,85**	**5,47**	**6,24**	**7,27**	**8,34**	**9,8**	**11,82**	**12,26**
GNI in millions, 2000 - 2009, PPP (Current international $)										
	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Austria	**226.608**	**226.692**	**241.283**	**249.836**	**265.146**	**272.948**	**295.612**	**311.172**	**328.703**	**322.453**
Germany	**2.112.960**	**2.189.610**	**2.247.270**	**2.340.560**	**2.489.390**	**2.615.140**	**2.829.610**	**2.973.320**	**3.100.770**	**3.026.670**
Hungary	**119.909**	**131.549**	**141.729**	**149.845**	**155.515**	**161.951**	**174.317**	**179.963**	**191.59**	**186.142**
Poland	**402.551**	**417.625**	**439.711**	**452.538**	**480.685**	**514.509**	**558.447**	**612.279**	**672.629**	**703.527**

Table 5 GNI indicators at national level

GDP per Capita (Year of est. 2005)	
	GDP per capita in US $
Austria	**32,7**
Germany	**30,4**
Hungary	**16,3**
Poland	**13,3**

Table 6 GDP per capita

GDP in current US $					
	2005	2006	2007	% growth 2006-7	
Austria	**304,816,553,984**	**322,001,010,688**	**377,028,345,856**	**17.09%**	
Germany	**2,786,966,896,640**	**2,896,876,273,664**	**3,297,232,551,936**	**13.82%**	
Hungary	**110,505,680,896**	**112,919,814,144**	**138,182,148,096**	**22.37%**	
Poland	**303,976,218,624**	**341,722,497,024**	**420,321,394,688**	**23.00%**	
GDP 2000 by sector composition by sector					
	agriculture	industry	services	year of estimate	
Austria	**2.2%**	**30.4%**	**67.4%**	**1999**	
Germany	**1.2%**	**30.4%**	**68.4%**	**1999**	
Hungary	**5.0%**	**35.0%**	**60.0%**	**2000**	
Portugal	**4.0%**	**36.0%**	**60.0%**	**1999**	
Economy - major exporting countries (2009 rankings)					
	2006	2007	2008	2009	change 2008-2009
	x 1 bln US $	x 1 bln US $	x 1 bln US $	x 1 bln US $	
Austria	**130.4**	**157.3**	**173.1**	**131.4**	**-24.1%**
Germany	**1,122.1**	**1,323.8**	**1,451.4**	**1,127.6**	**-22.3%**
Hungary	**74.2**	**93.4**	**107.5**	**84.6**	**-21.3%**
Poland	**110.9**	**138.8**	**168.7**	**134.7**	**-20.2%**
Economy - major importing countries (2009 rankings)					
	2006	2007	2008	2009	change 2008-2009
	x 1 bln US $	x 1 bln US $	x 1 bln US $	x 1 bln US $	
Austria	**130.9**	**156.8**	**176.1**	**136.4**	**-22.5%**
Germany	**922.4**	**1,056.0**	**1,186.7**	**939.0**	**-20.9%**
Hungary	**77.2**	**94.4**	**106.4**	**78.0**	**-26.7%**
Poland	**127.3**	**162.4**	**204.9**	**146.8**	**-28.4%**

Table 7 GDP indicators at national level

http://www.reegle.info/

	AUSTRIA	GERMANY	HUNGARY	POLAND
Electricity - production:	billion kWh (2010 est.)			
	63.98	**576.8**	**35.34**	**147.5**
country comparison to the world:	42	9	64	27
Electricity - consumption:	billion kWh (2009 est.)			
	61.51	**509.5**	**35.85**	**127.2**
country comparison to the world:	40	8	56	26
Electricity - exports:	billion kWh (2010 est.)			
	17.53	**57.92**	**4.702**	**7.664**
country comparison to the world:	11	3	30	24
Electricity - imports:	billion kWh (2010 est.)			
	19.75	**42.96**	**9.897**	**6.31**
country comparison to the world:	9	5	23	36
Electricity - installed generating capacity:	million kWh (2009 est.)			
	20.85	**146.9**	**8.804**	**33.03**
country comparison to the world:	34	7	60	25
Electricity - from fossil fuels:	% of total installed capacity (2009 est.)			
	19.6%	**50.5%**	**69%**	**90.4%**
country comparison to the world:	191	155	111	76
Electricity - from nuclear fuels:	% of total installed capacity (2009 est.)			
	0%	**13.9%**	**22%**	**0%**
country comparison to the world:	43	15	8	160
Electricity - from hydroelectric plants:	% of total installed capacity (2009 est.)			
	38.7%	**2.7%**	**0.6%**	**2.8%**
country comparison to the world:	55	133	144	130
Electricity - from other renewable sources:	% of total installed capacity (2009 est.)			
	20.4%	**28.3%**	**8.3%**	**2.5%**
country comparison to the world:	8	3	25	50
Crude oil - production:	bbl/day (2011 est.)			
	25.750	**100.300**	**22.560**	**19.730**
country comparison to the world:	68	49	69	73
Crude oil - exports:	bbl/day (2009 est.)			
	0	**2.200**	**0**	**4.520**
country comparison to the world:	75	62	128	60
Crude oil - imports:	bbl/day (2009 est.)			
	148.500	**1.961 million**	**108.500**	**402.000**
country comparison to the world:	39	7	45	22
Crude oil - proved reserves:	million bbl (1 January 2012 est.)			
	50	**276**	**31.72**	**155**
country comparison to the world:	78	57	83	65
Refined petroleum products - production:	bbl/day (2009 est.)			
	198.200	**2.348 million**	**167.900**	**462.600**
country comparison to the world:	56	9	60	33
Refined petroleum products - consumption:	bbl/day (2011 est.)			
	262.900	**2.4 million**	**141.100**	**576.600**
country comparison to the world:	48	10	71	32
Refined petroleum products - exports:	bbl/day (2009 est.)			
	46.020	**467.900**	**49.010**	**45.860**
country comparison to the world:	62	15	61	63
Refined petroleum products - imports:	bbl/day (2009 est.)			
	282.200	**696.400**	**171.600**	**129.800**
country comparison to the world:	25	10	33	44
Natural gas - production:	billion m^3 (2011 est.)			
	1.776	**11,9**	**2.464**	**6.247**
country comparison to the world:	60	40	57	50
Natural gas - consumption:	billion m^3 (2011 est.)			
	9015	**78.99**	**11.24**	**17.17**

country comparison to the world:	51	11	45	39
Natural gas - exports:	billion m³ (2011 est.)			
	4.96 million	**19.74 million**	**566**	**29**
country comparison to the world:	32	16	42	47
Natural gas - imports:	billion m³ (2011 est.)			
	14.28	**87.57**	**8.019**	**11.79**
country comparison to the world:	21	5	30	25
Natural gas - proved reserves:	billion m³ (2012 est.)			
	16.14 billion	**175.6**	**8.013**	**95**
country comparison to the world:	77	48	82	56
Carbon dioxide emissions from consumption of energy:	million Mt (2010 est.)			
	69.46	**793.7**	**50.39**	**303.7**
country comparison to the world:	49	7	62	22

Table 8 National energy indicators

Energy consumption by type 2009						
	million tonnes oil equivalent					
	oil	natural gas	coal	nuclear	hydro-electric	total
Austria	**13,00**	**8,40**	**2,30**	**-**	**8,30**	**32,00**
Germany	**113,90**	**70,20**	**71,00**	**30,50**	**4,20**	**289,80**
Hungary	**7,30**	**9,10**	**2,50**	**3,50**	**0,10**	**22,40**
Poland	**25,50**	**12,30**	**53,90**	**-**	**0,7**	**92,3**

Table 9 Energy consumption at national level by source type

source: "Statistical Review of World Energy 2010", BP.
note: This chart only tabulates commercially traded fuels, thus excluding fuels such as wood, peat and animal waste.

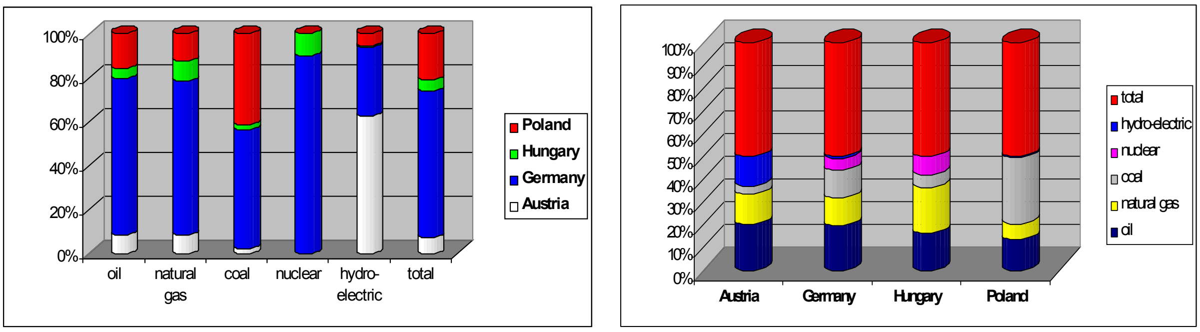

Figure 30 Energy consumption by type 2010

Countries energy profiles:
Austria
Germany
Hungary
Poland